

PROJECT MANUAL

CITY OF LUBBOCK

**Golf Storage Facility at Meadowbrook Golf Course
Lubbock, Texas**



November | 2023

Parkhill Project # 4176523

TABLE OF CONTENTS

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

Not Used

DIVISION 01 - GENERAL REQUIREMENTS

01 10 00	Summary
01 20 00	Price and Payment Procedures
01 30 00	Administrative Requirements
01 30 01	RFI Form
01 30 01.01	AIA Doc C106-2022
01 33 00	Submittal Procedures
01 40 00	Quality Requirements
01 42 00	References
01 50 00	Temporary Facilities and Controls
01 57 13	Temporary Erosion and Sediment Control
01 57 19	Temporary Environmental Controls
01 60 00	Product Requirements
01 70 00	Execution and Closeout Requirements



11/28/2023

DIVISION 02 - EXISTING CONDITIONS

02 41 13	Selective Site Demolition
----------	---------------------------

DIVISION 03 - CONCRETE

03 10 00	Concrete Forming and Accessories
03 20 00	Concrete Reinforcing
03 30 10	Cast-In-Place Concrete

DIVISIONS 04 - 06

Not Used

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 92 00	Joint Sealants
----------	----------------

DIVISION 08 - OPENINGS

08 11 13	Hollow Metal Doors and Frames
08 36 13	Sectional Doors

DIVISION 09 - FINISHES

09 91 13	Exterior Painting
----------	-------------------

DIVISION 10 - SPECIALTIES

10 44 16 Fire Extinguishers

DIVISIONS 11 - 12

Not Used

DIVISION 13 – SPECIAL CONSTRUCTION

13 34 19 Metal Building Systems

DIVISIONS 22 - 25

Not Used

DIVISION 26 - ELECTRICAL

26 05 00 Basic Electrical Methods
26 05 13 Building Wire and Cable
26 05 19 Equipment Wiring Systems
26 05 26 Grounding and Bonding
26 05 29 Supporting Devices
26 05 33 Conduit
26 05 33.16 Boxes
26 05 53 Electrical Identification
26 09 24 Lighting Controls
26 24 16 Panelboards
26 27 26 Wiring Devices
26 28 16.16 Enclosed Switches
26 51 00 Interior Lighting



11/28/2023

DIVISIONS 27 – 28

Not Used

DIVISION 31 - EARTHWORK

31 10 00 Site Clearing
31 20 00.10 Earth Moving for Facility
31 23 00 Excavation and Fill
31 23 00.10 Excavation and Fill for Utilities
31 31 16 Termite Control

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 11 50 Flexible Base Course
32 13 13 Concrete Paving
32 13 73 Concrete Paving Joint Sealants

DIVISION 33 - UTILITIES

33 05 00 Common Work Results for Utilities

DIVISIONS 34 - 48

Not Used



11/28/2023

DESIGN PROFESSIONAL RESPONSIBILITY

The Specification Sections authenticated by my seal and signature are limited to the following:

DIVISION 03 - CONCRETE

03 10 00	Concrete Forming and Accessories
03 20 00	Concrete Reinforcing
03 30 10	Cast-In-Place Concrete

DIVISION 31 - EARTHWORK

31 20 00.10	Earth Moving for Facility
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11/28/2023

DESIGN PROFESSIONAL RESPONSIBILITY

The Specification Sections authenticated by my seal and signature are limited to the following:

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 92 00 Joint Sealants

DIVISION 08 - OPENINGS

08 11 13 Hollow Metal Doors and Frames
08 36 13 Sectional Doors

DIVISION 09 - FINISHES

09 91 13 Exterior Painting

DIVISION 10 - SPECIALTIES

10 44 16 Fire Extinguishers

DIVISION 13 – SPECIAL CONSTRUCTION

13 34 19 Metal Building Systems



11/28/2023

DESIGN PROFESSIONAL RESPONSIBILITY

The Specification Sections authenticated by my seal and signature are limited to the following:

DIVISION 26 - ELECTRICAL

26 05 00	Basic Electrical Methods
26 05 13	Building Wire and Cable
26 05 19	Equipment Wiring Systems
26 05 26	Grounding and Bonding
26 05 29	Supporting Devices
26 05 33	Conduit
26 05 33.16	Boxes
26 05 53	Electrical Identification
26 09 24	Lighting Controls
26 24 16	Panelboards
26 27 26	Wiring Devices
26 28 16.16	Enclosed Switches
26 51 00	Interior Lighting



11/28/2023

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Work covered by Contract Documents.
 - 2. Contractor use of site and premises.
- B. Related Requirements:
 - 1. Other Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 01 30 00 "Administrative Requirements" for Project information management.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Identification: Golf Storage Facility at Meadowbrook Golf Course.
- B. Location: 601 Municipal Dr., Lubbock, Texas, 79403.
- C. Without force or effect, Work of Project consists of a new Pre-Engineered Metal Building, Concrete slab, and interior/exterior lighting.

1.3 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Utility Outages and Shutdown: Coordinate with Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Contingency Allowance.
 - 2. Schedule of Values.
 - 3. Application for Payment.
 - 4. Change procedures.
- B. Related Requirements:
 - 1. Other Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 01 30 00 "Administrative Requirements" for Project information management.
 - 3. Section 01 33 00 "Submittal Procedures" for Schedule of Values.
 - 4. Section 01 60 00 "Product Requirements" for product substitutions.

1.2 CONTINGENCY ALLOWANCE

- A. Include stipulated sum of \$50,000.00 for use upon Owner's instruction.
- B. Costs Included in Contingency Allowance: Contractor's costs for products, equipment, delivery, installation, labor, insurance, payroll, applicable taxes, and equipment rental; handling at site, including unloading, uncrating, and storage; protection of products from elements and from damage; finishing costs.
- C. Costs Not Included in Contingency Allowance, but Included in Contract Sum/Price: Bonds, overhead, profit, and other expenses contemplated for stated allowance amounts.
- D. Funds will be drawn from Contingency Allowance only by Change Order.
- E. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.3 SCHEDULE OF VALUES

- A. Submit typed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet.
- B. Submit Schedule of Values in duplicate within 15 days after date established in Notice to Proceed.
- C. Format: Utilize Table of Contents of this Project Manual. Identify each line item with number and title of major Specification Section, separating labor and material for each line item. Identify site mobilization, general conditions, testing, bonds, and insurance as separate line items.
- D. Include in each line item amount of Allowances specified in this Section.
- E. Include within each line item a directly proportional amount of Contractor's overhead and profit.
- F. Revise Schedule to list approved Change Orders with each Application for Payment.

1.4 APPLICATIONS FOR PAYMENT

- A. Submit notarized application on AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet.
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Payment Period: As defined in Owner-Contractor Agreement.
- D. A complete Application for Payment includes 1 copy of waiver of liens from each subcontractor, Construction Progress Schedule, and Submittal Schedule, all of which are required to process the Application for Payment.

1.5 CHANGE PROCEDURES

- A. Architect will advise of minor changes in Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by Owner/ Contractor Agreement by issuing Architect's Standard Supplemental Instruction Form.
- B. Architect may issue a Construction Change Request which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications and a change in Contract Time for executing change. Contractor will prepare and submit an estimate within 7 days.
- C. Contractor may propose a change by submitting request for change to Architect. Include reason for change and effect on Contract Sum/Price, Contract Time, and subcontractors. Document requested substitutions in accordance with Section 01 60 00 "Product Requirements."
- D. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for a Change Order as approved by Architect.
- E. Construction Change Directive: Architect may issue a directive on AIA Form G713 Construction Change Directive, signed by Owner, instructing Contractor to proceed with a change in Work for subsequent inclusion in a Change Order. Document will describe changes in Work and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute change.
- F. Time and Material Change Order:
 - 1. Submit itemized account and supporting data after completion of change within time limits indicated in Conditions of the Contract.
 - 2. Architect will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.
 - 3. Maintain detailed records of Work done on Time and Material basis.
 - 4. Provide full information required for evaluation of proposed changes and to substantiate costs for changes in Work.
- G. Change Order Forms: AIA Form G701 Change Order.
- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in Conditions of the Contract.

- I. Change Order: Furnish an itemized breakdown, in form acceptable to Architect of costs and supporting information, including but not limited to quantities and material prices. Tier subcontracted Work performed at labor rates, employer payments, and rental rates. Itemized breakdown detail shall be same for subcontractor Work. Provide complete supporting information for profit and overhead or markups used when requested. Consider the following items a part of overhead or Contractor's and subcontractor's markup and do not include as separate cost item: labor for superintendents, assistant superintendents, home office personnel, timekeepers, and maintenance mechanics at any level of contracting; individual pieces of equipment, hand tools or instruments having a new value of \$500.00 or less, whether or not consumed by use; on-site and main offices; modification to record Contract Documents; nor guarantee period costs.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project Information Management.
 - 2. Coordination.
 - 3. Electronic Drawing file (digital data) request.
 - 4. Submittal schedule.
 - 5. Preconstruction meeting.
 - 6. Request for Information.
 - 7. Progress meetings.
 - 8. Preinstallation meetings.
 - 9. Cutting and patching.
- B. Related Requirements:
 - 1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 PROJECT INFORMATION MANAGEMENT

- A. Project Website:
 - 1. Use Newforma Info Exchange; <https://projects.team-psc.com/UserWeb/Login> to send and receive Project information.
 - 2. Contact Architect to setup a username and password information.
 - 3. If this Project is not listed when logged in, contact Architect to add this Project to your account.
- B. Project information includes, but is not limited to, the following:
 - 1. Product submittals.
 - 2. Requests for Information (RFI).
 - 3. Applications for Payment.
 - 4. Schedules.
 - 5. Construction Change Requests (CCRs).
 - 6. Closeout Documents.
 - 7. Construction Document files.
 - a. Weather days.
 - b. Electronic file requests.
 - c. Correspondence.
 - d. Test reports.
 - e. Meeting minutes.
 - f. Field reports.

1.3 COORDINATION

- A. Coordinate scheduling, submittals, and Work to assure efficient and orderly sequence of installation of construction elements with provisions for accommodating items installed later.
- B. Verify that utility requirements and characteristics of 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.

- C. Coordinate space requirements and installation of mechanical and electrical Work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Large Apparatus: Any large apparatus which is to be installed in any space and is too large to permit access through windows, doorways, or shafts shall be provided before enclosing structure is completed.
- F. Items which require electrical connections shall be coordinated with Division 26 "Electrical" for:
 - 1. Voltage.
 - 2. Phase.
 - 3. Ampacity.
 - 4. Number and size of wires.
 - 5. Wiring diagrams.
 - 6. Starter size, details, and location.
 - 7. Control devices and details.
- G. Coordinate completion and clean-up of Work of separate Sections in preparation for Substantial Completion and for portions of Work designated for Owner's occupancy.
- H. After Owner occupancy of premises, coordinate access to site with Owner for correction of defective Work and Work not in accordance with Contract Documents to minimize disruption of Owner's activities.

1.4 ELECTRONIC DRAWING FILE (DIGITAL DATA) REQUEST

- A. During Procurement Phase:
 - 1. Bidders and Proposers may purchase a digital data file. Digital data file will be provided in software release currently used by Architect. File will be provided via Architect's Project website.
 - 2. AutoCAD Drawing files (dwg) are available for purchase from Architect upon request. Cost of files are indicated below plus applicable tax.
 - a. 1 - 3 Sheets: \$100.00 per sheet.
 - b. 4 - 6 Sheets: \$400.00 per sheet.
 - c. 7 - 9 Sheets: \$500.00 per sheet.
 - 3. Prior to delivery of file(s), purchaser shall sign a Digital Data Licensing Agreement. Payment for digital data file(s) shall occur upon delivery of file to purchaser.
 - 4. Digital data file(s) shall be used only for preparing Bids and Proposals required by this Project and shall not be used in any other form, in whole or in part.
- B. Upon Award of Contract:
 - 1. At the pre-construction meeting, Contractor shall bring the executed Digital Data Licensing Agreement (AIA C106- 2022) at the end of this Section for the release of electronic files. Upon Contractor submitting the executed Agreement to the Architect, the Architect will provide the Contractor 1 electronic copy of the AutoCAD (dwg) file(s) and Portable Document Format (pdf) file(s) at no charge within 5 working days. Files and Formats to be as follows:
 - a. Landscape: Overall master file in AutoCAD format.
 - 1) Overall site Plan with grading, flatwork, irrigation, and planting Plans.
 - 2) All details, detail annotations, and references are omitted and not part of the AutoCAD file.

2. Conformed Construction Documents: If Conformed Construction Documents are required by the Owner/Architect Agreement, they will be provided in PDF. Conformed Construction Documents are the Drawings and Specifications modified to include any Addenda issued before execution of the Contract.
 - a. To the extent Conformed Construction Documents are provided to the Contractor, the following provisions shall apply:
 - 1) The Conformed Construction Documents and related information contained therein, are provided for Contractor's convenience only, and does not relieve the Contractor from the requirements of the Contract Documents. Specifically, to the extent that any discrepancy or conflict exists between the issue for Bid Documents, including any Addenda issued prior to execution of the Contract or Modifications issued after the execution of the Contract on the one hand, and the Conformed Construction Documents on the other; the issue for Bid Documents, Addenda, and Modifications shall control unless otherwise specified in writing by the Architect.
 - 2) Contractor shall not use such Drawings, Documents, or other data, in whole or in part, for any purpose or Project other than this Project in the preparation of Shop Drawings and other submittals.
 - 3) Contractor acknowledges that such Drawings, Documents, and other data are subject to change or modification. Contractor shall be responsible for updating any Drawings, Documents, or other data obtained prior to use by them for any purpose.
 - 4) Any Conformed Construction Documents, including any Drawings, Specifications, Documents, or other data related thereto are provided "as is" without representation or warranty by Architect, either expressed or implied.
 - 5) Contractor acknowledges that Conformed Construction Documents provided by Architect are as a courtesy to Contractor, at their specific request, and accordingly, CONTRACTOR HEREBY AGREES TO RELEASE, HOLD HARMLESS, DEFEND, AND INDEMNIFY ARCHITECT AND OWNER FROM ANY AND ALL CLAIMS, DEMANDS, OR CAUSES OF ACTION, WHICH CONTRACTOR OR ANY THIRD PARTY MAY HAVE BY REASON OF ANY INJURY OR DAMAGE SUSTAINED BY CONTRACTOR OR THIRD PARTY ARISING OUT OF OR IN ANY WAY RELATED TO THE USE OF SUCH CONFORMED CONSTRUCTION DOCUMENTS.

1.5 SUBMITTAL SCHEDULE

- A. Prepare Submittal Schedule in accordance with General Conditions of the Contract for Construction.
- B. Include in Submittal Schedule all submittals and samples required by all Sections of this Project Manual and any additional submittals required by the Contractor to construct the Project.
- C. Submit Submittal Schedule for Architect's review within 15 days after date established in Notice to Proceed or with the first Application for Payment, whichever is sooner. Failure to submit Submittal Schedule with the first Application for Payment will be cause for not processing Application for Payment.

1.6 PRECONSTRUCTION MEETING

- A. Architect will schedule a meeting after Notice to Proceed.
- B. Attendance Required:
 - 1. Owner.
 - 2. Parkhill.
 - 3. Contractor.
- C. Agenda:
 - 1. Submission of executed bonds and insurance certificates.
 - 2. Distribution of Contract Documents.
 - 3. Submission of list of subcontractors, list of products, Schedule of Values, Submittal Schedule, and progress schedule.
 - 4. Designation of personnel representing each party in Contract and Architect.
 - 5. Procedures and processing of field decisions, submittals, substitutions, Applications for Payments, Proposal Request, Change Orders, Request for Information (RFI), and Contract closeout procedures.
 - 6. Review Notice to Proceed (NTP) and Substantial Completion dates.
 - 7. Scheduling:
 - a. Use of premises by Owner and Contractor.
 - b. Construction facilities and controls provided by Owner.
 - c. Temporary utilities provided by Owner.
 - d. Survey and building layout.
 - e. Security and housekeeping procedures.
 - f. Construction progress meetings.
 - g. Procedures for testing.
 - h. Procedures for maintaining record documents.
 - i. Requirements for start-up of equipment.
 - j. Inspection and acceptance of equipment put into service during construction period.
 - 8. Scheduling activities of construction material testing (CMT) lab with Geotechnical Engineer.
- D. Record minutes and distribute copies within 3 days after meeting to participants with 2 copies to Architect and those affected by decisions made.

1.7 REQUEST FOR INFORMATION

- A. Request for Information (RFI) requests from subcontractors or material suppliers will not be considered. All RFI's must be submitted by Contractor.
- B. RFI's must be submitted on the Parkhill RFI form, or equal approved by Architect in advance of submitting first RFI. A copy of the Parkhill RFI form may be obtained from Architect upon request by Contractor. A sample is attached following this Section.
- C. Information indicated on RFI shall be complete before submission. If Architect determines that request can be answered with information provided, Architect will assign an RFI tracking number. Requests determined by Architect not to be an RFI will be returned to Contractor electronically and deleted from Architect's electronic tracking software without being assigned an RFI tracking number. A transmittal document returning the denied RFI request will be provided with a response indicating action to be taken by Contractor.
- D. RFIs may contain more than 1 item when items are related issues. Otherwise, only 1 item shall be addressed on each RFI request.
- E. Allow 7 days for responses to each RFI.

- F. Response to RFI will be issued to Contractor and Owner per Section 01 33 00 "Submittal Procedures."
- G. Responses from Architect are not changes unless issued with a change per Section 01 20 00 "Price and Payment Procedures."

1.8 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of Work at minimum monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.
- C. Attendance Required:
 - 1. Owner.
 - 2. Job superintendent.
 - 3. Major subcontractors.
 - 4. Architect.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of Work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems which impede planned progress.
 - 5. Review of submittal schedule and status of submittals.
 - 6. Review of off-site fabrication and delivery schedules.
 - 7. Maintenance of progress schedule.
 - 8. Corrective measures to regain projected schedules.
 - 9. Planned progress during succeeding Work period.
 - 10. Coordination of projected progress.
 - 11. Maintenance of quality and Work standards.
 - 12. Effect of proposed changes on progress schedule and coordination.
 - 13. Other business relating to Work.
- E. Record minutes and distribute copies within 3 days to Architect, participants, and those affected by decisions made.

1.9 PREINSTALLATION MEETING

- A. When required in individual Specification Sections, convene a preinstallation meeting at site prior to installing Work.
- B. Require attendance of parties directly affecting, or affected by, Work.
- C. Notify Architect 4 days in advance of meeting date.
- D. Prepare agenda and preside at meeting.
 - 1. Review conditions of installation, preparation, and installation procedures.
 - 2. Review coordination with related Work.
- E. Record minutes, and distribute copies within 3 days after meeting to participants with 3 copies to Architect.

PART 2 - PRODUCTS

2.1 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Motors: Specific motor type is specified in individual Specification Sections.
- B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
- C. Cord and Plug: Provide minimum 6-foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Examine and verify specific conditions described in individual Specification Sections.
- C. Verify that utility services are available, of correct characteristics, and in correct location.

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 any manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 CUTTING AND PATCHING

- A. Employ skilled and experienced installer to perform cutting and patching.
- B. Submit request in advance of cutting or altering elements which affects:
 - 1. Structural integrity of element.
 - 2. Integrity of weather-exposed or moisture-resistant elements.
 - 3. Efficiency, maintenance, or safety of element.
 - 4. Visual qualities of sight-exposed elements.
 - 5. Work of Owner or separate Contractor.
- C. Execute cutting, fitting, and patching including excavation and fill to complete Work and to:
 - 1. Fit several parts together to integrate with other Work.
 - 2. Uncover Work to install or correct ill-timed Work.
 - 3. Remove and replace defective and non-conforming Work.
 - 4. Remove samples of installed Work for testing.
 - 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

- D. Execute Work by methods which will avoid damage to other Work, and provide proper surfaces to receive patching and finishing.
- E. Cut rigid materials using masonry saw or core drill.
- F. Restore Work with new products in accordance with requirements of Contract Documents.
- G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- I. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection. For an assembly, refinish entire unit.
- J. Identify any hazardous substance or condition exposed during Work to Architect for decision or remedy.

END OF SECTION

RFI
No.

TO: Parkhill

FROM:

PROJECT NAME:

PARKHILL PROJECT NO.:

Issue Date:		*Requested Reply Date:	
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*Items to be completed by Contractor before submittal to Parkhill for review. RFI form must be fully completed for Parkhill to respond.

***RFI DESCRIPTION:** *(Fully describe the question or type of information requested. Provide photos and/or sketches as applicable to help with the description.)*

***REFERENCES/ATTACHMENTS:** *(List specific documents researched when seeking the information requested.)*

Specifications	Drawings	Other

***CONTRACTOR'S PROPOSED SOLUTION:** *(If RFI concerns a site or construction condition, the sender shall provide a recommended solution, including cost and/or schedule considerations before Parkhill can respond. The proposal solution shall consist of a revised text, sketches, drawings, etc. as applicable to a full and complete explanation.)*

*Submitted by:

RESPONSE: *(Provide answer to RFI, including cost and/or schedule considerations, revised text, sketches, drawings, etc. as applicable to fully explain response.)*

☐ Attachments:

Response by:

Copies: ☐ Owner

☐ Consultants

☐

☐

Note: This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.



AIA[®] Document C106[™] – 2022

Digital Data Licensing Agreement

AGREEMENT made as of the day of in the year
(In words, indicate day, month, and year.)

BETWEEN the Party transmitting Digital Data ("Transmitting Party"):
(Name, address, and contact information, including electronic addresses)

and the Party receiving the Digital Data ("Receiving Party"):
(Name, address, and contact information, including electronic addresses)

for the following Project:
(Name and location or address of the Project)

for the following Digital Data ("Digital Data"):
(Identify below, in detail, the information created or stored in digital form that the Parties intend to be subject to this Agreement.)

[Revit Models (.rvt files)]
[AutoCAD (.dwg files)]
[Portable Document Format (.pdf)]

The Transmitting Party and Receiving Party agree as follows.

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

TABLE OF ARTICLES

1	GENERAL PROVISIONS
2	TRANSMISSION OF DIGITAL DATA
3	LICENSE CONDITIONS
4	LICENSING FEE OR OTHER COMPENSATION

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 The purpose of this Agreement is to grant a license from the Transmitting Party to the Receiving Party for the Receiving Party's use of Digital Data and to set forth the license terms.

§ 1.2 This Agreement is the entire and integrated agreement between the Parties. Except as specifically set forth herein, this Agreement does not create any other contractual relationship between the Parties.

§ 1.3 Confidential Digital Data is Digital Data containing confidential or business proprietary information that the Transmitting Party designates as "confidential."

ARTICLE 2 TRANSMISSION OF DIGITAL DATA

§ 2.1 The Transmitting Party grants to the Receiving Party a nonexclusive limited license to use the Digital Data solely and exclusively for the uses, and in accordance with the terms, set forth in Article 3.

§ 2.2 Only the Receiving Party is permitted to access and use the Digital Data. Unlicensed and unauthorized access or use by third parties is strictly prohibited except as set forth in Section 2.4.1.

§ 2.3 The transmission of Digital Data constitutes a warranty by the Transmitting Party to the Receiving Party that the Transmitting Party is the copyright owner of the Digital Data or otherwise has permission to transmit the Digital Data to the Receiving Party for its use on the Project in accordance with the terms and conditions of this Agreement.

§ 2.4 Where the Transmitting Party has designated information furnished pursuant to this Agreement as "confidential," the Receiving Party shall keep the information confidential and shall not disclose it to any other person or entity except as set forth in Section 2.4.1.

§ 2.4.1 The Receiving Party may disclose Confidential Digital Data after seven (7) days' notice to the Transmitting Party where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Receiving Party may also disclose Confidential Digital Data to its employees, consultants, sureties, subcontractors and their employees, sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.5 By transmitting Digital Data, the Transmitting Party does not convey any ownership right in the Digital Data or in the software used to generate the Digital Data. Unless otherwise granted in a separate license, the Receiving Party's right to use, modify, or further transmit Digital Data is specifically limited to those uses, and in accordance with the terms, set forth in Article 3, and nothing contained in this Agreement conveys any other right to use the Digital Data.

§ 2.6 To the fullest extent permitted by law, the Receiving Party shall indemnify and defend the Transmitting Party from and against all claims arising from or related to the Receiving Party's modification to, or unlicensed use of, the Digital Data.

§ 2.7 Transmission of the Digital Data does not abridge or extinguish the Transmitting Party's rights, including, to the extent applicable, exclusive ownership interest, in such information under all applicable state, federal, and international laws including, without limitation, laws governing the protection of copyrights and intellectual property.

§ 2.8 The provisions of this Article 2 shall survive the termination of this Agreement.

ARTICLE 3 LICENSE CONDITIONS

§ 3.1 The Receiving Party may use and rely upon the Digital Data to the extent set forth in this Article 3.

(Paragraph deleted)

[X] § 3.1.1 The Digital Data is transmitted solely for the Receiving Party's information. Receiving Party acknowledges that any use of the Digital Data shall be at Receiving Party's sole risk. The Receiving Party accepts the Digital Data "as is" without any warranty or representations from the Transmitting Party as to whether the Digital Data is accurate, complete, or fit for use as intended by the Receiving Party. The Receiving Party is solely responsible for verifying whether the Digital Data is accurate, complete, or fit for the Receiving Party's intended use.

(Paragraphs deleted)

§ 3.1.1.1 This Digital Data is part of the Transmitting Party's Instruments of Service and shall not be used by Receiving Party or anyone else receiving this data through or from the Receiving Party for any purpose other than as a convenience in the preparation of bid submittals, shop drawings, coordination drawings, construction phase submittals, and field layout and staking required by the Owner for the exclusive use of the referenced Project. Any use or reuse by the Receiving Party or by others will be at the Receiving Party's sole risk and without liability or legal exposure to Transmitting Party. The Receiving Party agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against Transmitting Party, its officers, directors, employees, or subconsultants that may arise out of or in connection with Receiving Party's use of this Digital Data.

§ 3.1.1.2 No representation as to the compatibility of this Digital Data with Receiving Party's hardware or software is provided.

§ 3.1.1.3 This Digital Data is not a Construction Document. Differences may exist between this Digital Data and corresponding two-dimensional hard-copy Construction Document. The Transmitting Party makes no representation regarding the accuracy or completeness of the Digital Data the Receiving Party receives. In the event that a conflict arises between the signed/sealed two-dimensional hard-copy Construction Document prepared by Transmitting Party and the Digital Data, the signed/sealed two-dimensional hard-copy Construction Document shall govern. The Receiving Party is responsible for determining if any conflict exists. By the Receiving Party's use of this Digital Data, Receiving Party is not relieved of their duty to fully comply with the Contract Documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, field measurements, verify field conditions and coordination of work with that of other contractors for the Project.

§ 3.1.1.4 Because information presented in the Digital Data can be modified, unintentionally or otherwise, the Transmitting Party reserves the right to remove all indicia of ownership and/or involvement from each Digital Data.

§ 3.1.1.5 Under no circumstances shall delivery of this Digital Data for use by the Receiving Party be deemed a sale of document ownership by Transmitting Party, and no warranties, either express or implied, of merchantability or fitness for any particular purpose is made. In no event shall the Transmitting Party be liable for any loss of profit or any consequential damages as a result of the Receiving Party's use or reuse of this Digital Data.

§ 3.1.1.6 The Digital Data file does not necessarily contain all the information that is required to produce finished Construction Documents. Because of this, there may be data within the Digital Data that is missing, incomplete or even contradictory to the information provided in the final two dimensional Construction Documents.

§ 3.1.1.7 Professional judgment will need to be used by the Receiving Party, along with reasonable expectations and interpretations in order to use the Digital Data for its intended purpose. Should the Transmitting Party provide revised and updated copies of the Digital Data to the Receiving Party throughout the Project, all terms and conditions of this agreement will be applicable and unchanged for all subsequent transmissions of the Digital Data

ARTICLE 4 LICENSING FEE OR OTHER COMPENSATION

The Receiving Party agrees to pay the Transmitting Party the following fee or other compensation for the Receiving Party's use of the Digital Data:

(State the fee, in dollars, or other method by which the Receiving Party will compensate the Transmitting Party for the Receiving Party's use of the Digital Data.)

This Agreement is entered into as of the day and year first written above and terminates one year from said date, except as set forth below.

(Indicate when this Agreement will terminate, if other than one year from the date it was entered into, and other conditions related to termination.)

N/A

PARKHILL

[RECEIVING PARTY]

TRANSMITTING PARTY *(Signature)*

RECEIVING PARTY *(Signature)*

(Printed name and title)

(Printed name and title)

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Submittal procedures.
 - 2. Resubmittals requirements.
 - 3. Construction progress schedules.
 - 4. Shop Drawings.
 - 5. Product data.
 - 6. Samples.
 - 7. Design data.
 - 8. Test reports.
 - 9. Certificates.
 - 10. Manufacturer instructions.
 - 11. Manufacturer field reports.
 - 12. Erection Drawings.
- B. Related Requirements:
 - 1. Other Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 01 20 00 "Price and Payment Procedures" for Schedule of Values; Inspecting and Testing Allowances.
 - 3. Section 01 30 00 "Administrative Requirements" for Project information management.
 - 4. Section 01 40 00 "Quality Requirements" for manufacturers' field services and reports; Testing Laboratory Services.
 - 5. Section 01 70 00 "Execution and Closeout Requirements" for Contract warranty, manufacturer's certificates, and closeout Submittals.

1.2 SUBMITTAL PROCEDURES

- A. Submit for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Produce copies and distribute in accordance with this Article.
- C. Use Project website to submit record documents as described in Section 01 70 00 "Execution and Closeout Requirements."
- D. Transmit each Submittal separately with Contractor's standard transmittal letter including Contractor's name, address, and phone number. Each Submittal shall contain only one Specification Section.
- E. Sequentially number transmittal forms using Section number or Contractor's other sequential numbering system.
- F. Identify Project, Contractor, subcontractor, or supplier; pertinent Drawing sheet and detail number(s), and Specification Section number appropriate to Submittal.
- G. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with requirements of Work and Contract Documents.
- H. Schedule Submittals to expedite Project, and deliver to Architect. Coordinate submission of related items.

- I. For each Submittal submitted for review, allow 15 days excluding delivery time to and from Contractor.
- J. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work. Information, comments, field verifications, responses, or other notations marked on Submittals by Contractor shall be done in blue or green colors only.
- K. Allow space on Submittals for Contractor and Architect's review stamps.
- L. Distribute copies of reviewed Submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.
- M. Submittals not requested will not be recognized or processed.
- N. Format:
 - 1. Submit all Submittals digitally using PDF file extension. Each Submittal shall be a single PDF file including transmittal letter. Multiple files for same Submittal will not be accepted.
 - 2. Submittal in any other format, including ZIP files, will be rejected.
 - 3. Hard copies will not be accepted.
 - 4. To ensure each page is legible, PDF pages of Drawings shall be same size/scale as a hard copy. Where applicable, scale symbols should be provided to indicate scale. Illegible Submittals will be rejected.
 - 5. Upload Submittals to Project website.
- O. Submittal procedures described in this Article apply to construction progress schedule, products list, Shop Drawings, product data, samples (actual samples and digital files of same), design data, test reports, certificates, manufacturer's instructions and field reports, Erection Drawings, and any other type of Submittal submitted to Architect.

1.3 RESUBMITTAL REQUIREMENTS

- A. Revise and resubmit Submittals, as required, and resubmit to meet requirements as specified and as noted on Submittal reviews.
- B. Mark as RESUBMITTAL.
- C. Re-use original transmittal number and supplement with sequential alphabetical or numeric suffix for each resubmittal.

1.4 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial progress schedule for Architect's review within 15 days after date established in Notice to Proceed or with the first Application for Payment, whichever is sooner.
- B. Revise and resubmit as required.
- C. Submit revised schedule with each Application for Payment, identifying changes since previous version.
- D. Submit a horizontal bar chart with separate line for each Section of Work identifying first workday of each week.
- E. Indicate product/material manufacturer's lead-time for delivery to site. Include as a separate line for each product/material.
- F. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.

- G. Indicate estimated percentage of completion for each item of Work at each submission.
- H. Dates reviewed Submittals will be required from Architect. Indicate decision dates for selection of finishes. Submit separate schedule of Submittal dates for the following:
 - 1. Shop Drawings.
 - 2. Product data.
 - 3. Samples.
 - 4. Owner furnished products.
 - 5. Products identified under Allowances.
- I. Determine appropriate lead times to allow for manufacturing and delivery of products/material for incorporation into Work. Indicate product/material manufacturer's lead-time for manufacturing and delivery to site. Include as a separate line for each product/material. Failure to timely submit and process Submittals, and ordering of products/materials for delivery to site will not be grounds for approval of substitutions for other products/materials.
- J. Revisions to Schedules:
 - 1. Indicate progress of each activity to date of Submittal, and projected completion date of each activity.
 - 2. Identify activities modified since previous Submittal, major changes in scope, and other identifiable changes.
 - 3. Prepare narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect including effect of changes on schedules of separate Contractors.

1.5 SHOP DRAWINGS

- A. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- B. Printable Image Size: Minimum 8-1/2 by 11 inches and maximum 30 by 42 inches.
- C. Draw details to a minimum scale of 1/2-inch equal to 1-foot.
- D. Draw Site Plans to same scale indicated on Contract Drawings.
- E. Draw other plans to a minimum scale of 1/8-inch equal to 1-foot.
- F. Construction Documents (electronic or paper format) issued by Architect cannot be used in any shape, form, or fashion in creation and development of Shop Drawings except that electronic files containing Floor Plans or Site Plans which have been acquired from Architect may be used as backgrounds for Contractor, subcontractors, sub-subcontractors, and material suppliers in Shop Drawing process.
- G. In creation and publication of Shop Drawings, under no circumstances shall Design Professional's seal or title block of Drawing be reproduced. Shop Drawings must be original works from Contractor, subcontractors, sub-subcontractors, and material suppliers.

1.6 PRODUCT DATA

- A. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.
- B. Include recommendations for application and use, and reference to compliance with specified standards of trade associations and testing agencies.
- C. Include notation of special coordination requirements for interfacing with adjacent Work and building utilities where applicable.
- D. After review, distribute in accordance with "Submittal Procedures" Article above and provide copies for Record Documents described in Section 01 70 00 "Execution and Closeout Requirements."

1.7 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of product with integral parts and attachment devices. Accompany physical sample with color digital image (photo or scanned PDF) of sample. Coordinate sample Submittals for interfacing Work.
- B. Unless otherwise specified, submit samples of finishes from manufacturer's full range of standard colors, textures, and patterns, for Architect's selection.
- C. Where variations in color, pattern, or texture are inherent in material or product, submit multiple samples to indicate approximate range or variations.
- D. Include full Project information and identification of manufacturer, model number, type, style, and color on each sample.
- E. Submit number of samples specified in individual Specification Sections; one of which will be retained by Architect.
- F. Reviewed samples which may remain as part of Work are indicated in individual Specification Sections.
- G. Samples will not be used for testing purposes unless specifically stated in individual Specification Sections.

1.8 DESIGN DATA

- A. Submit for Architect's knowledge as Contract Administrator or for Owner.
- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.9 TEST REPORTS

- A. Submit for Architect's knowledge as Contract Administrator or for Owner.
- B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.10 CERTIFICATES

- A. When specified in individual Specification Sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Architect.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

1.11 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual Specification Sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing.
- B. Identify conflicts between manufacturer's instructions and Contract Documents.
- C. Indicate special procedures, conditions requiring special attention, and special environmental criteria required for application or installation.

1.12 MANUFACTURER'S FIELD REPORTS

- A. Submit reports for Architect's benefit as Contract Administrator or for Owner.
- B. Submit report within 30 days of observation to Architect for information.
- C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.13 ERECTION DRAWINGS

- A. Submit Drawings for Architect's benefit as Contract Administrator or for Owner.
- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.
- C. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Quality control and control of installation.
 - 2. Tolerances.
 - 3. References.
 - 4. Mockup requirements.
 - 5. Examination.
 - 6. Preparation.
- B. Related Requirements:
 - 1. Other Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 01 30 00 "Administrative Requirements" for Project information management.
 - 3. Section 01 33 00 "Submittal Procedures" for submission of manufacturer's instructions and certificates.
 - 4. Section 01 60 00 "Product Requirements" for requirements for material and product quality.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce Work of specified quality.
- B. Comply with manufacturer's instructions including each step in sequence.
- C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as a minimum quality for Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce workmanship of specified quality.
- F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturer's tolerances. Should manufacturer's tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing in place.

1.4 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date of Notice to Proceed except where a specific date is established by Code.
- C. Obtain copy of standards when required by Specification Section.
- D. Neither contractual relationship, duties, nor responsibilities of parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.5 MOCKUP REQUIREMENTS

- A. Tests will be performed under provisions identified in this Section and identified in respective product Specification Sections.
- B. Assemble and erect specified items, with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mockups shall be comparison standard for quality level for Work.
- D. Where mockup has been accepted by Architect and is specified in individual Specification Sections to be removed, remove mockup and clear area.

1.6 TESTING AND INSPECTION SERVICES

- A. Employ and pay for services of an independent testing agency or laboratory.
- B. The independent firm will perform inspections, tests, and other services specified in individual Specification Sections and as required by Architect.
- C. Testing, inspections, and source quality control may occur on or off Project site. Perform off-site testing as required by Architect or Owner.
- D. Submit independent testing laboratory firm's reports to Architect. Reports to include observations and results of tests and will indicate compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, provide safe access to Project site, and provide assistance by incidental labor as requested.
 - 1. Notify Owner, Architect, and independent firm 48 hours prior to expected time for operations requiring services.
- F. Employment of independent testing agency or laboratory does not relieve Contractor from performing Work to Contract requirements.
- G. Re-testing and/or re-inspection required because of non-conformance to specified requirements will be charged to Contractor by deducting re-testing and/or re-inspection charges from Contract Sum/ Price.

1.7 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, and startup of equipment, test, adjust, and balance of equipment as applicable and to initiate instructions when necessary.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify 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. Verify utility services are available, of correct characteristics, and in correct locations.

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 new material or substance in contact or bond.

END OF SECTION

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Requirements:
 - 1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 DEFINITIONS

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

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
 - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. AABC - Associated Air Balance Council; www.aabc.com.
 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 7. ABMA - American Boiler Manufacturers Association; www.abma.com.
 8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
 9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 11. AF&PA - American Forest & Paper Association; www.afandpa.org.
 12. AGA - American Gas Association; www.aga.org.
 13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
 14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 15. AI - Asphalt Institute; www.asphaltinstitute.org.
 16. AIA - American Institute of Architects (The); www.aia.org.
 17. AISC - American Institute of Steel Construction; www.aisc.org.
 18. AISI - American Iron and Steel Institute; www.steel.org.
 19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
 20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
 21. ANSI - American National Standards Institute; www.ansi.org.
 22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
 23. APA - APA - The Engineered Wood Association; www.apawood.org.
 24. APA - Architectural Precast Association; www.archprecast.org.
 25. API - American Petroleum Institute; www.api.org.
 26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
 27. ARI - American Refrigeration Institute; (See AHRI).
 28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
 29. ASCE - American Society of Civil Engineers; www.asce.org.
 30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
 31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.

32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASSP - American Society of Safety Professionals (The); www.assp.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AVIXA - Audiovisual and Integrated Experience Association; (Formerly: Infocomm International); www.soundandcommunications.com.
38. AWEA - American Wind Energy Association; www.awea.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWP - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
50. CDA - Copper Development Association; www.copper.org.
51. CE - Conformite Europeenne; <http://ec.europa.eu/growth/single-market/ce-marking/>.
52. CEA - Canadian Electricity Association; www.electricity.ca.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - CompoSite Panel Association; www.compoSitepanel.org.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csa-group.org.
65. CSI - Construction Specifications Institute (The); www.csiresources.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTA - Consumer Technology Association; www.cta.tech.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.coolingtechnology.org.
69. CWC - CompoSite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHA - Decorative Hardwoods Association; (Formerly: Hardwood Plywood & Veneer Association); www.decorativehardwoods.org.
72. DHI - Door and Hardware Institute; www.dhi.org.
73. ECA - Electronic Components Association; (See ECIA).

74. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
75. ECIA - Electronic Components Industry Association; www.eciaonline.org.
76. EIA - Electronic Industries Alliance; (See TIA).
77. EIMA - EIFS Industry Members Association; www.eima.com.
78. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
79. EOS/ESD Association; (Electrostatic Discharge Association); www.esda.org.
80. ESTA - Entertainment Services and Technology Association; (See PLASA).
81. ETL - Intertek (See Intertek); www.intertek.com.
82. EVO - Efficiency Valuation Organization; www.evo-world.org.
83. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
84. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
85. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
86. FM Approvals - FM Approvals LLC; www.fmglobal.com.
87. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
88. FRSA - Florida Roofing, Sheet Metal Contractors Association, Inc.; www.floridarroof.com.
89. FSA - Fluid Sealing Association; www.fluidsealing.com.
90. FSC - Forest Stewardship Council U.S.; www.fscus.org.
91. GA - Gypsum Association; www.gypsum.org.
92. GANA - Glass Association of North America; (See NGA).
93. GS - Green Seal; www.greenseal.org.
94. HI - Hydraulic Institute; www.pumps.org.
95. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
96. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
97. HPVA - Hardwood Plywood & Veneer Association; (See DHA).
98. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
99. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
100. IAS - International Accreditation Service; www.iasonline.org.
101. ICBO - International Conference of Building Officials; (See ICC).
102. ICC - International Code Council; www.iccsafe.org.
103. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
104. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
105. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
106. IEC - International Electrotechnical Commission; www.iec.ch.
107. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
108. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
109. IESNA - Illuminating Engineering Society of North America; (See IES).
110. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
111. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
112. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
113. II - Infocomm International; (See AVIXA).
114. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
115. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.

116. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
117. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
118. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
119. ISO - International Organization for Standardization; www.iso.org.
120. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
121. ITU - International Telecommunication Union; www.itu.int/home.
122. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
123. LMA - Laminating Materials Association; (See CPA).
124. LPI - Lightning Protection Institute; www.lightning.org.
125. MBMA - Metal Building Manufacturers Association; www.mbma.com.
126. MCA - Metal Construction Association; www.metalconstruction.org.
127. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
128. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
129. MHIA - Material Handling Industry of America; www.mhia.org.
130. MIA - Marble Institute of America; (See NSI).
131. MPPA - Moulding & Millwork Producers Association; www.wmmpa.com.
132. MPI - Master Painters Institute; www.paintinfo.com.
133. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
134. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
135. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
136. NADCA - National Air Duct Cleaners Association; www.nadca.com.
137. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
138. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
139. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
140. NBI - New Buildings Institute; www.newbuildings.org.
141. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
142. NCMA - National Concrete Masonry Association; www.ncma.org.
143. NEBB - National Environmental Balancing Bureau; www.nebb.org.
144. NECA - National Electrical Contractors Association; www.necanet.org.
145. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
146. NEMA - National Electrical Manufacturers Association; www.nema.org.
147. NETA - InterNational Electrical Testing Association; www.netaworld.org.
148. NFHS - National Federation of State High School Associations; www.nfhs.org.
149. NFPA - National Fire Protection Association; www.nfpa.org.
150. NFPA - NFPA International; (See NFPA).
151. NFRC - National Fenestration Rating Council; www.nfrc.org.
152. NGA - National Glass Association (The); (Formerly: Glass Association of North America); www.glass.org.
153. NHLA - National Hardwood Lumber Association; www.nhla.com.
154. NLGA - National Lumber Grades Authority; www.nlga.org.
155. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
156. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
157. NRCA - National Roofing Contractors Association; www.nrca.net.

158. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
159. NSF - NSF International; www.nsf.org.
160. NSI - National Stone Institute; (Formerly: Marble Institute of America); www.naturalstoneinstitute.org.
161. NSPE - National Society of Professional Engineers; www.nspe.org.
162. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
163. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
164. NWFA - National Wood Flooring Association; www.nwfa.org.
165. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
166. PDI - Plumbing & Drainage Institute; www.pdionline.org.
167. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
168. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
169. RFCI - Resilient Floor Covering Institute; www.rfci.com.
170. RIS - Redwood Inspection Service; www.redwoodinspection.com.
171. SAE - SAE International; www.sae.org.
172. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
173. SDI - Steel Deck Institute; www.sdi.org.
174. SDI - Steel Door Institute; www.steeldoor.org.
175. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
176. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
177. SIA - Security Industry Association; www.siaonline.org.
178. SJI - Steel Joist Institute; www.steeljoist.org.
179. SMA - Screen Manufacturers Association; www.smainfo.org.
180. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
181. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
182. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
183. SPIB - Southern Pine Inspection Bureau; www.spib.org.
184. SPRI - Single Ply Roofing Industry; www.spri.org.
185. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
186. SSINA - Specialty Steel Industry of North America; www.ssina.com.
187. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
188. STI - Steel Tank Institute; www.steeltank.com.
189. SWI - Steel Window Institute; www.steelwindows.com.
190. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
191. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
192. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
193. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
194. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
195. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
196. TMS - The Masonry Society; www.masonrysociety.org.
197. TPI - Truss Plate Institute; www.tpinst.org.
198. TPI - Turfgrass Producers International; www.turfgrasssod.org.
199. TRI - Tile Roofing Institute; www.tilerroofing.org.
200. UL - Underwriters Laboratories Inc.; www.ul.com.
201. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.

202. USAV - USA Volleyball; www.usavolleyball.org.
 203. USGBC - U.S. Green Building Council; www.usgbc.org.
 204. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
 205. WA - Wallcoverings Association; www.wallcoverings.org.
 206. WASTEC - Waste Equipment Technology Association; www.wastec.org.
 207. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
 208. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
 209. WDMA - Window & Door Manufacturers Association; www.wdma.com.
 210. WI - Woodwork Institute; www.wicnet.org.
 211. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
 2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 3. ICC - International Code Council; www.iccsafe.org.
 4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
1. COE - Army Corps of Engineers; www.usace.army.mil.
 2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 4. DOD - Department of Defense; www.quicksearch.dla.mil.
 5. DOE - Department of Energy; www.energy.gov.
 6. EPA - Environmental Protection Agency; www.epa.gov.
 7. FAA - Federal Aviation Administration; www.faa.gov.
 8. FG - Federal Government Publications; www.gpo.gov/fdsys.
 9. GSA - General Services Administration; www.gsa.gov.
 10. HUD - Department of Housing and Urban Development; www.hud.gov.
 11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
 12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 13. SD - Department of State; www.state.gov.
 14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
 15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
 17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
 18. USP - U.S. Pharmacopeial Convention; www.usp.org.
 19. USPS - United States Postal Service; www.usps.com.

- E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
 2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
 3. FED-STD - Federal Standard; (See FS).
 4. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
 5. MILSPEC - Military Specification and Standards; (See DOD).
 6. USAB - United States Access Board; www.access-board.gov.
 7. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 3. CDHS; California Department of Health Services; (See CDPH).
 4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
 5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
 6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
 7. TAS; Architectural Barriers Texas Accessibility Standards; www.tdlr.texas.gov/ab/abtas.htm.
 8. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservation.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Temporary Utilities:
 - a. Electricity.
 - b. Lighting.
 - c. Ventilation.
 - d. Communication services.
 - e. Water.
 - f. Sanitary.
 - 2. Construction Facilities:
 - a. Field offices and sheds.
 - b. Vehicular access.
 - c. Parking.
 - d. Progress cleaning.
 - e. Project identification.
 - 3. Temporary Controls:
 - a. Barriers.
 - b. Fencing.
 - c. Water control.
 - d. Dust control.
 - e. Erosion and sediment control.
 - f. Noise control.
 - g. Pest and rodent control.
 - h. Pollution control.
 - i. Protection of Work.
 - 4. Removal of utilities, facilities, and controls.
- B. Related Requirements:
 - 1. Other Divisions 01 Specification Sections apply to Work of this Section.
 - 2. Section 01 70 00 "Execution and Closeout Requirements" for final cleaning.

1.2 EMPLOYEE RESIDENTIAL OCCUPANCY

- A. Not allowed on Owner's property.

1.3 VEHICULAR ACCESS

- A. Construct temporary all-weather access roads from public thoroughfares to serve construction area, of width and load bearing capacity to accommodate unimpeded traffic for construction purposes.
- B. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.
- C. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.

- D. Location as approved by Architect.
- E. Provide unimpeded access for emergency vehicles. Maintain 20-foot-wide driveways with turning space between and around combustible materials.
- F. Provide and maintain access to fire hydrants and control valves free of obstructions.
- G. Provide means of removing mud from vehicle wheels before entering public streets.

1.4 PARKING

- A. Provide temporary gravel surface parking areas to accommodate construction personnel.
- B. Locate as approved by Architect.
- C. When site space is not adequate, provide additional off-site parking.
- D. Do not allow heavy or tracked vehicles or construction equipment in parking areas.
- E. Do not allow vehicle parking on existing pavement.
- F. Permanent Pavements and Parking Facilities:
 - 1. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.
- G. Maintenance:
 - 1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
 - 2. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.
- H. Removal, Repair:
 - 1. Remove temporary materials and construction when permanent paving is usable Substantial Completion.
 - 2. Remove underground Work and compacted materials to depth of 2 feet; fill and grade site as specified.
 - 3. Repair permanent facilities damaged by use, to specified condition.
- I. Mud from Site Vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.5 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 space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust.
- D. Remove waste materials, debris, and rubbish from site and dispose off-site at intervals as required to maintain clean site.

1.6 PROJECT IDENTIFICATION

- A. Project Identification Sign:
 - 1. Size: Provide one, 8 feet wide by 4 feet high.
 - 2. Materials: 3/4-inch-thick exterior grade plywood and solid wood frame.
 - 3. Background Paint: Exterior quality, 2 coats.
 - 4. Lettering: Exterior paint of quality adequate to withstand weathering, fading, and chipping for duration of construction, contrasting colors as selected with exhibit lettering by professional sign painter.

5. Design: To be determined.
 6. Content:
 - a. Project title, as indicated on Contract Documents.
 - b. Owner's name and logo.
 - c. Names and titles of Architect and consultants.
 - d. Name of Prime Contractor.
 7. Lettering: Series C of Standard Alphabet for Highway Signs, Public Roads Administration, Federal Works Agency.
- B. Design sign and structure to withstand 90 miles per hour wind velocity.
- C. Installation:
1. Install Project identification sign within 15 days after date fixed by Notice to Proceed.
 2. Erect at location directed by Architect.
 3. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
 4. Install sign surface plumb and level with butt joints. Anchor securely.
 5. Paint exposed surfaces of sign supports and framing.
- D. No other signs are allowed without Owner's permission except those required by law.
- E. Removal: Remove signs, framing, supports, and foundations at completion of Project and restore area.

1.7 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide protection for the following items designated to remain. Replace damaged items condition to original condition.
 1. Trees.
 2. Lawns.
- C. Protect site improvements including but not limited to pavements, walkways, and drainage structures from damage. Replace damaged site improvements to original condition.
- D. Protect non-owned vehicular traffic and stored materials from damage.

1.8 TEMPORARY FENCING

- A. Construction: Commercial grade chain link fence.
- B. Provide 6-foot-high fence around construction site and temporary materials storage area; equip with vehicular gates with locks.

1.9 WATER CONTROL

- A. Grade site to drain.
- B. Maintain excavations free of water.
- C. Provide, operate, and maintain pumping equipment.
- D. Protect site from puddling and running water. Provide water barriers as required to protect site from soil erosion.

1.10 DUST CONTROL

- A. Execute Work by methods to minimize raising dust from construction operations.
- B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

1.11 EROSION AND SEDIMENT CONTROL

- A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- B. Minimize surface area of bare soil exposed at one time.
- C. Provide temporary measures including berms, dikes, and drains and other devices to prevent water flow that would result in erosion.
- D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
- E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.12 NOISE CONTROL

- A. Conduct activities that will produce noise that will or potentially will interfere with Owner's operations and activities at times agreed to by Owner.

1.13 POLLUTION CONTROL

- A. 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.
- B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

1.14 PROTECTION OF INSTALLED WORK

- A. Protect installed Work and provide special protection where specified in individual Specification Sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to minimize damage.
- C. Provide protective coverings at openings in walls, roof, and soffits.
- D. Protect finished walkways, drives, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects by protecting with durable sheet materials.
- E. 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.
- F. Prohibit traffic from landscaped areas.

1.15 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary above grade utilities, equipment, facilities, and materials as soon as permanent facilities can be utilized.
- B. Remove risers for underground utilities to a minimum depth of 2 feet and cap.
- C. Remove buried equipment, facilities, and materials completely to a minimum depth of 2 feet and cap.

- D. Backfill excavations as specified in other Sections and grade site as indicated.
- E. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.
- F. Remove the following at completion of Work:
 - 1. Office.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 57 13 - TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes obtaining permits and furnishing labor, materials, equipment, and incidentals necessary to provide erosion and sediment control during construction including furnishing, installing, and maintaining erosion and sediment control structures and procedures and the proper removal when no longer required.
- B. Related Requirements:
 - 1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 SUBMITTALS

- A. Submittals shall be per Project requirements and include copies of submitted forms and inspection reports as Project progresses.

1.3 TPDES PERMIT

- A. Permit Provisions:
 - 1. Prepare a Stormwater Pollution Prevention Plan (SWPPP), including site map, per TPDES Construction General Permit (TXR 150000) for Stormwater Discharge associated with construction activity.
 - 2. Contractor shall be Primary Operator of SWPPP, will install and maintain physical measures detailed in Plan, and provide administrative oversight of Plan.
 - 3. Contractor Shall:
 - a. Prepare and submit a Notice of Intent (NOI) to TCEQ with a copy to Owner.
 - b. Sign and post onsite a completed "Construction Site Notice," and provide copy to operator of any separate municipal storm sewer system per permit requirements.
 - c. Install Best Management Practices (BMPs) noted on SWPPP Site Plan.
 - d. Maintain BMPs during construction.
 - e. Periodically inspect BMPs, monitor Plan, file reports, and other items required by TPDES Construction General Permit. Contractor shall maintain a master copy of SWPPP Plan at job site and insert copies of required periodic inspection reports into master copy of SWPPP.
 - f. Make revisions to BMPs if needed as construction progresses, revise if BMPs shown do not adequately limit sediments leaving site.
 - g. Prepare and submit a Notice of Termination (NOT) to TCEQ and copy Owner.
 - h. Remove BMPs from Project site.
 - 4. General Permit requirements supersede noted items in the event of a conflict.
 - 5. For assistance in completing NOI or NOT, Contractor may access TCEQ website at www.tceq.state.tx.us.

- B. Temporary Drainage Provisions:
 - 1. Contractor shall provide for drainage of stormwater and water as applied or discharged onsite in performance of Work. Drainage facilities shall be adequate to prevent damage to Work, site, and adjacent property.
 - 2. Clean, enlarge, or supplement existing drainage channels and conduits as necessary to carry all increased runoff attributable to Contractor operations. Construct dikes as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect Owner facilities and Work, and direct water to drainage channels or conduits. Ponding provided as necessary to prevent downstream flooding.
- C. Dust Control: No construction activity shall take place without applying reasonable measures required to prevent particulate matter from becoming airborne, so it remains visible beyond limits of construction. Reasonable measures may include application of water or chemical dust suppressants, paving, frequent road cleaning, and planting vegetative ground cover. Utilize methods and practices of construction to eliminate blowing dust in full observance of state and federal regulations. If dust complaints received by local municipality or Owner, apply reasonable control measures.

1.4 JOB CONDITIONS, CODES, AND ORDINANCES

- A. Comply with local codes and ordinances. If local codes and ordinances require more stringent or additional erosion and sediment control measures during construction, Contractor shall provide such measures.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 57 19 - TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Environmental protection requirements.
 - 2. Protection of natural resources.
 - 3. Erosion and sediment control measures.
 - 4. Control and disposal of solid and sanitary wastes.
- B. Related Requirements:
 - 1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

- A. These publications form a part of this Specification to extent referenced and are referred to in text by basic designation only.
 - 1. 29 CFR 1910-Subpart G - Occupational Health and Environmental Control.
 - 2. Corps of Engineers (COE) COE EP-1165-2-304 - 1976 Flood Plain Regulations for Flood Plain Management.

1.3 DEFINITIONS

- A. Sediment: Soil and other debris that eroded and was transported by runoff water or wind.
- B. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, agricultural operations, and community activities.
- C. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass, crockery, metal, lumber, cans, and bones.
- D. Debris: Combustible and noncombustible wastes such as ashes and waste materials resulting from construction or maintenance and repair Work, leaves, and tree trimmings.
- E. Chemical Wastes: Salts, acids, alkalies, herbicides, pesticides, organic chemicals, and spent products which serve no purpose.
- F. Sanitary Wastes: Sewage.
- G. Wastes Characterized as Domestic Sanitary Sewage: Garbage including refuse and scraps resulting from preparation, cooking, dispensing, and consuming food.
- H. Oily Waste: Petroleum products and bituminous materials.

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

- A. Provide and maintain, during life of Contract, environmental protection as defined. Contractor shall comply with all requirements as described in Construction General Permit (TXR150000). Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions to develop during construction of permanent or temporary environmental features associated with Project. Comply with federal, state, and local regulations pertaining to environment, including but not limited to water, air, and noise pollution.

B. Best Management Practices (BMPs):

1. Waste Materials: Collect and store all waste materials, including construction debris, in a securely lidded metal dumpster. Do not bury construction material onsite. Transit dumpster shall comply with ordinance 18.52.010 (enclosure and removal of waste materials during construction). Dumpster shall be emptied as necessary or as required by ordinance 9.04 (solid waste management) and trash hauled to licensed landfill.
2. Hazardous Waste: At minimum, these product categories are considered hazardous: paint, acids for cleaning masonry surfaces, cleaning solvents, asphalt products, chemical additives for spill stabilization, curing compounds, and additives. In the event of a spill which may be hazardous, take immediate action, contact the fire department and TCEQ.
3. Sanitary Waste: All shall be collected from construction portable units as necessary or required, chapter 18.08 (building code), by a licensed sanitary waste management Contractor. All waste material shall be responsibility of Contractor.
4. Spill Prevention. Use these practices to reduce risk of spills or other accidental exposures of materials to stormwater runoff:
 - a. Good Housekeeping:
 - 1) Store only enough products required to do job.
 - 2) Neatly and orderly store materials onsite.
 - 3) Keep products in original container.
 - 4) Do not mix substances with one another, unless otherwise recommended by manufacturer.
 - 5) Use entire contents of product before disposing container.
 - 6) Follow manufacturer recommendations for proper use and disposal.
 - b. Hazardous product practices used to reduce risks:
 - 1) Keep products in original container if possible.
 - 2) Retain original labels, product information, and material safety data sheets (MSDS).
 - 3) Dispose surplus product per manufacturer-, local-, and/or state-recommended methods.
 - c. Petroleum Products: Monitor all onsite vehicles for leaks and receive regular preventive maintenance to reduce chance of spills. Store petroleum in tightly-sealed containers, clearly labeled. Apply any asphalt substances used onsite per manufacturer recommendation.
5. Spill Control Practices:
 - a. Clearly post manufacturer-recommended methods for spill cleanup and site personnel made aware of procedures.
 - b. Keep materials and equipment necessary for spill cleanup in material storage area onsite.
 - c. Clean all spills immediately after discovery.
 - d. Spill area shall be well ventilated and appropriate clothing worn.
 - e. Report any spill to appropriate governmental agency.
 - f. Take measures to prevent a spill from reoccurring.
6. Maintenance and Inspection Procedures: Inspect all pollution prevention measures at least once a month. Following a storm event of 0.5-inch or more, inspect BMPs and pollution control procedures for adequacy. Keep a record of result of site inspections onsite.
7. Construct disposal areas, stockpiles, and haul roads to minimize and control sediment that may enter receiving waters or streambeds. Construct construction staging areas and vehicle maintenance areas to minimize runoff of pollutants.

- C. Stormwater Pollution Prevention Plan (SWPPP):
 - 1. Understand Erosion Control relating to Texas Pollutant Discharge Elimination System (TPDES).
 - 2. Install erosion control measures as follows:
 - a. Install silt fencing all existing inlets before start of construction.
 - b. Place temporary swales and desilting basins where necessary to convey stormwater runoff.
 - c. Daily sweep paved street adjacent to site entrance to remove any excess mud, dirt, or rock tracked from site.
 - d. Ensure all erosion control methods are inspected monthly or after every erodible rainfall (1/2-inch or more). Make any necessary repairs or cleanup to maintain effectiveness of erosion control at that time.
 - e. Measures are recommendations only. Ensure requirements of TPDES are met.
- D. Perform a preconstruction survey of Project site with Architect; assess existing environmental conditions in and adjacent to site.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

- A. Preserve natural resources within Project boundaries and outside limits of permanent Work. Restore to equivalent or improved condition upon completion of Work. Confine construction activities to within limits of Work indicated or specified.
- B. Land Resources: Except in areas cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without Architect permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by Architect. Where use of attached ropes, cables, or guys is authorized, Contractor is responsible for any resultant damage.
 - 1. Protect existing trees to remain and may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. By approved excavation, remove trees with 30 plus percent of root systems destroyed.
 - 2. Replacement: Remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain Architect approval before replacement.
 - 3. Temporary Construction: Remove traces of temporary construction facilities (haul roads, Work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, etc.). Grade temporary roads, parking areas, and similar temporarily used areas to conform with surrounding contours.
- C. Water Resources/ Oily Wastes: Prevent oily or other hazardous substances from entering ground, drainage areas, or local bodies of water. Surround all temporary fuel oil or petroleum storage tanks with a temporary earth berm of sufficient size and strength to contain contents of tanks in event of leakage or spillage.
- D. Fish and Wildlife Resources: Do not disturb fish and wildlife, alter water flows, or otherwise significantly disturb native habitat adjacent to Project and critical to survival of fish and wildlife, except as indicated or specified.

3.2 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

- A. Carefully protect in-place and report immediately to Architect historical and archaeological items or human skeletal remains discovered in course of Work. Stop Work in immediate area of discovery until directed by Architect to resume. If historical and archaeological resources such as artifacts (stone tools), features (stone walls), deposits (seashells and charcoal stained soil), human bones, and other cultural remains encountered, stop that portion of Work and notify Architect immediately. Within 36 hours, Owner will determine if a change pursuant to Contract should be issued or direct Contractor to proceed without change. No adjustment in Contract Price or completion time allowed for delays that do not exceed 36 hours from the time Contractor is notified to stop Work. Owner retains ownership and control over historical and archaeological resources.

3.3 EROSION AND SEDIMENT CONTROL MEASURES

- A. Burnoff of ground cover not permitted.
- B. Manage and control borrow areas to prevent sediment from entering nearby streams or lakes. Restore areas, including those outside borrow areas, disturbed by borrow and haul operations. Restoration includes grading, replacement of topsoil, and establishment of a permanent vegetative cover.
- C. Protection of Erodible Soils: Immediately finish earthwork brought to a final grade, as indicated, or specified. Immediately protect side and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize duration of exposure of unprotected soils.
- D. Temporary Protection of Erodible Soils: Mechanically retard and control rate of runoff from construction site including construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses.

3.4 CONTROL AND DISPOSE SOLID AND SANITARY WASTES

- A. Pick up solid wastes and place in containers regularly emptied. Do not prepare, cook, or dispose food on Project site. Prevent contamination of site of other areas when handling and disposing wastes. On completion, leave areas clean. Control and dispose waste.
 - 1. Dispose Rubbish and Debris per requirements specified in area as directed by Owner. Rubbish may be disposed in current landfill if all rules for disposal are followed.
 - 2. Place garbage in approved containers and move to a pickup point or disposal area, where directed.

3.5 DUST CONTROL

- A. Control dust along all haul roads and in Project area. Minimize dust at all times, including nonworking periods. Sprinkle or treat with dust suppressants, site soil, haul roads, and other areas disturbed by operations.

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Products.
 - 2. Product delivery, storage, and handling.
 - 3. Product options.
 - 4. Substitutions.
- B. Related Requirements:
 - 1. Other Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 01 30 00 "Administrative Requirements" for Project information management.
 - 3. Section 01 40 00 "Quality Requirements" for product quality monitoring. Testing Laboratory Services.
 - 4. Section 01 42 00 "References."

1.2 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming Work and does not include machinery and equipment used for preparation, fabrication, conveying and erection of Work. When allowed by Contract Documents, products may include used and/or existing materials or components.
- B. Hazardous Materials: Products or material containing hazardous materials or substances, including but not limited to asbestos or polychlorinated biphenylshall (PCB), shall not be included in Work.
- C. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.
- D. Provide interchangeable components of same manufacturer, for similar components.
- E. Materials required to match existing Work and not otherwise specified, shall be equal to existing Work in quality, color, and finish. Workmanship and installation shall be comparable to adjacent existing Work. Architect shall be authority in determination of acceptable Work.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Delivery:
 - 1. Deliver materials, products, and equipment to site in manufacturer's original, unopened containers or packaging with identifying labels intact and legible.
 - 2. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
 - 3. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
 - 4. Arrange deliveries in accord with construction schedule and in ample time to facilitate inspection prior to installation to avoid unnecessary delays in construction process.

- B. Storage:
 - 1. Store and protect products in accordance with manufacturer's instructions with seals and labels intact and legible.
 - 2. Store sensitive products in weathertight, climate-controlled enclosures.
 - 3. For exterior storage of fabricated products, place on supports, above ground, sloped to drain water.
 - 4. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of products.
 - 5. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
 - 6. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
 - 7. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
 - 8. Materials, products, and equipment may be stored off-site in a bonded and insured warehouse approved by Architect and Owner. Pay all costs incurred for off-site storage facilities. Products properly stored in off-site storage facilities may be included in progress pay requests with written approval of Architect.
- C. Handling: Handle materials, products, and equipment in a manner prescribed by manufacturer or specified to protect from damage during storage and installation.

1.4 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of 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 in accordance with this Section.

1.5 SUBSTITUTIONS

- A. Instructions to Proposers specify time restrictions for submitting requests for substitutions during Proposal period to requirements specified in this Section.
- B. Substitutions (after Proposal period) may be considered when a product becomes unavailable through no fault of Contractor.
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- D. A request constitutes a representation that Proposer:
 - 1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
 - 2. Will provide same warranty for substitution as for specified product.
 - 3. Will coordinate installation and make changes to other Work which may be required for Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
- E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or product data submittals, without separate written request or when acceptance will require revision to Contract Documents.

- F. Substitution Submittal Procedure:
1. Submit request for substitution for consideration. Limit each request to 1 proposed substitution.
 2. Requests shall include name of material or equipment to be substituted and a description of proposed substitution including Drawings, performance and test data, and other information necessary for an evaluation.
 3. Submit item-by-item (line-by-line) comparison of each item listed in Specification compiled and submitted comparing specified material/product with proposed substitution and specifically noting all differences between the compared products and/or systems.
 4. Submit statement setting forth changes in other material, equipment, or other portions of Work including changes in Work of other contracts that incorporation of proposed substitution would require shall be included.
 5. Submit Shop Drawings, product data, and certified test results for proposed product equivalence.
 6. Architect will notify Contractor, in writing, of decision to accept or reject request.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Closeout procedures.
 - 2. Final cleaning.
 - 3. Starting of systems.
 - 4. Protecting installed construction.
 - 5. Hazardous materials affidavits.
 - 6. Project record documents.
 - 7. Operation and maintenance data.
 - 8. Manual for equipment and systems.
 - 9. Spare parts and maintenance products.
 - 10. Product warranties and product bonds.
- B. Related Requirements:
 - 1. Other Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 01 30 00 "Administrative Requirements" for Project information management.

1.2 CLOSEOUT PROCEDURES

- A. Submit written certification 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 review.
- B. Provide Submittals to Architect required by authority having jurisdiction.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- D. Closeout documents will be submitted electronically in OCR (Optical Character Recognition)/PDF format.
- E. At Owner's request, Contractor shall provide a hard copy of Closeout Documents in 3-ring binders.
- F. Owner will occupy all of building as specified in Section 01 10 00 "Summary."

1.3 FINAL CLEANING

- A. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces.
- B. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
- C. Replace filters of operating equipment.
- D. Clean debris from roofs, gutters, downspouts, and drainage systems.
- E. Clean site, sweep paved areas, rake clean landscaped surfaces.
- F. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 STARTING OF SYSTEMS

- A. Coordinate schedule for startup of various equipment and systems.
- B. Notify Architect 7 days prior to startup of each item.
- C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute startup under supervision of applicable manufacturer's representative in accordance with manufacturer's instructions.
- G. When specified in individual Specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to startup and to supervise placing equipment or system in operation.
- H. Submit a written report in accordance with Section 01 33 00 "Submittal Procedures" that equipment or system has been properly installed and is functioning correctly.

1.5 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual Specification Sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

1.6 HAZARDOUS MATERIALS AFFIDAVITS

- A. Provide notarized affidavits declaring that hazardous materials were not incorporated into or delivered to site.
- B. Hazardous materials include asbestos, lead polychlorinated biphenyl (PCB), prohibited termite eradication chemicals or any substance of any proportion determined or suspected by an agency of federal or state government to create a health hazard.
- C. Provide table of contents listing affidavits in alphabetical order.
- D. Prepare cover page with printed title "AFFIDAVITS OF NON-INCORPORATED HAZARDOUS MATERIALS," Title of Project, Project Address, Owner's Name, Address and Phone, and Date of Construction Completion.
- E. Provide 1 complete set of aforementioned information in OCR (Optical Character Recognition)/ PDF format.
- F. Submit prior to Application for Final Payment.

1.7 PROJECT RECORD DOCUMENTS

- A. Maintain on site 1 set of record documents; record actual revisions to Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change orders and other modifications to Contract.
 - 5. Reviewed Shop Drawings, product data, and samples.
 - 6. Complete set of MSDS sheets for materials.
 - 7. 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 not less than weekly.
- E. Specifications: Legibly mark and record at each product Section description of products installed, including following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda, Change Orders, RFI responses, and other modifications. For Addenda, Change Orders, and RFI responses, cut out and tape to pages in appropriate location referencing source of change.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish main floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract Drawings.
 - 6. Changes made by Addenda, Change Order, RFI responses, and other modifications. For Addenda, Change Orders, and RFI responses, cut out and tape to pages in appropriate location, referencing source of change.
 - 7. Submit in OCR (Optical Character Recognition)/ PDF format.
 - 8. Submit MSDS on products used in construction of Project.
 - 9. Submit MSDS electronically in 8-1/2- by 11-inch format text pages.
 - 10. Prepare cover page with printed title "MATERIAL SAFETY DATA SHEETS (MSDS)," Title of Project, Project Address, Owner's Name, Address and Phone, and Date of Construction Completion.
 - 11. Internally subdivide contents with page dividers organized into CSI format shown in Project Manual.
 - 12. Prepare a Table of Contents listing each of Division headings and listing each material/ product under each heading by manufacturer and material/ product name.
 - 13. Submit complete set of aforementioned information in OCR (Optical Character Recognition)/ PDF format.
 - 14. Submit information with Application for Final Payment and include MSDS for materials/ products delivered or installed in Project.
 - 15. Failure to submit updated electronic MSDS documents will cause Application for Final Payment to be held by Architect (not submitted to Owner for processing) until such time updated electronic MSDS documents are received and reviewed for compliance by Architect.
- G. Submit documents to Architect with claim for final Application for Payment.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit data electronically in 8-1/2- by 11-inch text pages, OCR (Optical Character Recognition)/ PDF format.
- B. Prepare cover page with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," title of Project.
- C. Internally subdivide contents with page dividers, logically organized as described below:
 - 1. Drawings: Provide in OCR (Optical Character Recognition)/PDF format.
 - 2. Contents: Prepare Table of Contents for each file (if multiple files), with each product or system description identified, in 3 parts as follows:
 - a. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, subcontractors, and major equipment suppliers.
 - b. Part 2: Operation and maintenance instructions, arranged by system and subdivided by Specification Section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify:
 - 1) Significant design criteria.
 - 2) List of equipment.
 - 3) Parts list for each component.
 - 4) Operating instructions.
 - 5) Maintenance instructions for equipment and systems.
 - c. Part 3: Project documents and certificates, including:
 - 1) Shop Drawings and product data.
 - 2) Air and water balance reports.
 - 3) Certificates.
 - 4) Scanned copies of warranties and bonds in OCR (Optical Character Recognition)/ PDF format.
- D. Submit 1 complete set of aforementioned information in OCR (Optical Character Recognition)/ PDF format.
- E. Submit documents with Application for Final Payment.

1.9 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit in OCR (Optical Character Recognition)/ PDF format of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return with comments.
- B. For equipment or component parts of equipment put into service during construction and operated by Owner, submit electronic documents within 10 days after acceptance.
- C. Submit electronic copy of completed volume(s) 15 days prior to final inspection. Draft copy to be reviewed and returned after final inspection, with Architect comments. Revise content of electronic document set as required prior to final submission.
- D. Submit electronic documents in OCR (Optical Character Recognition)/ PDF format of revised final volumes in final form within days after final inspection.
- E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; by label machine.
- G. Include color coded wiring diagrams as installed.

- H. Operating Procedures: Include startup, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and special operating instructions.
- I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- J. Include servicing and lubrication schedule and list of lubricants required.
- K. Include manufacturer's printed operation and maintenance instructions.
- L. Include sequence of operation by controls manufacturer.
- M. Include original manufacturer's parts list, illustrations, assembly Drawings, and diagrams required for maintenance.
- N. Include control diagrams by controls manufacturer as installed.
- O. Include Contractor's coordination Drawings with color coded piping diagrams as installed.
- P. Include charts of valve tag numbers with location and function of each valve, keyed to flow and control diagrams.
- Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- R. Include test and balancing reports as specified in Section 01 40 00 "Quality Requirements."
- S. Additional Requirements: As specified in individual product Specification Sections.
- T. Include listing in Table of Contents for design data with dividers.

1.10 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual Specification Sections.
- B. Deliver to and place in location as directed by Owner; obtain receipt prior to final payment.
- C. Submit receipts signed by Owner or letter stating Contractor has delivered extra products to Owner.

1.11 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed by responsible subcontractors, suppliers, and manufacturers within 10 days after completion of applicable item of Work.
- B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information, and are notarized.
- D. Co-execute submittals when required.
- E. Include Table of Contents.
- F. Submit 1 complete set of aforementioned information in OCR (Optical Character Recognition)/ PDF format for review.
- G. Submit prior to Application for Final Payment.
- H. Time of Submittals:
 - 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 date of acceptance as beginning of warranty or bond period.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 02 41 13 - SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes preparing Project area for construction operations by demolition, removal, and salvage or disposal of all obstructions within limits of Project construction area. Such obstructions are expected to include but not necessarily limited to foundations, asphalt paving, concrete slabs, concrete curb and gutter, existing light poles with concrete footings and associated electrical conduit and wiring, existing water meter boxes, vaults and valve boxes with associated conduit and appurtenances, existing fence with concrete footings, and all rubbish and debris, whether above or below ground, except live utility facilities.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 ITEMS TO REMAIN IN PLACE

- A. Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Owner. Repair or replace damaged items as approved by the Architect. Coordinate the Work of this Section with all other Work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition of Work. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal Work. Repairs, reinforcement, or structural replacement require approval by Architect prior to performing such Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

- A. Where applicable, all lines separating pavement to remove from that to remain in place, shall be cut neatly, in a straight line, or separated at an existing expansion or construction joint. Make cuts by sawing or other methods approved by Owner's Representative which will produce a satisfactory edge. In no case shall line be cut with a motor grader blade.
- B. Remove all existing materials to remove and dispose under this item and dispose in appropriate disposal areas off Owner property. Accomplish removal operations to minimize disturbance of existing underlying courses and adjacent pavement structures or improvements to remain in place. Rework, recompact, and regrade any underlying courses disturbed during removal operations to Architect satisfaction. Repair any damage to adjacent pavement structures or improvements to remain in place to Architect satisfaction.
- C. Unless otherwise indicated on Plans, remove all obstructions to 2 feet below lower elevations of excavation or to bottom of structure, whichever is lower.

- D. Backfill any voids created from removing obstructions within construction area with acceptable material. Compact per requirements of subgrade preparation of Contract Documents.
- E. Complete Work specified herein so prepared construction area is free of holes, ditches, and other abrupt changes in elevations and irregularities to contour.
- F. Protect personnel from possible airborne contaminants, including but not limited to, asbestos fibers, dried fecal matter, and metal dust.
- G. If material containing asbestos is encountered, an Asbestos Hazard Abatement Plan must be prepared.

END OF SECTION

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Form-facing material for cast-in-place concrete.
 - 2. Form liners.
 - 3. Insulating concrete forms.
 - 4. Shoring, bracing, and anchoring.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 DEFINITIONS

- A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction, movement, contraction, and isolation joints.
 - c. Forms and form-removal limitations.
 - d. Shoring and reshoring procedures.
 - e. Anchor rod and anchorage device installation tolerances.

1.4 ACTION SUBMITTALS

- A. Product Data: For each of the following:
 - 1. Void forms.
 - 2. Form liners.
 - 3. Waterstops.
 - 4. Form-release agent.

1.5 QUALITY ASSURANCE

- A. Testing and Inspection Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Form Liners: Store form liners under cover to protect from sunlight.
- B. Insulating Concrete Forms: Store forms off ground and under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.
- C. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 - 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
- B. Design, engineer, erect, shore, brace, and maintain insulating concrete forms in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design cross ties to transfer the effects of the following loads to the cast-in-place concrete core:
 - a. Wind Loads: As indicated on Drawings.
 - 1) Horizontal Deflection Limit: Not more than 1/360 of the wall height.

2.2 FORM-FACING MATERIALS

- A. As-Cast Surface Form-Facing Material:
 - 1. Provide continuous, true, and smooth concrete surfaces.
 - 2. Furnish in largest practicable sizes to minimize number of joints.
 - 3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete," and as follows:
 - a. Plywood, metal, or other approved panel materials.
 - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA HDO (high-density overlay).
 - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
 - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
 - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.
- B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
 - 1. Provide lumber dressed on at least two edges and one side for tight fit.

- C. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- D. Form Liners:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Architectural Polymers, Inc.
 - b. Fitzgerald Formliners.
 - c. Sika Corporation.
 - d. Spec Formliners, Inc.

2.3 WATERSTOPS

- A. Flexible PVC Waterstops: U.S. Army Corps of Engineers CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints, with factory fabricate corners, intersections, and directional changes.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BoMetals, Inc.
 - b. Sika Corporation.
 - c. Vinylex Waterstop & Accessories.
 - 2. Profile: Ribbed without center bulb.
 - 3. Dimensions: 6 inches by 3/8-inch-thick; nontapered.
- B. 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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing Inc.
 - b. CETCO, a Minerals Technologies company.
 - c. Concrete Sealants Inc.
 - d. Henry Company.
 - e. JP Specialties, Inc.
 - f. Sika Corporation.

2.4 RELATED MATERIALS

- A. 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.
- B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034-inchthick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4- by 3/4-inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

- E. 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.
 - 2. Form release agent for form liners shall be acceptable to form liner manufacturer.
- F. 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.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete" for as-cast finishes.
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-1.0: ACI 117 Class D, 1-inch.
 - 2. Surface Finish-2.0: ACI 117 Class B, 1/4-inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 3. Place joints perpendicular to main reinforcement.
 - 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
 - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 6. Space vertical joints in walls as indicated on Drawings.
 - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 - 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 3. 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.
 - 4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
 - 5. Clean embedded items immediately prior to concrete placement.

3.3 INSTALLATION OF WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.
 - 1. Install in longest lengths practicable.
 - 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
 - 3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified in Section 03 30 00 "Cast-In-Place Concrete."
 - 4. Secure waterstops in correct position at 12 inches on center.
 - 5. Field fabricate joints in accordance with manufacturer's instructions using heat welding.
 - a. Miter corners, intersections, and directional changes in waterstops.
 - b. Align center bulbs.
 - 6. Clean waterstops immediately prior to placement of concrete.
 - 7. Support and protect exposed waterstops during progress of the Work.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.
 - 1. Install in longest lengths practicable.
 - 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
 - 3. Protect exposed waterstops during progress of the Work.

3.4 INSTALLATION OF INSULATING CONCRETE FORMS

- A. Comply with ACI 301 and manufacturer's instructions.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Install forms in running bond pattern.
 - 1. Align joints.
 - 2. Align furring strips.
- D. Construct forms tight to prevent loss of concrete mortar.
- E. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 - 2. Close temporary ports and openings with tight fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- I. Shore insulating concrete forms to ensure stability and to resist stressing imposed by construction loads.

3.5 REMOVING AND REUSING FORMS

- A. 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 degrees F for 24 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.
 - 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 - 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
 - 1. Align and secure joints to avoid offsets.
 - 2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.6 SHORING AND RESHORING INSTALLATION

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.7 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a 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. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
 - 2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel reinforcement bars.
 - 2. Welded-wire reinforcement.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction contraction and isolation joints.
 - c. Steel-reinforcement installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of steel reinforcement.
 - 2. Epoxy repair coating.
 - 3. Zinc repair material.
 - 4. Bar supports.
 - 5. Mechanical splice couplers.
 - 6. Structural thermal break insulated connection system.
- B. Shop Drawings: Comply with ACI SP-066:
 - 1. Include placing Drawings that detail fabrication, bending, and placement.
 - 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
 - 3. For structural thermal break insulated connection system, indicate general configuration, insulation dimensions, tension bars, compression pads, shear bars, and dimensions.
- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
 - 1. Location of construction joints is subject to approval of the Architect.
- D. Delegated-Design Submittal: For structural thermal break insulated connection system, including analysis data signed and sealed by the qualified Professional Engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For testing and inspection agency.
- B. Welding certificates.
 - 1. Reinforcement To Be Welded: Welding procedure Specification in accordance with AWS D1.4
- C. Material Certificates: For each of the following, signed by manufacturers.
 - 1. Mechanical splice couplers.
- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - 1. Store reinforcement to avoid contact with earth.
 - 2. Do not allow dual-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
 - 3. Do not allow stainless-steel reinforcement to come into contact with uncoated reinforcement.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A706, deformed.
- C. Headed-Steel Reinforcing Bars: ASTM A970.
- D. Plain-Steel Welded-Wire Reinforcement: ASTM A1064, plain, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064, flat sheet.

2.2 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Epoxy-Coated Joint Dowel Bars: ASTM A615, Grade 60, plain-steel bars, ASTM A775 epoxy coated.

- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless-steel bar supports.
 - b. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - c. For dual-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - d. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
 - e. For stainless-steel reinforcement, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless-steel bar supports.

2.3 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1-inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
 - 2. Stagger splices in accordance with ACI 318.

- G. Install welded-wire reinforcement in longest practicable lengths.
 - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.
 - 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
 - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 - 4. Lace overlaps with wire.

3.3 JOINTS

- A. 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.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
 - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
- B. 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 1 side of joint.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a 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.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 03 10 00 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
 - 3. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
 - 4. Section 31 20 00.10 "Earth Moving for Facility" for drainage fill under slabs-on-ground.

1.2 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. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. 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.
 - 2. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction joints, control joints, isolation joints, and joint-filler strips.
 - c. Semirigid joint fillers.
 - d. Vapor-retarder installation.
 - e. Anchor rod and anchorage device installation tolerances.
 - f. Cold and hot weather concreting procedures.
 - g. Concrete finishes and finishing.
 - h. Curing procedures.
 - i. Forms and form-removal limitations.
 - j. Shoring and reshoring procedures.
 - k. Methods for achieving specified floor and slab flatness and levelness.

- l. Floor and slab flatness and levelness measurements.
- m. Concrete repair procedures.
- n. Concrete protection.
- o. Initial curing and field curing of field test cylinders (ASTM C31.)
- p. Protection of field cured field test cylinders.

1.4 ACTION SUBMITTALS

- A. Product Data: For each of the following.
 1. Portland cement.
 2. Fly ash.
 3. Aggregates.
 4. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
 5. Floor and slab treatments.
 6. Liquid floor treatments.
 7. Curing materials.
 - a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.
 8. Joint fillers.
 9. Repair materials.
- B. Design Mixtures: For each concrete mixture, include the following:
 1. Mixture identification.
 2. Minimum 28-day compressive strength.
 3. Durability exposure class.
 4. Maximum w/cm.
 5. Calculated equilibrium unit weight, for lightweight concrete.
 6. Slump limit.
 7. Air content.
 8. Nominal maximum aggregate size.
 9. Steel-fiber reinforcement content.
 10. Synthetic micro-fiber content.
 11. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
- C. Shop Drawings:
 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.
- D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
 1. Concrete Class designation.
 2. Location within Project.
 3. Exposure Class designation.
 4. Formed Surface Finish designation and final finish.
 5. Final finish for floors.
 6. Curing process.
 7. Floor treatment if any.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Fiber reinforcement.
 - 4. Curing compounds.
 - 5. Floor and slab treatments.
 - 6. Bonding agents.
 - 7. Adhesives.
 - 8. Vapor retarders.
 - 9. Semirigid joint filler.
 - 10. Joint-filler strips.
 - 11. Repair materials.
- B. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Portland cement.
 - 2. Fly ash.
 - 3. Aggregates.
 - 4. Admixtures:
 - a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician.
 - 1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.
- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.
 - 1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
 - 1. Include the following information in each test report:
 - a. Admixture dosage rates.
 - b. Slump.
 - c. Air content.
 - d. Seven-day compressive strength.
 - e. 28-day compressive strength.
 - f. Permeability.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94 and ACI 301.

1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
 - 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 2. When average high and low temperature is expected to fall below 40 degrees F for 3 successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 3. Do not use frozen materials or materials containing ice or snow.
 - 4. Do not place concrete in contact with surfaces less than 35 degrees F, other than reinforcing steel.
 - 5. 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 at time of discharge to not exceed 95 degrees F.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/ termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

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

2.2 CONCRETE MATERIALS

- A. Source Limitations:
 - 1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
 - 2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
 - 3. Obtain aggregate from single source.
 - 4. Obtain each type of admixture from single source from single manufacturer.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C150, Type I/II.
 - 2. Fly Ash: ASTM C618, Class C or F.

- C. Normal-Weight Aggregates: ASTM C33, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Alkali-Silica Reaction: Comply with one of the following:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
 - c. Alkali Content in Concrete: Not more than 4 lb./cu. yd for moderately reactive aggregate or 3 lb./cu. yd for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
 - 2. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
 - 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C260.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures 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 C494, Type A.
 - 2. Retarding Admixture: ASTM C494, Type B.
 - 3. Water-Reducing and -Retarding Admixture: ASTM C494, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
 - 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C1017, Type II.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) BASF Corporation.
 - 2) Euclid Chemical Company (The); an RPM company.
 - 3) GCP Applied Technologies Inc.
 - 4) Sika Corporation.
 - 7. Permeability-Reducing Admixture: ASTM C494, Type S, hydrophilic, permeability-reducing crystalline admixture, capable of reducing water absorption of concrete exposed to hydrostatic pressure (PRAH).
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AQUAFIN, Inc.
 - 2) Kryton International Inc.
 - 3) Xypex Chemical Corporation.
 - b. Permeability: No leakage when tested in accordance with U.S. Army Corps of Engineers CRC C48 at a hydraulic pressure of 200 psi for 14 days.
- F. Water and Water Used to Make Ice: ASTM C94, potable.

2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Barrier-Bac; Inteplast Group, Ltd.
 - b. Fortifiber Building Systems Group.
 - c. ISI Building Products.
 - d. Poly-America, L.P.
 - e. Raven Industries, Inc.
 - f. Reef Industries, Inc.
 - g. Stego Industries, LLC.
 - h. Tex-Trude, LP.
 - i. W.R. Meadows, Inc.

2.4 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Corporation.
 - b. Bon Tool Co.
 - c. Brickform; a division of Solomon Colors.
 - d. ChemMasters, Inc.
 - e. Dayton Superior.
 - f. Euclid Chemical Company (The); an RPM company.
 - g. Kaufman Products, Inc.
 - h. Lambert Corporation.
 - i. Laticrete International, Inc.
 - j. Metalcrete Industries.
 - k. Nox-Crete Products Group.
 - l. Sika Corporation.
 - m. SpecChem, LLC.
 - n. TK Products.
 - o. Vexcon Chemicals Inc.
 - p. W.R. Meadows, Inc.
- 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 C171, polyethylene film burlap-polyethylene sheet.
 - 1. Color:
 - a. Ambient Temperature Below 50 degrees F: Black.
 - b. Ambient Temperature between 50 degrees F and 85 degrees F: Any color.
 - c. Ambient Temperature Above 85 degrees F: White.

- D. Water: Potable or complying with ASTM C1602.
- E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anti-Hydro International, Inc.
 - b. ChemMasters, Inc.
 - c. Dayton Superior.
 - d. Euclid Chemical Company (The); an RPM company.
 - e. Kaufman Products, Inc.
 - f. Lambert Corporation.
 - g. Laticrete International, Inc.
 - h. Nox-Crete Products Group.
 - i. SpecChem, LLC.
 - j. TK Products.
 - k. Vexcon Chemicals Inc.
 - l. W.R. Meadows, Inc.

2.5 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.
- C. Bonding Agent: ASTM C1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C881, 2-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
 - 1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 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 C150 portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
 - 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 4,100 psi at 28 days when tested in accordance with ASTM C109.

- 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 C150 portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
 - 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 5,000 psi at 28 days when tested in accordance with ASTM C109.

2.7 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, in accordance with ACI 301.
 - 1. Use a qualified 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 or Other Pozzolans: 25 percent by mass.
 - 2. Silica Fume: 10 percent by mass.
 - 3. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
 - 4. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
 - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.

2.8 CONCRETE MIXTURES

- A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.
 - 1. Exposure Class: ACI 318F1.
 - 2. Minimum Compressive Strength: 3,000 psi at 28 days.
 - 3. Maximum w/cm: 0.50.
 - 4. Slump Limit: Four inches, plus or minus 1-inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
- B. Class B: Normal-weight concrete used for interior slabs-on-ground.
 - 1. Minimum Compressive Strength: As indicated at 28 days.
 - 2. Maximum w/cm: 0.45.
 - 3. Minimum Cementitious Materials Content: 520 lb/cu. yd.
 - 4. Slump Limit: 5 inches, plus or minus 1-inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
 - 5. Air Content:
 - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 - 1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
 - 2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
 - 1. Daily access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
 - 4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.4 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
 - 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 - 2. Face laps away from exposed direction of concrete pour.
 - 3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
 - 4. Lap joints 6 inches and seal with manufacturer's recommended tape.

5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
 7. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.5 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
 3. Locate joints for beams, slabs, joists, and girders at third points 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 on Drawings. Unless otherwise indicated on Drawings, locate vertical 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. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
 1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8-inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form control 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 cracks.
- D. Isolation Joints in Slabs-on-Ground: 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 on Drawings.
 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 07 92 00 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than 1 length is required, lace or clip sections together.

- E. Doweled Joints:
 - 1. Install dowel bars and support assemblies at joints where indicated on Drawings.
 - 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to 1 side of joint.
- F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
 - 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 - 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. 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.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.
 - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. 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.
- F. 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. Do not place concrete floors and slabs in a checkerboard sequence.
 - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 3. Maintain reinforcement in position on chairs during concrete placement.
 - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.

5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than 1-1/2 inches wide or 1/2-inch-deep.
 - b. Remove projections larger than 1-inch.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 Class D.
 - e. Apply to concrete surfaces not exposed to public view.
2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than 3/4-inch-wide or 1/2-inch-deep.
 - b. Remove projections larger than 1/4-inch.
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 Class B.
3. ACI 301 Surface Finish SF-3.0:
 - a. Patch voids larger than 3/4-inch-wide or 1/2-inch-deep.
 - b. Remove projections larger than 1/8-inch.
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 Class A.

B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:

1. Smooth-Rubbed Finish:
 - a. Perform no later than 1 day after form removal.
 - b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
 - c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.

C. Related Unformed Surfaces:

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

3.8 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish:
 - 1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
 - 2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4-inch in one direction.
 - 3. Apply scratch finish to surfaces to receive concrete floor toppings.
- C. Float Finish:
 - 1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
 - 2. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
 - 3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish:
 - 1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
 - 2. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance.
 - 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 4. Do not add water to concrete surface.
 - 5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
 - 6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
 - a. Slabs on Ground:
 - 1) Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, FF 24; and of levelness, FL 17.
 - b. Suspended Slabs:
 - 1) Specified overall values of flatness, F_F 35; and of levelness, F_L 20; with minimum local values of flatness, FF 24; and of levelness, FL 15.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.
 - 1. Coordinate required final finish with Architect before application.
 - 2. 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 locations indicated on Drawings.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
 - 2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

- A. Filling In:
 - 1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
 - 2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
 - 3. 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 6 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
 - 3. Minimum Compressive Strength: 3,000 psi 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.
 - a. Use setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. 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.
 - 1. Cast-in inserts and accessories, as shown on Drawings.
 - 2. Screed, tamp, and trowel finish concrete surfaces.

3.10 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 - 1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
 - 2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
 - 3. Maintain moisture loss no more than 0.2 lb/sq. ft. by h, calculated in accordance with ACI 305.1, before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
 - 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
 - 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.

3. If forms remain during curing period, moist cure after loosening forms.
 4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within 3 hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
1. Begin curing immediately after finishing concrete.
 2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12-inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than 7 days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than 7 days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than 7 days, utilizing 1, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
 - b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than 7 days.

- 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than 7 days.
- 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than 7 days, utilizing 1, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- c. Floors to Receive Polished Finish: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than 7 days.
 - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than 7 days, utilizing 1, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- d. Floors to Receive Chemical Stain:
 - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
 - 2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
 - 3) Butt sides of curing paper tight; do not overlap sides of curing paper.
 - 4) Leave curing paper in place for duration of curing period, but not less than 28 days.
- e. Floors to Receive Urethane Flooring:
 - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - 2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
 - 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
 - 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

- f. Floors to Receive Curing Compound:
 - 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within 3 hours after initial application.
 - 3) Maintain continuity of coating, and repair damage during curing period.
 - 4) 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.
- g. Floors to Receive Curing and Sealing Compound:
 - 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within 3 hours after initial application.
 - 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.11 TOLERANCES

- A. Conform to ACI 117.

3.12 APPLICATION OF LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with 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 7 days' old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
 - 4. Rinse with water; remove excess material until surface is dry.
 - 5. 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 in accordance with manufacturer's written instructions.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least 1 month.
 - 2. 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.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
 - 1. Repair and patch defective areas when approved by Architect.
 - 2. 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.
 - a. Limit cut depth to 3/4-inch.
 - b. Make edges of cuts perpendicular to concrete surface.
 - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
 - d. Fill and compact with patching mortar before bonding agent has dried.
 - e. 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.
 - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
 - b. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces:
 - 1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 2. Repair finished surfaces containing surface defects, including 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.
 - 3. After concrete has cured at least 14 days, correct high areas by grinding.
 - 4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
 - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - b. Feather edges to match adjacent floor elevations.
6. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of 1/4-inch to match adjacent floor elevations.
 - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes 1-inch or less in diameter, by cutting out and replacing with fresh concrete.
 - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
8. Repair random cracks and single holes 1-inch or less in diameter with patching mortar.
 - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. 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.

3.15 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
 1. Testing agency shall be responsible for providing curing container for composite samples on site and verifying that field-cured composite samples are cured in accordance with ASTM C31.
 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.

3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports shall include reporting requirements of ASTM C31, ASTM C39, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at 7 days and 28 days.
- C. Batch Tickets: For each load delivered, submit 3 copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
 1. Headed bolts and studs.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172 shall be performed in accordance with the following requirements:
 1. Testing Frequency: Obtain 1 composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd, plus 1 set for each additional 50 cu. yd or fraction thereof.
 - a. When frequency of testing provides fewer than 5 compressive-strength tests for each concrete mixture, testing shall be conducted from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
 2. Slump: ASTM C143:
 - a. One test at point of placement for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.

3. Slump Flow: ASTM C1611:
 - a. One test at point of placement for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 4. Air Content: ASTM C231 pressure method, for normal-weight concrete;
 - a. One test for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.
 5. Concrete Temperature: ASTM C1064:
 - a. One test hourly when air temperature is 40 degrees F and below or 80 degrees F and above, and 1 test for each composite sample.
 6. Unit Weight: ASTM C567 fresh unit weight of structural lightweight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 7. Compression Test Specimens: ASTM C31:
 - a. Cast and laboratory cure 2 sets of two 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
 8. Compressive-Strength Tests: ASTM C39.
 - a. Test 1 laboratory-cured specimen at 7 days and 2 specimens at 28 and 1 specimen for reserve.
 - b. A compressive-strength test shall be the average compressive strength from a set of 2 specimens obtained from same composite sample and tested at age indicated.
 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 10. Strength of each concrete mixture will be satisfactory if every average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5,000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5,000 psi.
 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:
 - a. 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.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.
 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.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Architect.

3.16 PROTECTION

- A. Protect concrete surfaces as follows:
 - 1. Protect from petroleum stains.
 - 2. Diaper hydraulic equipment used over concrete surfaces.
 - 3. Prohibit vehicles from interior concrete slabs.
 - 4. Prohibit use of pipe-cutting machinery over concrete surfaces.
 - 5. Prohibit placement of steel items on concrete surfaces.
 - 6. Prohibit use of acids or acidic detergents over concrete surfaces.
 - 7. 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.
 - 8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Joint Fillers.
 - 2. Preparing sealant substrate surfaces.
 - 3. Sealant and backing.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
 - 1. Submit product data indicating sealant chemical characteristics, performance criteria, limitations and color availability.
 - 2. Submit manufacturer's standard printed installation instructions.
- B. Samples: Submit 4 sample kits in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For installer.
 - 2. For qualified testing agency.
- B. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
- C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- D. Field-Adhesion-Test Reports: For each sealant application tested.
- E. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Applicator: Company specializing in applying the Work of this Section with minimum 5 years' documented experience.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each kind of sealant and joint substrate.
 - 3. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - 4. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 - 5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 FIELD CONDITIONS

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

1.7 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written Specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design Specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's standard range. Unless noted otherwise, do not paint sealants to achieve color.

2.2 MATERIALS

- A. Semi-Rigid Joint Filler:
 - 1. Semi-Rigid Epoxy Joint Filler: Provide 2-component, epoxy, semi-rigid joint filler exhibiting the following properties.
 - a. Tensile Strength at 7 days, ASTM D638.
 - b. Shore A Hardness, ASTM D2240.
 - c. Shore D Hardness, ASTM D2240.
 - d. Elongation at Break at 7 days, ASTM D638.
 - e. Tack Free Time: 12 hours.
 - f. Product: Euclid Chemical Co.; EUCO 700.
 - g. Color: As chosen by Owner's representative from manufacturer's standard color selection.
 - 2. Manufacturer shall have ISO 9001 Quality Certification.
- B. Elastomeric Sealants:
 - 1. Manufacturer's standard chemically curing, urethane, polyurethane, or polysulfide polymer based elastomeric sealant complying with ASTM C920.
 - 2. Types:
 - a. S-1: Type M, Grade P, Class 25.
 - b. S-2: Type S, Grade P, Class 25.
 - c. S-3: Type M, Grade NS, Class 25.
 - d. S-4: Type S, Grade NS, Class 25.
 - 3. Color: As selected by Architect from manufacturer's full range of standard colors.
 - 4. Use locations as indicated in Schedule at end of this Section.
- C. Latex Sealants:
 - 1. Manufacturer's standard one-part, nonsag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior and protected exterior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.
 - 2. Type S-5; Acrylic-Emulsions Sealant:
 - a. Composition: Manufacturer's standard product accommodating joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.
 - b. Conformance: ASTM C834.
 - 3. Color: As selected by Architect from manufacturer's full range of standard colors.
 - 4. Use locations as indicated in Schedule at end of this Section.

- D. Butyl Sealant:
 - 1. Manufacturer's standard one-part, nonsag, nonstaining, paintable, solvent-release-curing, polymerized butyl sealant formulated with minimum of 75 percent solids and tack-free time of 24 hours or less, complying with ASTM C1311.
 - 2. Type: S-6; Butyl Sealant.
 - 3. Color: As selected by Architect from manufacturer's full range of standard colors.
 - 4. Use Locations: As indicated in Schedule at end of this Section.
- E. Pigmented Narrow Joint Sealant:
 - 1. Manufacturer's standard, solvent-release-curing, pigmented synthetic rubber sealant formulated for sealing joints 3/16-inch or smaller in width, complying with AAMA 803.3.
 - 2. Type S-7; Pigmented Narrow Joint Sealant.
 - 3. Color: As selected by Architect from manufacturer's full range of standard colors.
 - 4. Use locations as indicated in Schedule at end of this Section.

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. New concrete must be a minimum of 28 days old.
- B. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- C. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- D. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 SEMI-RIGID JOINT FILLER APPLICATION

- A. Mix and install Semi-Rigid Joint Filler per manufacturer's published instructions.
1. Do not use backer rod, sand or other fill material for the purpose of reducing Semi-Rigid Joint Filler volume. The full depth of the joint or crack shall be filled for proper load transfer.
 2. Utilizing manufacturer recommended mechanical mixer and pump, install semi-rigid joint filler full depth in saw-cut joint. Overfill joint and trim joint filler flush with top of joint after hardening. Concave joints are not acceptable.

3.4 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.5 CLEANING

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

3.6 PROTECTION

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

3.7 JOINT-SEALANT SCHEDULE

- A. Interior Concrete Floor Joints:
 - 1. Horizontal Traffic Joints: Semi-Rigid Joint Filler.
- B. Exterior Joints:
 - 1. Horizontal traffic joints not exposed to fuel or gas spillage: Sealant types S-1 or S-2.
 - 2. Horizontal traffic joints exposed to fuel or gas spillage: Sealant types S-1 or S-2.
 - 3. Horizontal non-traffic joints not exposed to fuel or gas spillage: Sealant types S-1, S-2, S-3, or S-4.
 - 4. Vertical or inclined joints such as panel, coping and control: Sealant types S-3 or S-4.
 - 5. Vertical or inclined joints such as perimeters of doors and wall penetrations: Sealant types S-3 or S-4.
 - 6. Threshold Bedding: Sealant Type: S-6.
 - 7. Joints in Sheet Metal Flashing: Sealant Type: S-7.
- C. Interior Joints:
 - 1. Horizontal traffic joints not exposed to fuel or gas spillage: Sealant types S-1 or S-2.
 - 2. Horizontal non-traffic joints not exposed to fuel or gas spillage: Sealant types S-1, S-2, S-3, or S-4.
 - 3. Vertical or inclined joints such as panel, coping and control: Sealant types S-3, S-4.
 - 4. Vertical or inclined joints such as perimeters of doors or wall penetrations: Sealant types S-3 or S-4.
 - 5. Non-structural hollow metal doors. Sealant types S-3, S-4, or S-5.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting Drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.
- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ceco Door; ASSA ABLOY.
 - 2. Curries Company; ASSA ABLOY.
 - 3. Steelcraft; an Ingersoll-Rand company.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053-inch, with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion. Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 degrees F by h by sq. ft./Btu when tested according to ASTM C1363.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053-inch, with minimum A40 coating.
 - b. Construction: Face welded.

2.3 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Exterior Non-Security Frames: Level 3, 16 gauge.
 - 2. Weld Z anchors to frame.
 - 3. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
 - 4. Prepare interior frame for silencers except where scheduled to receive sound seals or weatherstripping. Provide for 3 single silencers on strike side of single doors and 2 single silencers on frame head at double doors without mullions.
 - 5. Provide minimum 14 gauge steel floor angle clips welded to each jamb.

2.4 MATERIALS

- A. Hot-Rolled Steel Sheet: ASTM A1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Frame Anchors: ASTM A879, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008 or ASTM A1011, hot-dip galvanized according to ASTM A53, Class B.
- C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153.

2.5 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026-inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8-inch in 2 inches.
 - 3. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 - 4. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
 - 5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.6 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 - 4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.

- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8-inch plus or minus 1/32-inch.
 - b. Between Edges of Pairs of Doors: 1/8-inch to 1/4-inch plus or minus 1/32-inch.
 - c. At Bottom of Door: 3/4-inch plus or minus 1/32-inch.
 - d. Between Door Face and Stop: 1/16-inch to 1/8-inch plus or minus 1/32-inch.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave Work in complete and proper operating condition. Remove and replace defective Work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08 36 13 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sectional-door assemblies.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 09 91 13 "Exterior Painting" for finish painting of factory-primed steel doors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
 - 2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.
 - 1. Include Plans, elevations, Sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer.
- B. Sample Warranties: For manufacturer's warranty and finish warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.
- B. Manufacturer's warranty.
- C. Finish warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with provisions in the U.S. Department of Justice's "2010 ADA Standards for Accessible Design" U.S. Department of Transportation's "ADA Standards for Transportation Facilities" the United States Access Board's "Architectural Barriers Act (ABA) Standards" 41 CFR, Appendix A to Subpart 101-19.6, "Uniform Federal Accessibility Standards" ICC A117.1 applicable to sectional doors.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components or operators before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
 - 1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.

2. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
 - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.
3. Operability under Wind Load: Design sectional doors to remain operable under uniform pressure (velocity pressure) of 20 lbf/sq. ft. wind load, acting inward and outward.

2.3 SECTIONAL-DOOR ASSEMBLY

- A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Clopay Building Products.
 - b. Overhead Door Corporation.
- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.
- C. Steel Door Sections: ASTM A653, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G60 zinc coating.
 1. Door-Section Thickness: 2 inches.
 2. Section Faces:
 - a. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
 3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch nominal coated thickness and welded to door section.
 4. Intermediate Stiles: Provide intermediate stiles formed from not less than 0.064-inch-thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.
 5. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
 - a. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal (weatherseal).
- D. Track: Manufacturer's standard, galvanized-steel, contour track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.
 1. Material: Galvanized steel, ASTM A653, minimum G60 zinc coating.
 2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings 2 inches wide.
 3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.

- E. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom top and jambs of door. Provide combination bottom weatherseal and sensor edge for bottom seal.
- F. Locking Device:
 - 1. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - a. Keying: Keyed to building keying system.
 - b. Keys: Two for each cylinder.
- G. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
 - 3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 foot or lower.
 - 4. Usage Classification: Light duty, up to 10 cycles per hour.
 - 5. Operator Type: Jackshaft, side mounted .
 - 6. Motor: Reversible-type with controller (disconnect switch) for interior, clean, and dry motor exposure. Use adjustable motor-mounting bases for belt-driven operators.
 - a. Motor Size: 3/4 hp.
 - b. Electrical Characteristics:
 - 1) Phase: Single phase.
 - 2) Volts: 120 V.
 - 7. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
 - a. Monitored Entrapment Protection: Electric sensor edge on bottom section designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
 - 8. Control Station: Surface mounted, 2-position (open and close) control.
 - a. Operation: Push button.
 - b. Interior-Mounted Unit: Full-guarded, surface-mounted, standard-duty, weatherproof-type, NEMA ICS 6, Type 4 enclosure.
 - 9. Emergency Manual Operation: Chain type designed so required force for door operation does not exceed 25 lbf.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.
- B. Tracks:
 - 1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
 - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Power-Operated Doors: Install automatic garage doors openers in accordance with UL 325.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780.

END OF SECTION

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523, a matte flat finish.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit samples on rigid backing, 8 inches square.
 - 2. Step coats on samples to show each coat required for system.
 - 3. Label each coat of each sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. VOC content.

1.4 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture's label with the following information:
 - 1. Product name and type (description).
 - 2. Batch date.
 - 3. Color number.
 - 4. VOC content.
 - 5. Environmental handling requirements.
 - 6. Surface preparation requirements.
 - 7. Application instructions.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
- D. Hazardous Materials: Hazardous materials including lead paint may be present in buildings and structures to be painted. A report on the presence of known hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company products indicated or comparable product from one of the following:
 - 1. Benjamin Moore & Co.
 - 2. Kwal, Division of Sherwin-Williams.
 - 3. Glidden Professional, Division of PPG Architectural Finishes, Inc.
 - 4. PPG Architectural Finishes, Inc.
 - 5. Kelly Moore.
 - 6. Dunn Edwards.
- B. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
 - 1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 PAINT, GENERAL

- A. Standards: Provide products that comply with Manufacture's Premium 1st Quality standards indicated and like VOC limits.
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As selected by Architect from manufacturer's full range.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
 - 1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
- B. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following Work where exposed to view:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. Ferrous Metal, Galvanized-Metal, and Aluminum Substrates:
 - 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Primer, water-based, anti-corrosive for metal: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, 5.0 to 10.0 mils wet, 2.0 to 4.0 mils dry.
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (Gloss Level 5): S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.

END OF SECTION

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Divisions 01 Specification Sections apply to Work of this Section.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each mounting bracket (FEB) indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Larsens Manufacturing Company.
 - c. Potter Roemer LLC.

2.3 MOUNTING BRACKETS (FEB)

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
- B. Fire Extinguishers:
 - 1. Type I:
 - a. Fire Class: A,B, C.
 - b. Type: Multi-purpose Dry Chemical.
 - c. Capacity: 10 pounds.
 - d. Range: 15 feet.
 - e. UL Rating: 4A-60BC.
 - f. Shell Material: Enameled Steel.
- C. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets:
 - a. Fire extinguishers weighing 40 pounds or less: 54 inches above finished floor to top of cabinet.
 - b. Fire extinguishers weighing more than 40 pounds: 42 inches above finished floor to top of cabinet.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 13 34 19 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural-steel framing.
 - 2. Metal roof panels.
 - 3. Metal wall panels.
 - 4. Gutters and downspouts.
 - 5. Personnel doors and frames.
 - 6. Accessories.
- B. Related Requirements:
 - 1. Section 08 36 13 "Sectional Doors" for sectional vehicular doors in metal building systems.

1.2 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.3 SYSTEM DESCRIPTION

- A. Single span rigid frame.
- B. Bay Spacing: As indicated on Drawings.
- C. Primary Framing: Rigid frame of rafter beams and columns, braced end frames, end wall columns, and wind bracing.
- D. Secondary Framing: Purlins, girts, eave struts, flange bracing, sill supports, clips, and other items as required for a complete structure.
- E. Wall System: Preformed metal panels with sub-girt framing/anchorage assembly and accessory components.
- F. Roof System: Screw down R-panel roof with purlin framing/anchorage assembly and accessory components.
- G. Roof Slope: One-inch in 12 inches.

1.4 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."
- B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining Work to provide a leakproof, secure, and noncorrosive installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Metal roof panels.
 - b. Metal wall panels.
- B. Shop Drawings: Indicate components by others. Include full building Plan, elevations, Sections, details and the following:
 - 1. Anchor-Rod Plans: Submit anchor-rod Plans and templates before foundation Work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
 - 2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
 - 3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
 - a. Show wall-mounted items including personnel doors, vehicular doors, windows, louvers, and lighting fixtures.
 - 4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim.
 - b. Gutters.
 - c. Downspouts.
- C. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.
 - 1. Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.
 - 2. Keying Schedule: Detail Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
- D. Delegated Design Submittals: For metal building systems.
 - 1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified Professional Engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For erector and manufacturer.
- B. Welding certificates.
- C. Letter of Design Certification: Signed and sealed by a qualified Professional Engineer in the State of Texas. Include the following:
 - 1. Name and location of Project.
 - 2. Order number.
 - 3. Name of manufacturer.
 - 4. Name of Contractor.
 - 5. Building dimensions including width, length, height, and roof slope.
 - 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - 7. Governing building code and year of edition.
 - 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 - 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 - 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- D. Erector Certificates: For qualified erector, from manufacturer.
- E. Material Test Reports: For each of the following products:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shop primers.
 - 5. Nonshrink grout.
- F. Source quality-control reports.
- G. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panel finishes and door hardware to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Materials: Obtain roof and wall panels, components, transitions, and assemblies from the same manufacturer.
- B. Manufacturer's Qualifications:
 - 1. Manufacturer having a minimum of 3 years experience in manufacturing panels of this nature.
 - 2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a Professional Engineer who is legally qualified to practice in jurisdiction where Project is located.

- C. Installer's Qualifications: Installation of panels and accessories by installers with a minimum of 2 years experience in panel projects of this nature and approved by Manufacturer.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Butler Manufacturing Company; a division of BlueScope Buildings North America, Inc.
 - 2. Nucor Corporation, Nucor Buildings Group.
 - 3. Varco-Pruden Buildings; a division of BlueScope Buildings North America, Inc.

2.2 SYSTEM DESCRIPTION

- A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
- B. Primary-Frame Type:
 - 1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
- C. End-Wall Framing:
 - 1. Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.
- D. Secondary-Frame Type: Manufacturer's standard purlins and joists and exterior-framed (bypass) girts.
- E. Eave Height: Manufacturer's standard height, as indicated by nominal height on Drawings.
- F. Bay Spacing: As indicated on Drawings.
- G. Roof Slope: One-inch per 12 inches.
- H. Roof System: Manufacturer's standard screw down metal roof rpanels.
- I. Exterior Wall System: Manufacturer's standard exposed-fastener, tapered-rib, metal wall panels.

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified Professional Engineer licensed in Texas, as defined in Section 01 40 00 "Quality Requirements," to design metal building system.
- B. Structural Performance: Metal building systems to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection and Drift Limits:
 - a. Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
 - b. No greater than the following:
 - 1) Purlins and Rafters: Vertical deflection of 1/360 of the span.
 - 2) Girts: Horizontal deflection of 1/240 of the span.
 - 3) Metal Roof Panels: Vertical deflection of 1/360 of the span.
 - 4) Metal Wall Panels: Horizontal deflection of 1/240 of the span.
 - 5) Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - 6) Lateral Drift: Maximum of 1/200 of the building height.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

- D. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
- E. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- F. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- G. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft.
- H. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft.
- I. Energy Star Listing: Roof panels that are listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low -slope roof products.
- J. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:
 - 1. Three-year, aged, solar reflectance of not less than 0.55 and emissivity of not less than 0.75.

2.4 STRUCTURAL-STEEL FRAMING

- A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
- B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
 - 2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
 - 3. Frame Configuration: Single gable.
 - 4. Exterior Column: Tapered.
 - 5. Rafter: Tapered.
- E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
 - 1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
 - 2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

- F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
 - 1. Purlins:
 - a. C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch- wide flanges.
 - b. Steel joists of depths indicated on Drawings.
 - 1) Depth: As needed to comply with system performance requirements.
 - 2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch-wide flanges.
 - a. Depth: As required to comply with system performance requirements.
 - 3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
 - 4. Flange Bracing: Minimum 2- by 2- by 1/8-inch structural-steel angles or 1-inch-diameter, cold-formed structural tubing to stiffen primary-frame flanges.
 - 5. Sag Bracing: Minimum 1- by 1- by 1/8-inch structural-steel angles.
 - 6. Base or Sill Angles: Manufacturer's standard base angle, minimum 3- by 2-inch, fabricated from zinc-coated (galvanized) steel sheet.
 - 7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
 - 8. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
 - 9. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- G. Bracing: Provide adjustable wind bracing using any method as follows:
 - 1. Rods: ASTM A36; ASTM A572, Grade 50; or ASTM A529, Grade 50; minimum 1/2-inch-diameter steel; threaded full length or threaded a minimum of 6 inches at each end.
 - 2. Cable: ASTM A475, minimum 1/4-inch-diameter, extra-high-strength grade, Class B, zinc-coated, 7-strand steel; with threaded end anchors.
- H. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.
- I. Materials:
 - 1. W-Shapes: ASTM A992; ASTM A572, Grade 50 or 55; or ASTM A529, Grade 50 or 55.
 - 2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36; ASTM A572, Grade 50 or 55; or ASTM A529, Grade 50 or 55.
 - 3. Plate and Bar: ASTM A36; ASTM A572, Grade 50 or 55; or ASTM A529, Grade 50 or 55.
 - 4. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A, carbon-steel, hex-head bolts; ASTM A563 carbon-steel hex nuts; and ASTM F844 plain (flat) steel washers.
 - a. Finish: Plain.

5. High-Strength Bolts, Nuts, and Washers, Grade A325: ASTM F3125, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.
 - a. Finish: Plain.
6. High-Strength Bolts, Nuts, and Washers, Grade A490: ASTM F3125, Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.
7. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125, Grade F1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1 hardened carbon-steel washers.
 - a. Finish: Plain.
8. Unheaded Anchor Rods: ASTM A572, Grade 50.
 - a. Configuration: Straight.
 - b. Nuts: ASTM A563 heavy-hex carbon steel.
 - c. Plate Washers: ASTM A36 carbon steel.
 - d. Washers: ASTM F436 hardened carbon steel.
 - e. Finish: Plain.
9. Headed Anchor Rods: ASTM A307, Grade A.
 - a. Configuration: Straight.
 - b. Nuts: ASTM A563 hex carbon steel.
 - c. Plate Washers: ASTM A36 carbon steel.
 - d. Washers: ASTM F436 hardened carbon steel.
 - e. Finish: Plain.
10. Threaded Rods: ASTM A572, Grade 50.
 - a. Nuts: ASTM A563 hex carbon steel.
 - b. Washers: ASTM F436 hardened carbon steel.
 - c. Finish: Plain.
- J. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
 1. Clean and prepare in accordance with SSPC-SP2.
 2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.

2.5 METAL ROOF PANELS

- A. Screw Down R-Panel Roof.
 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.
 - a. Exterior Finish: Siliconized polyester.
 - b. Color: As selected by Architect from manufacturer's full range.
 2. Major-Rib Spacing: 12 inches .c.
 3. Panel Coverage: 36 inches.
 4. Panel Height: 1.25 inches.

- B. Finishes:
 - 1. Exposed Coil-Coated Finish:
 - a. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a minimum dry film thickness of 0.2 mil for primer and 0.8 mil for topcoat.
 - 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.6 METAL WALL PANELS

- A. Exposed-Fastener, Tapered-Rib, Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.
 - a. Exterior Finish: Siliconized polyester.
 - b. Color: As selected by Architect from manufacturer's full range.
 - 2. Major-Rib Spacing: 12 inches .c.
 - 3. Panel Coverage: 36 inches.
 - 4. Panel Height: 1.25 inches.

2.7 PERSONNEL DOORS AND FRAMES

- A. Swinging Personnel Doors and Frames:
 - 1. As specified in Section 08 11 13 "Hollow Metal Doors and Frames."

2.8 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.

- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.
 - 1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 - 2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
 - 1. Gutter Supports: Fabricated from same material and finish as gutters.
 - 2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.
 - 1. Mounting Straps: Fabricated from same material and finish as gutters.

2.9 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 - 1. Mark each piece and part of the assembly to correspond with previously prepared erection Drawings, diagrams, and instruction manuals.
 - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members to be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
 - 1. Make shop connections by welding or by using high-strength bolts.
 - 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 - 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 - 4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
 - 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
 - 1. Make shop connections by welding or by using non-high-strength bolts.
 - 2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.10 SOURCE QUALITY CONTROL

- A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.
 - 1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.
 - a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
 - 1. Engage land surveyor to perform surveying.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and Drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's Professional Engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC Specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base 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. 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.
 - 3. 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.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. 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 will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than 7 days after placement.
 - 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
 - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 - 2. Locate and space wall girts to suit openings such as doors and windows.
 - 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

- H. Bracing: Install bracing in roof and sidewalls where indicated on erection Drawings.
 - 1. Tighten rod and cable bracing to avoid sag.
 - 2. Locate interior end-bay bracing only where indicated.
- I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 - 1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
- D. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 - 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
 - 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Locate metal panel splices over structural supports with end laps in alignment.
 - 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
 - a. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
 - 7. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

- E. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- F. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
 - 1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
 - 1. Install ridge caps as metal roof panel work proceeds.
 - 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
- C. Screw Down R-Panel Roof: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
 - 1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
 - 2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
 - 3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
 - 4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- E. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4-inch in 20 feet on slope and location lines and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 - 2. Shim or otherwise plumb substrates receiving metal wall panels.
 - 3. When 2 rows of metal panels are required, lap panels 4 inches minimum.

4. When building height requires 2 rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
 6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 7. Install screw fasteners in predrilled holes.
 8. Install flashing and trim as metal wall panel work proceeds.
 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

3.7 DOOR AND FRAME INSTALLATION

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
- B. Door Hardware:
1. Install surface-mounted items after finishes have been completed at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 4. Set thresholds for exterior doors in full bed of sealant complying with requirements for concealed mastics specified in Section 07 92 00 "Joint Sealants."

3.8 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install Work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch-deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1-inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
 - 1. Provide elbows at base of downspouts to direct water away from building.

3.9 FIELD QUALITY CONTROL

- A. Product will be considered defective if it does not pass tests and inspections.
- B. Prepare test and inspection reports.

3.10 ADJUSTING

- A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.
- B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.

3.11 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Touchup Painting:
 - 1. After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
 - a. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 - b. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

- D. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
 - 1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- E. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.
 - 1. Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION

SECTION 26 05 00 - BASIC ELECTRICAL METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

- A. Regulatory Agencies: Installation, materials, equipment and workmanship shall conform to the applicable provisions of the following:
- B. National Electrical Code (NEC).
- C. National Electrical Safety Code (NESC).
- D. Terms and conditions of the electrical utility and other authorities having lawful jurisdiction pertaining to the Work required.
- E. All temperature control wiring and associated conduit and boxes, shall be provided under other Sections of the Specifications. All power and control wiring, not identified under Divisions 22 and 23, shall be provided under Division 26.
- F. The Work covered by Division 26 of the Specifications includes the furnishing of all materials, labor, transportation, tools, permits, and fees for the complete installation of all electrical work required in the Contract Drawings.
- G. In the event that additional or special construction is required, Contractor is responsible for providing all material and equipment which are usually furnished with such construction in order to complete the installation, whether indicated or not.
- H. Contractor shall familiarize himself with the existing conditions of the site and advise Architect of any discrepancy or conflict prior to Bidding.
- I. Contractor shall be responsible for all permits, fees, and licenses required for the Project. All cost of such permits or fees shall be included in the Bid.
- J. All equipment and material shall be installed in accordance with applicable manufacturer's recommendations and standards.
- K. Install sleeves, sealant pans, and roof penetrations as required for the installation of the electrical work. All such Work is subject to the approval of Architect.
- L. Contractor shall be responsible for coordinating with the utility service provider to verify all locations, routing, equipment and labor that will be furnished as a part of this Contract.
- M. Any fees or charges associated with delivering permanent power for the Project shall be included in Contractor's Bid.

1.3 SUBMITTALS

- A. The intent of this Section is to give general submittal information; refer to specific submittal information in the subsequent Mechanical Sections.
- B. Within 10 days after award of the Contract, and before orders are placed, Contractor shall submit specific information on list of equipment and principal materials specified. Contractor shall indicate and/or provide names of manufacturers, catalog and model numbers, cut sheets, and such other supplementary information as necessary for evaluation. Minimum of 6 copies, or as directed by Architect, of each shall be submitted and shall include all items mentioned by model number and/or manufacturer's name in the Specifications or in schedules on the Drawings.

- C. Requirements for Each Submittal:
 - 1. Bear a dated stamp or specific written indication that Contractor has reviewed and approved all submittal prior to submission to Architect.
 - 2. Have all information deleted by Contractor that pertains to the means and methods of construction or to fabrication, assembly, installation, or erection (approval by Architect shall not extend to these areas unless specifically noted by Architect).
 - 3. Be clearly and SPECIFICALLY marked as to which specific piece of equipment is being submitted, by use of a permanent marker, stamp, etc., so as to distinguish it from other pieces of equipment that may occur on the same page.
 - 4. Be clearly marked as to which available options are being submitted that are associated with a piece of equipment.
 - 5. Be complete with respect to quantities, dimensions, specific performance, materials, and similar data to enable Architect to review the proposed equipment.
- D. Omission by Contractor of any of the above requirements or submittals will subject submittal to automatic rejection without review.
- E. Any submittals received by Architect that were not requested shall be returned without review of any kind.

PART 2 - PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

- A. The electrical requirements for equipment specified or indicated on the Drawings are based on information available at the time of design. If equipment furnished for installation has electrical requirements other than indicated on the Electrical Drawings, Contractor shall make any required changes to wire and conduit size, controls, overcurrent protection, and installation as required to accommodate the equipment supplied, without additional charge to Owner. The complete responsibility and costs for such adjustments shall be assigned to the respective Section of this Specification under which the equipment is furnished.

2.2 MATERIALS

- A. All similar materials and equipment shall be the product of the same manufacturer unless specified otherwise.
- B. Materials and equipment shall be the standard products of manufacturers regularly engaged in the production of such material and shall be the manufacturer's current and standard design.
- C. Altitude: Equipment affected by altitude shall perform satisfactorily for the function intended at the altitude of the Project site.
- D. Detectable Warning Tape: Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6-inch-wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30-inch-deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

- E. Backfill Material:
 - 1. Material 4 inches below and 12 inches above pipes and conduit shall be natural or manufactured sand complying to ASTM C33.
 - 2. Material more than 12 inches above pipes and conduits shall be sand indicated above or native fill free of rock or gravel larger than 3/8 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

PART 3 - EXECUTION

3.1 GENERAL

- A. Fabrication, erection, and installation of the complete electrical system shall be done in accordance with accepted good practice by qualified personnel experienced in such Work and shall proceed in an orderly manner so as not to impede the progress of the Project. Electrical Contractor shall check all areas and surfaces where electrical equipment material is to be installed, removed, or relocated and report any unsatisfactory conditions before starting Work. Commencement of work signifies this Contractor's acceptance of existing conditions. In the acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of workers. Surfaces requiring coatings will be completed prior to installation of any electrical work on these surfaces.
- B. The Electrical Drawings are diagrammatic. The installation requirements shall be carefully coordinated with structural, architectural, and mechanical conditions and shall be adjusted to avoid conflict.
- C. All Work shall be concealed in walls, ceilings, and chases unless specifically noted to be exposed or otherwise approved.
- D. The locations of electrical equipment are approximate and are not intended to convey the exact details and mounting of location of outlets, equipment, and other items. Exact locations are to be field determined by actual measurements.
- E. The location height and projection of fixtures illuminating signs or special features shall be approved by Architect prior to installation.
- F. Contractor shall coordinate the location of all exterior fixtures with Architectural Drawings and Specifications.
- G. Consult Architectural Drawings to determine wall finishes and locations of wall-mounted equipment, countertop splashes, and similar items to avoid conflict with electrical equipment. At locations where surface or pendant mounted light fixtures are noted, provide for all necessary framing channels, pendants, chains, canopies, and other hardware as required for a complete and operable system.
- H. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- I. Excavation for Pipe and Conduit:
 - 1. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 2. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

3. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - a. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - b. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - c. Excavate trenches 4 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
4. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
5. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D698:
 - a. Under structures, building slabs, steps, and pavements, scarify and recompact top 12-inch of existing subgrade and each layer of backfill or fill material at 95 percent.
 - b. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.
 - c. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.
6. Install detectable warning tape above conduits and pipe, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
7. Protection:
 - a. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
 - b. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1) Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
 - c. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1) Restore appearance, quality, and condition of finished surfacing to match adjacent Work, and eliminate evidence of restoration to the greatest extent possible.
8. Disposal of Surplus and Waste Materials:
 - a. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property unless otherwise directed by Owner.
 - b. Repair: Any damage to shrubs, grass or structures shall be repaired to previous condition by Contractor at no additional expense to Owner.

- J. It shall be the responsibility of Division 26 Contractor to provide for all disconnecting and motor control devices for all equipment. Contractor shall coordinate to determine voltage, phase, and configurations. Any changes necessary to coordinate these items between Divisions 22, 23, and 26 shall be considered part of this Contract.
- K. Division 26 Contractor shall be responsible for providing for all power requirements associated with the mechanical systems including power, control devices, smoke dampers, etc. Refer to Division 22 and 23 Drawings for locations and requirements. Connect all smoke dampers to the fire alarm control panel.

3.2 PERFORMANCE TESTS

- A. Thoroughly test all control circuits, fixtures, services, and all circuits for proper operating condition and freedom from grounds and short circuits before acceptance is requested. All equipment, appliances, and devices shall be operated under load conditions.
- B. After the interior wiring system installation is complete conduct operating tests for approval. When requested, test all the wire, cable, devices, and equipment after installation, to assure that all material continues to possess all the original characteristics as required by governing codes and standards listed in these Specifications.
- C. After motor operation has been verified make voltage readings at all panelboards and starters. Based on these readings, make final adjustments of primary taps on all transformers in the building as directed, or coordinate with the utility proper building voltage.
- D. Perform such other tests as required by other Sections of these Specifications or as requested to prove acceptability.
- E. Furnish all instruments and labor for testing.
- F. All material installed shall be listed, inspected, and approved by a nationally accepted testing laboratory such as UL and/ or ETL. All material shall bear the UL or ETL label where available.

3.3 SUBMITTAL AND APPROVAL OF MATERIALS

- A. All requirements for Submittals shall comply with the applicable provisions included in the individual Specification Sections.
- B. Unless identified as a sole source item, the listing of product manufacturers, catalog numbers, etc., on Drawings is intended to establish a standard of quality of the product. It is the responsibility of Contractor to review all items he intends to submit. If equipment other than that indicated on Drawings is proposed by Contractor, the information will be reviewed at the time of the submission of the Submittal.

END OF SECTION

SECTION 26 05 13 - BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

- A. NECA Standard of Installation (National Electrical Contractors Association).
- B. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).
- C. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS FOR REVIEW

- A. Refer to Section 01 33 00 "Submittal Procedures" for procedures for Submittals.
- B. Product Data: Provide for each cable assembly type.

1.4 SUBMITTALS FOR INFORMATION

- A. Refer to Section 01 33 00 "Submittal Procedures" for procedures for Submittals.
- B. Test Reports: Indicate procedures and values obtained.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for procedures for Submittals.
- B. Project Record Documents: Record actual locations of components and circuits.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.

1.7 REGULATORY REQUIREMENTS

- A. Conform to NFPA 70.
- B. Furnish products listed and classified by UL as suitable for the purpose specified and indicated.

1.8 FIELD SAMPLES

- A. Provide under provisions of Section 01 40 00 "Quality Requirements."

1.9 PROJECT CONDITIONS

- A. Refer to Section 01 30 00 "Administrative Requirements."
- B. Verify that field measurements are as indicated.
- C. Conductor sizes are based on copper.
- D. Wire and cable routing indicated is approximate unless dimensioned.

1.10 COORDINATION

- A. Coordinate Work under provisions of Section 01 30 00 "Administrative Requirements."
- B. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Manufacturers:
 - 1. American Cable.
 - 2. Houston Wire and Cable.
 - 3. Southwire.
 - 4. Substitutions: Refer to Section 01 60 00 "Product Requirements."
- B. Description: Single conductor insulated wire.
- C. Conductor: Copper.
- D. Insulation Voltage Rating: 600 volts.
- E. Insulation: NFPA 70, Type indicated herein.
- F. MC Cable: Shall not be utilized on this Project.

2.2 WIRING CONNECTORS

- A. Split Bolt Connectors:
 - 1. Buchanan.
 - 2. Burndy.
 - 3. IlSCO.
 - 4. Substitutions: Refer to Section 01 60 00 "Product Requirements."
- B. Solderless Pressure Connectors:
 - 1. Buchanan.
 - 2. Burndy.
 - 3. IlSCO.
 - 4. Substitutions: Refer to Section 01 60 00 "Product Requirements."
- C. Spring Wire Connectors:
 - 1. Ideal.
 - 2. Substitutions: Refer to Section 01 60 00 "Product Requirements."
- D. Compression Connectors:
 - 1. Buchanan.
 - 2. Burndy.
 - 3. IlSCO.
 - 4. Substitutions: Refer to Section 01 60 00 "Product Requirements."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Refer to Section 01 30 00 "Administrative Requirements" for verification of existing conditions before starting Work.
- B. Verify that interior of building has been protected from weather.
- C. Verify that mechanical work likely to damage wire and cable has been completed.
- D. Verify that raceway installation is complete and supported.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 WIRING METHODS

- A. Concealed Dry Interior Locations: Use only building wire, Type THHN/ THWN insulation, in raceway.
- B. Exposed Dry Interior Locations: Use only building wire, Type THHN/ THWN insulation, in raceway.
- C. Above Accessible Ceilings: Use only building wire, Type THHN/ THWN insulation, in raceway.
- D. Wet or Damp Interior Locations: Use only building wire, Type THHN/ THWN insulation, in raceway.
- E. Exterior Locations: Use only building wire, Type THHN/ THWN insulation, in raceway.
- F. Use wiring methods indicated.

3.4 INSTALLATION

- A. Refer to Section 01 40 00 "Quality Requirements" for manufacturer's instructions.
- B. Route wire and cable as required to meet Project Conditions.
- C. Install cable in accordance with the NECA "Standard of Installation."
- D. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- E. Use stranded conductors for control circuits.
- F. Use conductor not smaller than 12 AWG for power and lighting circuits with the exception of pre-manufactured fixture whips, listed for such use and not exceeding 6 feet in length.
- G. Use conductor not smaller than 14 AWG for control circuits.
- H. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 100 feet and as indicated on the Drawings.
- I. Install all conductors in conduit.
- J. Pull all conductors into raceway at same time.
- K. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- L. Protect exposed cable from damage.
- M. All cables shall be neatly supported.
- N. Use suitable cable fittings and connectors.
- O. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- P. Clean conductor surfaces before installing lugs and connectors.
- Q. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

- R. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- S. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- T. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- U. Identify and color code wire and cable under provisions of Section 26 05 53 "Electrical Identification." Identify each conductor with its circuit number or other designation indicated.
- V. The number of conductors in each conduit run shall be limited to the requirements as indicated on the Drawings and indicated in Article 310 of the National Electrical Code.

3.5 FIELD QUALITY CONTROL

- A. Refer to Section 01 40 00 "Quality Requirements" for field inspection, testing, and adjusting.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION

SECTION 26 05 19 - EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes basic electrical connections to equipment specified under other Sections.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

- A. NEMA WD 1 - General Purpose Wiring Devices.
- B. NEMA WD 6 - Wiring Device Configurations.
- C. ANSI/NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 "Submittal Procedures."
- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/ NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

1.5 COORDINATION

- A. Coordinate Work under provisions of Section 01 30 00 "Submittal Procedures."
- B. Obtain and review Shop Drawings, product data, and manufacturer's instructions for equipment furnished under other Sections.
- C. Determine connection locations and requirements.
- D. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
- E. Sequence electrical connections to coordinate with startup schedule for equipment.

PART 2 - PRODUCTS

2.1 CORDS AND CAPS

- A. Attachment Plug Construction: Conform to NEMA WD 1.
- B. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
- C. Cord Construction: ANSI/ NFPA 70, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- E. Division 26 Contractor shall be responsible for providing matching cord/receptacle for all equipment not furnished with such equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify conditions under provisions of Section 01 30 00 "Submittal Procedures."
- B. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.
- D. Provide receptacle outlet where connection with attachment plug is indicated. Provide cord and cap where field-supplied attachment plug is indicated.
- E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- F. Install disconnect switches, controllers, control stations, and control devices as indicated.
- G. Modify equipment control wiring with terminal block jumpers as indicated.
- H. Provide interconnecting conduit and wiring between devices and equipment where indicated.
- I. Check and modify phase connections as required for proper motor rotation.
- J. Provide power to equipment only after equipment supplier verifies acceptance to receive and approves.
- K. Contractor shall coordinate with all equipment to verify exact power and control wiring as required to properly serve equipment.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rod electrodes.
 - 2. Mechanical connectors.
 - 3. Exothermic connections.
 - 4. Wire.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 01 40 00 "Quality Requirements" for requirements for references and standards.

1.2 REFERENCES

- A. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).
- B. NFPA 70 - National Electrical Code.

1.3 GROUNDING SYSTEM DESCRIPTION

- A. Metal underground water pipe.
- B. Metal frame of the building.
- C. Rod electrodes.

1.4 PERFORMANCE REQUIREMENTS

- A. Grounding System Maximum Resistance: 10 ohms.

1.5 SUBMITTALS FOR REVIEW

- A. Refer to Section 01 33 00 "Submittal Procedures."
- B. Product Data: Provide for grounding electrodes and connections.

1.6 SUBMITTALS FOR CLOSEOUT

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for procedures for Submittals.
- B. Project Record Documents: Record actual locations of components and grounding electrodes.
- C. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience, and with service facilities within 100 miles of Project.

1.8 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by UL as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 ROD ELECTRODES

- A. Material: Copper.
- B. Diameter: 3/4-inch.
- C. Length: 10 feet.

2.2 MECHANICAL CONNECTORS

- A. Description: In lieu of exothermic connections, high compression type as manufactured by Burndy using the 12 ton Hy-Ground series.

2.3 EXOTHERMIC CONNECTIONS

- A. Manufacturers: Cadweld.

2.4 WIRE

- A. Material: Stranded copper.
- B. Grounding Electrode Conductor: Minimum size to meet NFPA 70 requirements or as indicated on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Refer to Section 01 30 00 "Administrative Requirements" for verification of existing conditions prior to beginning Work.
- B. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

- A. Refer to Section 01 40 00 "Quality Requirements" for manufacturer's instructions.
- B. Install rod electrodes. Install additional rod electrodes as required to achieve a resistance to ground of 10 ohms or less. Rods shall be installed with a minimum separation of 6 feet.
- C. Provide bonding to meet Regulatory Requirements.
- D. Bond together metal siding not attached to grounded structure; bond to ground.
- E. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- F. Grounding Electrode System: The new grounding electrode system shall consist of the common bonding of building steel, underground steel water piping and supplemental ground rods, concrete re-enforcing bar, as detailed on the Drawings.
- G. Provide proper bonding of the electrical system's grounded conductor (neutral) and the grounding electrode system sized in accordance with NEC Article 250. This bonding shall occur at all locations where there are separately derived systems.

3.3 FIELD QUALITY CONTROL

- A. Refer to Section 01 40 00 "Quality Requirements" for field inspection, testing, and adjusting.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.

END OF SECTION

SECTION 26 05 29 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Supports for conduit and equipment.
 - 2. Anchors and fasteners.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

- A. NECA - National Electrical Contractors Association.
- B. NFPA 70 - National Electrical Code.

1.3 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 SUPPORTS

- A. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

2.2 ANCHORS AND FASTENERS

- A. Concrete Structural Elements: Use expansion anchors, powder actuated anchors, and preset inserts.
- B. Steel Structural Elements: Use beam clamps, spring steel clips, and steel ramset fasteners.
- C. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
- D. Sheet Metal: Use sheet metal screws.
- E. Wood Elements: Use wood screws.
- F. Roof Support/Jacks: Advanced supports products # SS1000A or approved equal.

2.3 MATERIALS AND FINISHES

- A. Provide adequate corrosion resistance.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation."
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Obtain permission from Architect before drilling or cutting structural members.
- E. Fabricate supports from structural steel as indicated on Drawings. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use lock washers under all nuts.
- F. Install surface-mounted cabinets and panelboards with minimum of 4 anchors.
- G. In wet and damp locations, use steel channel supports to stand cabinets and panelboards 1-inch off wall.
- H. Install conduit supports a maximum spacing specified in the NEC.

END OF SECTION

SECTION 26 05 33 - CONDUIT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal conduit.
 - 2. Flexible metal conduit.
 - 3. Liquidtight flexible metal conduit.
 - 4. Electrical metallic tubing.
 - 5. Fittings and conduit bodies.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 26 05 33.16 "Boxes."
 - 3. Section 26 05 53 "Electrical Identification."

1.2 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
- C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- D. NECA "Standard of Installation."
- E. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- F. NFPA 70 - National Electrical Code.

1.3 DESIGN REQUIREMENTS

- A. Conduit Size: NFPA 70.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 "Submittal Procedures."
- B. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, nonmetallic conduit, fittings and conduit bodies.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01 70 00 "Execution and Closeout Requirements."
- B. Accurately record actual routing of conduits.

1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/ NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Section 01 60 00 "Product Requirements."
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

1.8 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

- A. Minimum Size: 3/4-inch for all branch circuits located above ceiling. Contractor may use 1/2-inch conduit down the wall to receptacles and light switches.
- B. Wet and Damp Locations above grade: Use rigid steel or liquid tight flexible conduit.
- C. Dry Locations: Use electrical metallic tubing for concealed and exposed locations.
- D. Below Slab: Non-metallic PVC conduit is acceptable within limitations specified.
- E. Below Grade: Use only PVC coated rigid galvanized steel, wrapped rigid steel, or non-metallic PVC conduit within limitations specified.
- F. MC Cable: Shall not be utilized on this Project.

2.2 METAL CONDUIT

- A. Manufacturers:
 - 1. Allied.
 - 2. Wheatland.
 - 3. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Fittings and Conduit Bodies: ANSI/ NEMA FB 1; all steel fittings.

2.3 FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - 1. Allied Tube.
 - 2. Electri-Flex.
 - 3. Greenfield.
 - 4. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
- B. Description: Interlocked steel construction. Aluminum is not permitted.

- C. Fittings: ANSI/ NEMA FB 1 with fittings approved for steel flex.
- D. Applications: Use for final connections to motorized equipment, connections to recessed lighting fixtures located in accessible ceilings, and connections to dry type transformers. Utilization of 3/8-inch in lieu of the minimum 1/2-inch is acceptable under the limitations of the National Electrical Code.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - 1. Electri-flex.
 - 2. Ultratite.
 - 3. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
- B. Description: Interlocked steel construction with PVC jacket.
- C. Fittings: ANSI/ NEMA FB 1.
- D. Applications: Use for final connections to motorized equipment in exterior locations and areas subjected to moisture (kitchen).

2.5 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied.
 - 2. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
- B. Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: ANSI/ NEMA FB 1; all steel, compression.
- D. Applications: Do not use below grade or in exterior locations. Use only in interior locations.

2.6 PVC COATED METAL CONDUIT

- A. Manufacturers:
 - 1. Levy.
 - 2. Robroy Industries.
 - 3. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
- B. Description: NEMA RN-1, rigid steel conduit with external PVC coating, 20 mil thick.
- C. General: Protective layer may be factory applied or galvanized rigid steel conduit may be applied with 2 layers of corrosion resistant tape.
- D. Fittings and Conduit Bodies: ANSI/ NEMA FB 1; steel fittings with external PVC coatings to match conduit.

2.7 NON-METALLIC PVC CONDUIT

- A. Manufacturers:
 - 1. Allied.
 - 2. Carlon.
 - 3. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
- B. Description: NEMA TC2; Schedule 40 PVC. Flame retardant type resistant to bending and cracking.
- C. Fittings and conduit bodies: NEMA TC3.

- D. Vertical risers and ells installed below grade shall be rigid steel with wrapping.
- E. Do not use above grade.
- F. Joints made with PVC fittings shall be applied with solvent compound after thorough cleaning.
- G. Refer to Part 3. Do not use PVC conduit for conduits passing vertically through the slab.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install conduit in accordance with NECA "Standard of Installation."
- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange supports to prevent misalignment during wiring installation.
- D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- E. Group related conduits; support using conduit rack. Construct rack using steel channel.
- F. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29 "Supporting Devices."
- G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- H. Do not attach conduit to ceiling support wires.
- I. Arrange conduit to maintain headroom and present neat appearance.
- J. Route exposed conduit parallel and perpendicular to walls.
- K. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- L. Maintain adequate clearance between conduit and piping.
- M. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- N. Cut conduit square using saw or pipecutter; de-burr cut ends.
- O. Bring conduit to shoulder of fittings; fasten securely.
- P. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- Q. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2-inch size.
- R. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- S. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.
- T. Provide suitable pull string in each empty conduit except sleeves and nipples.
- U. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- V. Ground and bond conduit under provisions of Section 26 05 26 "Grounding and Bonding."
- W. Identify conduit under provisions of Section 26 05 53 "Electrical Identification."
- X. Ducts shall be cleaned with a flexible mandrel assembly.
- Y. All conduits passing vertically through slabs or through earth on grade shall be PVC-coated, rigid steel. Rigid steel conduits shall be applied with protective coatings as indicated herein. All transitions from PVC to rigid steel shall occur below the slab.
- Z. Underground branch circuit extensions to parking lot lighting fixtures and other branch circuits may be direct buried PVC conduit. Service entrance PVC conduit shall be concrete encased in accordance with the Drawings unless otherwise approved by Architect.

- AA. Minimum cover for underground conduits shall be 24 inches unless otherwise noted.
- BB. All conduit shall be routed concealed as much as possible including conduit serving roof-mounted equipment. Roof penetrations for conduits shall adhere to the requirements and details as indicated on the Architectural Drawings.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Section 07 84 13 "Penetration Firestopping."
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.

END OF SECTION

SECTION 26 05 33.16 - BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wall and ceiling outlet boxes.
 - 2. Pull and junction boxes.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

- A. NECA - Standard of Installation.
- B. NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
- C. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- D. NEMA 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum).
- E. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS FOR CLOSEOUT

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for submittals for Project closeout.
- B. Record actual locations and mounting heights of outlet, pull, and junction boxes on Project record documents.

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Provide Products listed and classified by UL as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 WALL AND CEILING OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
- B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2-inch male fixture studs where required.
- C. Cast Boxes: NEMA FB 1, Type FD, cast ferrous alloy. Provide gasketed cover by box manufacturer.

2.2 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box.
- C. Material: Galvanized cast iron.
- D. Cover: Furnish with ground flange, neoprene gasket, and stainless-steel cover screws.
- E. Fiberglass boxes are allowed in landscaping areas. Equipment shall be pedestrian rated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify locations of outlets in all locations areas prior to rough-in.

3.2 INSTALLATION

- A. Install boxes in accordance with NECA "Standard of Installation."
- B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- C. Set wall mounted boxes at elevations to accommodate mounting heights specified in Section for outlet device.
- D. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose.
- E. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26 "Wiring Devices."
- F. Maintain headroom and present neat mechanical appearance.
- G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- H. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- I. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- K. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- L. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- M. Use adjustable steel channel fasteners for hung ceiling outlet box.
- N. Do not fasten boxes to ceiling support wires.
- O. Support boxes independently of conduit.
- P. Use gang box where more than 1 device is mounted together. Do not use sectional box.
- Q. Use gang box with plaster ring for single device outlets.
- R. Use cast outlet box in exterior locations exposed to the weather and wet locations.
- S. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.
- T. Coordinate with other trades for box rough-in, such that control devices are grouped (i.e., thermostats, wall switches, volume controls, etc.).

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate installation of outlet box for equipment connected under Section 26 05 19 "Equipment Wiring Systems."

3.4 ADJUSTING

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for adjusting installed Work.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused box openings.

3.5 CLEANING

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for cleaning installed Work.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

3.6 REPAIR

- A. Repair any areas or surfaces damaged during conduit installation.
- B. Paint (resurface) to original condition.

END OF SECTION

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates and labels.
 - 2. Wire, conduit, and box markers.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.

PART 2 - PRODUCTS

2.1 NAMEPLATES AND LABELS

- A. Nameplates and Labels: Engraved 3-layer laminated plastic, white letters on black background.
- B. Locations:
 - 1. Each electrical distribution and control equipment enclosure.
 - 2. Communication cabinets and computer cabinets.
 - 3. Field disconnects, start stop stations, control panels.
- C. Letter Size:
 - 1. Use 1/4-inch letters for identifying individual equipment and loads.
 - 2. Use 1/4-inch letters for identifying grouped equipment and loads.
 - 3. Use 3/8-inch letters for identifying main disconnect equipment.
 - 4. Use 1/4-inch letters for identifying receptacle and light switches.

2.2 WIRE, CONDUIT, AND BOX MARKERS

- A. Description: Brady B-321 Heat-Shrink Polyolefin markers. Typed label to identify each termination end point of the conductor. DC conductors shall identify polarity.
- B. Locations: Each conductor at wireway, pull boxes, outlet and junction boxes, and each load connection. All conduit penetrations identifying the location of each end.
- C. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated on Drawings.
- D. Boxes:
 - 1. Label each junction box in accessible locations to indicate the type of system (i.e.; security; power circuit - 1, 3, 5; etc.).
 - 2. Boxes serving fire alarm system shall have box covers painted red.
 - 3. Provide label in each light switch and receptacle back box.

- E. Panelboards and Switchboards:
 - 1. Provide phenolic label with maximum available fault current at main switchboard. Utilize number as indicated in panel schedule.
 - 2. Provide warning labels with arc-flash hazard warning for all electrical equipment as indicated in Article 110.16 of NEC.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

- A. Install nameplate and label parallel to equipment lines.
- B. Secure nameplate to equipment front using screws or rivets.
- C. Identify underground conduits using underground warning tape. Install 1 tape per trench at 12 inches below finished grade. Identify all conduit at exposed locations into all boxes, cabinets, etc. Refer to Section 26 05 00 "Basic Electrical Methods."
- D. Identify all conductors at every termination indicating endpoints of termination and tag identification as required.
- E. Color Coding for Phase Identification:

120/208 Volts	Phase	277/480 Volts
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray
Green	Ground	Green
- F. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by colored electrical tape. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made.

END OF SECTION

SECTION 26 09 24 – LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Network lighting control system and components:
 - a. Touch panel controls.
 - b. Lighting management panels.
 - c. Lighting management modules.
 - d. Low voltage wall stations.
 - e. Power interfaces.
 - f. Wired sensors.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 26 27 26 “Wiring Devices.”
 - 3. Section 26 05 53 “Electrical Identification.”
 - 4. Section 26 51 00 “Interior Lighting.”

1.2 REFERENCES

- A. Underwriters Laboratories (UL):
 - 1. UL 508 - Industrial Control Equipment American National Standards Institute (ANSI).
 - 2. UL 924 - Emergency Lighting and Power Equipment.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electric Code.
- C. IEC 61000-4-2 Electromagnetic Compatibility (EMC) – Part 4-2: Testing and Measurement Techniques-Electrostatic Discharge Immunity Test; 2008.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate placement of daylight and occupancy sensors to achieve optimum performance. Proper sensor placement should be coordinated with others in order to avoid obstructions that would interfere with maintaining prescribed light levels.
 - 2. Coordinate the Work to provide luminaires and lamps that are compatible with the lighting controls to be installed.
 - 3. Notify Architect of any conflicts or deviations from the Contract Documents to obtain direction prior to proceeding with Work.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 "Submittal Requirements."
- B. Specification Conformance Document. Clearly define where the equipment submitted for review:
 - 1. Meets Specification exactly as specified.
 - 2. Meets Specification as an alternate with clear definition of compliance.
- C. Shop Drawings include:
 - 1. CAD renderings of the device with precise dimensions.
 - 2. System schematic/typical riser diagrams.
- D. Product Data Sheets: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
 - 1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.
 - 2. Wall Dimmers: Include derating information for ganged multiple devices.
- E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Project Record Documents: Record actual installed locations and settings for lighting control system components.
- G. Operations and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1.5 PROJECT CLOSEOUT DOCUMENTATION

- A. Section 01 70 00 "Execution and Closeout Requirements" for Submittals for Project closeout.
- B. Provide a factory published manual:
 - 1. Warranty.
 - 2. Technical support contact.
 - 3. Submit manufacturer's operation and maintenance instructions for each product.

1.6 QUALITY ASSURANCE

- A. Manufacturer: Minimum 10 years of experience designing and assembling architectural lighting controls.
- B. All devices are 100 percent factory function tested prior to delivery.
- C. Compliant with the requirements of NFPA 70.
- D. All power components UL listed for required loads.
- E. Maintain at the Project site a copy of each referenced document that prescribes execution requirements.

1.7 PROJECT CONDITIONS

- A. Only install equipment after the following site conditions are maintained:
 - 1. Ambient temperature 14 to 105 degrees F.
 - 2. Relative humidity less than 90 percent non-condensing.
- B. Standard electrical enclosures are permanently installed.
- C. Equipment is protected from dust, debris, and moisture.

1.8 WARRANTY

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for additional warranty requirements.
- B. Five-year 100 percent parts replacement.

1.9 MAINTENANCE AND SUSTAINABILITY

- A. Provide new parts, upgrades, and/or replacements available for a minimum of 5 years available to the end user.
- B. Provide free telephone technical support.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable:
 - 1. Acuity Brands.
 - 2. Lutron.
 - 3. Watt Stopper.
 - 4. Cooper/Eaton.
 - 5. Hubbell.
- B. Basis of controls design Manufacturer: Acuity Brands.
 - 1. Sensor switch.
- C. Substitutions:
 - 1. Refer to Section 26 05 00 "Basic Electrical Methods" for requirements.

2.2 GENERAL

- A. Provide system hardware that is designed, tested, manufactured, warranted by a single manufacturer.
- B. Operational Life: At least 10 years expected life while operating within the specified ambient temperature and humidity range.
- C. Power Failure Memory: Automatically store system settings and recover from a power failure without requiring user input.
- D. Wireless devices:
 - 1. Automatically sync for system operation without addressing.
 - 2. Send and receive messages for real-time operation and feedback.
 - 3. Use industry standard RF protocols.
 - 4. Be in compliance with FCC and IEE standards.

2.3 OCCUPANCY DETECTION TECHNOLOGY REQUIREMENTS

- A. The occupancy sensor system shall sense the presence of human activity within the desired space and fully control the on/ off function of the lights.
- B. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus, preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
- C. Sensors shall be suitable for space and application.

- D. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.
- E. Dual technology sensors shall have 1 of its 2 technologies do not require motion to detect occupancy. Acceptable dual technology includes PIR/ Microphonics’ (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect nothing (PIR/ Ultrasonic) shall not be acceptable.
- F. All sensing technologies shall be acoustically passive meaning they do not transmit sound waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/ or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

2.4 OCCUPANCY SENSOR OPERATION REQUIREMENTS

- A. Sensors shall offer a minimum ON timer of at least 15 minutes, in order to prevent all cycling of lamps before they have burned for the lamp manufacturers minimum recommended time period. This timer shall be in addition to the regular occupancy time delay that keeps lights on after last detected occupancy. User shall be able to disable/enable and change the value of this timer.
- B. Sensors shall utilize an occupancy time delay that keeps lights on after last detected occupancy. Factory default setting of the occupancy time delay shall be 10 minutes. Sensors with a longer factory default setting shall not be permitted as they greatly restrict energy savings potential.
- C. Manual adjustment to the occupancy time delay so as to increase it shall be accommodated but shall not be allowed unless a calculation showing the resulting energy savings loss is presented to the building Owner and specifying Engineer.
- D. Automatic adjustments to the occupancy time delay shall only be permitted if the controlling algorithm maximizes both lamp life and energy savings. For example, a shorter more energy saving time delay setting shall only be allowed if the resulting lamp life is also improved.
- E. Installer, in accordance with manufacturer’s recommendation, shall determine final sensor location. All sensors shall be factory calibrated for optimum performance for its installed PIR lens and shall not require initial or subsequent field adjustment of detection sensitivity.
- F. All sensor setting adjustments shall be digital and made using a push-button. Dip switches, analog dials, and/or the need for tools of any kind shall not be accepted.
- G. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

2.5 WALL SWITCH OCCUPANCY SENSORS – SMALL AREAS

- A. Sensor shall provide wall-to-wall PIR detection such that small hand motions are detected out to 20 feet.
- B. In areas with periodic or permanent obstruction to a sensor’s field of view, sensors that utilize dual technology (PIR/ Microphonics) detection shall be used (as specified in above Section 1.1, Occupancy Sensor Technology Requirements).
- C. For applications requiring independent control of 2 loads, a sensor with 2 dual relays and dual override switches shall be required. Each relay shall have independent programmable occupancy time delays.

- D. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, and 1/4 HP motor load.
- E. Sensor shall recess into single gang switch box and fit a standard GFI opening.
- F. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.
- G. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
- H. Sensor shall not require a neutral connection regardless of number of poles and/or detection technology (only exception is versions with lighted pushbuttons).
- I. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (off) condition. Sensor shall not require a minimum load to be connected in order to function.
- J. Sensors shall have optional features for photocell/ daylight override, vandal resistant lens, low temperature/ high humidity operation.
- K. All sensor settings, including time delay and photocell settings shall be digital and accessible for adjustment via a pushbutton without requiring removal of cover plate or tools of any kind.
- L. Wall Switch sensors shall have field programmable adjustments for selecting operational modes, occupancy time delays, minimum on time, and photocell set point as applicable.
- M. All models shall be capable of both Auto-On and Manual On operation.
- N. All models shall be capable of a "Reduced Turn On" operation where the initial PIR turn on level is higher in order to eliminate PIR from reflective surfaces from being detected. PIR shall be returned to normal levels upon initial PIR detection.
- O. All models shall have a "Predictive Off" mode where user can manually turn the lights off when leaving the room and still have them come on automatically when they return to space.
- P. All models shall be capable of disabling override switch.

2.6 WALL SWITCH OCCUPANCY SENSORS – LARGE AREAS

- A. Sensor shall provide wall-to-wall PIR detection such that small hand motions are detected out to 40 feet.
- B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/ Microphonics) detection shall be used (as specified in above Section 1.1, Occupancy Sensor Technology Requirements).
- C. For applications requiring independent control of 2 loads, a sensor with 2 dual relays and dual override switches shall be required. Each relay shall have independent programmable occupancy time delays.
- D. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz.
- E. Load ratings shall be 13A each pole, 1/4 HP motor load.
- F. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.
- G. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
- H. Sensor shall not require a neutral connection regardless of number of poles and/or detection technology.
- I. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (Off) condition. Sensor shall not require a minimum load to be connected in order to function.

2.7 LOW VOLTAGE OCCUPANCY SENSORS

- A. The installing contractor shall install 1 or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.
- B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/ Microphonics) detection shall be used (as specified in above Section 1.1, Occupancy Sensor Technology Requirements).
- C. Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, so as to provide a high degree of RF immunity.
- D. Sensors shall interconnect with other sensors and power/relay packs with Class 2, 3-conductor wire.
- E. Sensors shall operate on 12 to 24 VAC or VDC and consume no more than 5 mA so that up to 14 sensors may be connected to a single power pack.
- F. Upon initial power up, sensors must immediately turn on. Power packs may be wired on the line or load side of local switching and must not exhibit any delays when switch is energized.
- G. Each designated zone shall contain 1 sensor with a SPDT class 2 auxiliary relay, providing an input to building automation system (BAS). All sensors in designated zone shall communicate to sensor with relay for status to BAS. Sensor relay coil shall energize in the unoccupied state to load share the low voltage current from power pack. Note that power pack must be installed on the line side of the local toggle switch for auxiliary relay to Work properly.
- H. Sensors shall have test mode that temporarily shortens/ disables all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.
- I. Sensors shall have optional features for on/off photocell control, automatic dimming control photocell, high/low occupancy-based dimming, and usage in low temperature/high humidity environments.

2.8 POWER PACKS

- A. Power packs shall accept and switch 120 or 277 VAC, be plenum rated, and provide Class 2 power for up to 14 remote sensors.
- B. Power pack shall securely mount to junction location through a threaded 1/2-inch chase nipple. Plastic clips into junction box shall not be accepted. All class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
- C. When required by local code, power pack must be installed inside standard electrical enclosure and provide UL recognized support to junction box. All class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
- D. Power pack shall incorporate a Class 1 relay and an AC electronic switching device. The AC electronic switching device shall make and break the load, while the relay shall carry the current in the on condition. This system shall provide full 20 Amp switching of all load types and be rated for 400,000 cycles.
- E. Power packs shall be single circuit, or 2 circuits. Slave packs may be used to control additional circuits. When 2 circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.

2.9 LINE VOLTAGE OCCUPANCY SENSORS

- A. Sensors shall be self-contained and accept Class 1 wiring directly without the use of a power pack.
- B. The installing contractor shall install 1 or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.
- C. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/ Microphonics) detection shall be used (as specified in above Section 1.1, Occupancy Sensor Technology Requirements).
- D. Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, so as to provide a high degree of RF immunity.
- E. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
- F. Multiple sensors controlling the same load shall be wired in parallel.
- G. For applications requiring independent control of 2 loads, a sensor with 2 dual relays shall be required. Each relay shall have independent programmable occupancy time delays.
- H. Dual relay sensors shall have an optional operational mode called "Alternating On" where when during unoccupied periods, 1 relay is always left closed (thus 1 load is always on). The particular relay that is left closed alternates each cycle so that the aging of the connected lamps is even.
- I. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, and 1/4 HP motor load.
- J. Specific sensors capable of switching 5 Amps of 2 phase power (208/240 or 480 VAC) shall be available. These sensors shall always simultaneously switch both phases as per NEC guidelines.
- K. Wall mounted sensors must be installed at 7 to 8 feet above the floor. Single and 2 circuit units shall be available.
- L. Sensors shall have test mode that temporarily shortens/ disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.
- M. Sensors shall have optional features for on/ off photocell control, automatic dimming control photocell, high/ low occupancy-based dimming, and usage in low temperature/high humidity environments.

2.10 INDOOR PHOTOCELLS AND DAYLIGHT HARVESTING CONTROLS

- A. Low voltage photocell shall accept 12 to 24 VAC or VDC and provide a SPDT relay for interface with remote switching system. Sensors shall interface with occupancy sensors, directly with power pack, or other system as shown.
- B. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
- C. Photocell set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Further adjustment may be made manually if needed.

- D. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
- E. Low voltage dimming sensors shall accept 12 to 24 VAC or VDC (from power pack or other low voltage source) and control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of Class 2 current (typically 40 or more ballasts).
- F. Low voltage dimming sensor's set point shall be automatically calibrated through the sensor's microprocessor by initiating the "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
- G. Low voltage dimming sensors shall be equipped with an automatic override for 100-hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)
- H. Combination photocell/dimming sensors shall accept 12 to 24 VAC or VDC (from power pack or other low voltage source) and control the on/ off function as well as the dimming function of 0 to 10 VDC dimmable ballasts.
- I. Combination photocell/dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating the "Automatic Set-point Programming" procedure. Min and max dim settings as well as set point may be manually entered.
- J. Combination photocell/ dimming sensors shall be equipped with an automatic override for 100-hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)
- K. Dual zone option shall be available for photocell, dimming, or combination units. The second zone shall be controlled as an "offset" from the primary zone and shall be the zone farthest from the natural light source.
- L. Standalone ambient light sensors (CM ALC version only) shall interface directly with the 0 to 10 VDC, without any other power source connection, and control dimmable ballasts by sinking up to 20 milliamps of class 2 current. Sensors shall incorporate a photodiode viewing out of a ceiling enclosure at a 30-degree angle from horizontal to detect diffused light from the ambient and artificial sources. Sensor shall allow for removal of response delays for adjustment, however, provide dampening delay for normal operation. Settings shall be made manually.
- M. Line voltage versions of the above-described photocell and combination photocell/ dimming sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, and 1/4 HP motor load.
- N. Line voltage versions of the above-described dimming sensors shall be capable of powering off 120/ 277 VAC.
- O. Line voltage versions of the above-described photocell and combination photocell/ dimming sensors shall be capable of switching 5 Amps of 2-phase power (208/ 240 or 480 VAC) shall be available. These sensors shall always simultaneously switch both phases as per NEC guidelines.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as shown on Drawings.
- B. Verify that ratings and configurations of system components are consistent with indicated requirements.

- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that conditions are satisfactory for installation prior to starting Work.

3.2 INSTALLATION

- A. Follow manufacturer's instructions for all installation steps.
- B. Provide a complete installation per Contract Documents.
- C. Ensure sensor locations provide complete coverage of associated areas and are placed to avoid conflicts with equipment and appurtenances of other trades.
- D. Ensure daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.
- E. Identify system components in accordance with Section 26 05 53 "Electrical Identification."

3.3 FIELD QUALITY CONTROL

- A. Refer to Section 01 40 00 "Quality Requirements" for additional requirements.
- B. Manufacturer's Full-Scope Start-Up Service is required.
- C. Correct defective Work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- D. Provide a complete installation per Contract Documents.

3.4 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for closeout Submittals.
- B. Demonstration:
 - 1. Demonstrate proper operation of lighting control devices to Owner and correct deficiencies or make adjustments as directed.
 - 2. On-Site Performance-Verification Walkthrough: Provide on-site demonstration of system functionality to commissioning agent.
- C. Training:
 - 1. Include services of manufacturer's certified service representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of on-site start-up services.

3.6 STARTUP AND PROGRAMMING

- A. Provide telephone support via toll free line.
- B. Factory trained service.

3.7 MAINTENANCE

- A. Refer to Section 01 70 00 – Execution and Closeout Requirements, for additional related maintenance service.
- B. Factory trained service technicians available within the continental US.
- C. Offer integrated help on-screen and via online videos.
- D. Factory telephone support via toll free line.

3.8 PROTECTION

- A. Protect installed products from subsequent construction operations.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Distribution and branch circuit panelboards.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 26 05 29 "Supporting Devices."
 - 3. Section 26 05 53 "Electrical Identification" for engraved nameplates.

1.2 REFERENCES

- A. NECA (National Electrical Contractors Association) "Standard of Installation."
- B. NEMA AB 1 - Molded Case Circuit Breakers.
- C. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- D. NEMA KS 1 - Enclosed Switches.
- E. NEMA PB 1 - Panelboards.
- F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- G. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker, fusible switch arrangement, and sizes.
- B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA Standard of Installation.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 5 years' experience.

1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated.

1.8 MAINTENANCE MATERIALS

- A. Provide maintenance materials under provisions of General Conditions. Provide 2 of each panelboard key if required.

PART 2 - PRODUCTS

2.1 PANELBOARDS

- A. Manufacturers:
 - 1. Eaton.
 - 2. G.E.
 - 3. Siemens.
 - 4. Square-D.
- B. Description: NEMA PB-1, circuit breaker type.
- C. Panelboard Bus: Copper with ratings as indicated. Provide a copper ground bus in each panelboard.
- D. Minimum integrated short circuit rating: Fully rated devices with minimum levels as indicated. Series rated systems will not be allowed. Minimum calculated values are labeled on each panelboard and are indicated as "AIC."
- E. Molded Case Circuit Breakers: NEMA AB-1, bolt-on, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as type HACR for air-conditioning equipment loads and type SWD for switching applications.
- F. Enclosure: NEMA PB-1, Type 1.
- G. Cabinet Front: Surface or recessed type as indicated on the Drawings, fastened with concealed trim clamps, hinged door with flush lock, metal directory frame, and finished in manufacturer's standard gray enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1. Install panelboards plumb. Provide support in accordance with Drawings and Section 26 05 29 "Supporting Devices." Height: 6 feet maximum to top of panelboard. Provide filler plates for unused spaces in panelboards. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads. Spare slots shall be labeled as such in erasable pencil on directory. Provide engraved plastic nameplates under the provisions of Section 26 05 53 "Electrical Identification."
- B. Provide 2 empty 1-inch conduits from each recessed panelboard to an accessible location above and label as "spare."
- C. Ground each panelboard in accordance with Section 26 05 26 "Grounding and Bonding."

3.2 FIELD QUALITY CONTROL

- A. Field inspection and test for grounds on each circuit after installation is completed. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wall switches.
 - 2. Receptacles.
 - 3. Wall plates.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 26 05 33.16 "Boxes."

1.2 REFERENCES

- A. NECA - Standard of Installation.
- B. NEMA WD 1 - General Requirements for Wiring Devices.
- C. NEMA WD 6 - Wiring Device - Dimensional Requirements.
- D. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS FOR REVIEW

- A. Refer to Section 01 33 00 "Submittal Procedures."
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Manufacturers with similar catalog numbers will not be considered as a basis for an equivalent product.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Provide products listed and classified by UL as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell PRO 1221-I.
 - 2. Substitutions: Refer to Section 01 60 00 "Product Requirements."
- B. Description: NEMA WD 1, 20 amp, Heavy-Duty, AC only general-use snap switch.

- C. Body and Handle: Nylon ivory handle.
- D. Utilize equivalent series of manufacturer's numbers above for 3-way, 4-way, and 2-pole applications.

2.2 RECEPTACLES

- A. Manufacturers:
 - 1. Hubbell PRO 5352-I.
 - 2. Substitutions: Refer to Section 01 60 00 "Product Requirements" or equivalent.
- B. Description: NEMA WD 1, Heavy-duty, general-use receptacle, with triple wipe contacts and grounding contacts integral with backstrap (no rivets).
- C. Device Body: Ivory plastic.
- D. Configuration: NEMA WD 6, type as specified and indicated.
- E. Convenience Receptacle: Type 5-20.
- F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements. Hubbell GF5352-I or equivalent.

2.3 WALL PLATES

- A. Weatherproof Cover Plate: Gasketed cast metal with gasketed device cover on exterior devices and in wet locations. Provide "In-use shields for device boxes in exterior and wet locations.
- B. Surface Mounted Plates: Galvanized steel plates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Refer to Section 01 30 00 "Administrative Requirements" for verification of existing conditions prior to beginning Work.
- B. Verify that outlet boxes are installed at proper height.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- E. Verify installation location of all boxes to be installed in millwork with Architect.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.3 INSTALLATION

- A. Install in accordance with NECA "Standard of Installation."
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Do not share neutral conductor on load side of dimmers.
- E. Install receptacles with grounding pole located on the bottom as required by Owner.
- F. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

- G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- H. Connect wiring devices by wrapping conductor around screw terminal.
- I. Use jumbo size plates for outlets installed in masonry walls.
- J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- K. Install blank cover plate to match other wall plates on all unused boxes.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 "Boxes" to obtain mounting heights specified and indicated on Drawings.
- B. Install all wall switches, thermostats, and fire alarm pull stations at 48 inches above finished floor.
- C. Install convenience receptacle 18 inches above finished floor.
- D. Install convenience receptacle 6 inches above backsplash of counter unless otherwise directed by Architect.
- E. Install telephone jack 18 inches above finished floor.
- F. Install telephone for jack wall telephone to position top of telephone at 48 inches above finished floor.

3.5 FIELD QUALITY CONTROL

- A. Refer to Section 01 40 00 "Quality Requirements" for field inspection, testing, adjusting, and balancing.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify that each receptacle device is energized.
- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for adjusting installed Work.
- B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for cleaning installed Work.
- B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 28 16.16 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Non-fusible switches.
 - 3. Fuses.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

- A. NEMA KS 1 - Enclosed Switches.
- B. NFPA 70 - National Electrical Code.
- C. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Type.
- D. UL 198E - Class R Fuses.
- E. NEMA AB 1 - Molded Case Circuit Breakers.
- F. NECA - Standard of Installation.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 "Submittal Procedures."
- B. Product Data: Provide switch ratings and enclosure dimensions.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA Standard of Installation.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.

1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Eaton.
- B. General Electric.
- C. Siemens.
- D. Square D.

2.2 ENCLOSED SWITCHES

- A. Fusible or Non-fusible as indicated.
- B. Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- C. Fuse Clips: Designed to accommodate NEMA FU1, class R fuses.
- D. Enclosures: NEMA KS 1.
- E. Interior Dry Locations: Type 1.
- F. Exterior Locations: Type 3R or 4.
- G. NEMA ratings of enclosures as specified on Drawings take precedence over location Specification.
- H. Current rating of switch to be equal to or greater than that of the circuit it is interrupting.

2.3 FUSES

- A. Manufacturers:
 - 1. Bussman.
 - 2. Gould Shawmut.
 - 3. Littlefuse.
- B. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.
- C. Voltage: Provide fuses with suitable voltage ratings for phase to phase voltages.
- D. Service Entrance: Class L, Bussman Low-peak or equivalent.
- E. General Purpose Loads: Class RK1, Bussman Low-peak or equivalent.
- F. Motor Loads: Class RK5, Bussman Fusetron or equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with NECA Standard of Installation.
- B. Install fuses in all fusible disconnects.
- C. Apply adhesive tag on the inside door of all disconnects indicating the NEMA class fuse and size installed.
- D. Provide a disconnect switch for all equipment where indicated or required by the National Electrical Code. Coordinate with other disciplines to determine where disconnects are furnished with equipment.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Luminaires.
 - 2. Exit signs.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

- A. NEMA WD 6 - Wiring Devices-Dimensional Requirements.
- B. NFPA 70 - National Electrical Code.
- C. NFPA 101 - Life Safety Code.

1.3 SUBMITTALS

- A. Refer to Section 01 33 00 "Submittal Procedures" for Submittals.
- B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.

1.4 SUBSTITUTIONS

- A. Refer to Section 26 05 00 "Basic Electrical Methods" for requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for Submittals for Project closeout.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Conform to requirements of NFPA 101, the IBC, and the IFC.
- C. Products: Listed and classified by UL as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 LUMINAIRES

- A. Furnish products as scheduled. Refer to Section 01 60 00 "Product Requirements" for substitutions and product options.

2.2 EXIT SIGNS

- A. Furnish products as scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- B. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- C. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.
- D. Install wall mounted luminaires, emergency lighting units and exit signs at height as indicated on the Drawings or as scheduled.
- E. Install accessories furnished with each luminaire.
- F. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- G. Bond products and metal accessories to branch circuit equipment grounding conductor.
- H. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

3.2 FIELD QUALITY CONTROL

- A. Refer to Section 01 40 00 "Quality Requirements" for field inspection, testing, and adjusting.
- B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for adjusting installed work.
- B. Aim and adjust luminaires as directed.
- C. Position exit sign directional arrows as indicated.

3.4 CLEANING

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for cleaning installed Work.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.

3.5 DEMONSTRATION AND INSTRUCTIONS

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for demonstrating installed Work.

3.6 PROTECTION OF FINISHED WORK

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for protecting installed Work.
- B. Relamp luminaires that have failed lamps at Substantial Completion.

END OF SECTION

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Removing trees and other vegetation.
 - 2. Clearing, grubbing, and topsoil stripping.
 - 3. Removing above-grade site improvements.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1-inch in diameter; and free of weeds, roots, and other deleterious materials.

1.3 MATERIALS OWNERSHIP

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

1.4 SUBMITTALS

- A. Record Drawings According to General Conditions: Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.5 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to salvage and store on Owner's premises where indicated.
- C. Notify utility locator service to locate and mark utilities in Project area before site clearing.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Protect existing site improvements to remain from damage during construction. Restore damaged improvements to original condition, as acceptable to Owner.
- D. Verify existing plant life or items designated to remain are tagged or identified.

3.2 UTILITIES

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions, then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than 2 days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
- B. Coordinate removal of underground utilities with other Sections of Contract Documents.

3.3 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or relocated.
 - 2. Cut minor roots and branches of trees indicated to remain, clean and carefully, where such roots and branches obstruct installation of new construction.
 - 3. Completely remove stumps, roots, obstructions, and debris extending to 18 inches below exposed subgrade.
 - 4. Use only hand methods for grubbing within drip line of remaining trees.
- B. Fill clearing and grubbing depressions with satisfactory soil material, unless further excavation or earthwork indicated. Place fill material in horizontal layers not exceeding 8-inch loose depth. Compact each layer to density equal to adjacent original ground.

3.4 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depths encountered to prevent intermingling with underlying subsoil or other waste materials. Strip surface soil of unsuitable topsoil including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Limit height of topsoil stockpiles to 72 inches.
 - 2. Do not stockpile topsoil within drip line of remaining trees.
 - 3. Stockpile surplus topsoil and allow for respreading deeper topsoil.

3.5 SITE IMPROVEMENTS

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

3.6 DISPOSAL

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of off Owner's property.

END OF SECTION

SECTION 31 20 00.10 - EARTH MOVING FOR FACILITY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating and filling for rough grading the site.
 - 2. Preparing subgrades for slabs-on-grade.
 - 3. Excavating and backfilling for buildings and structures.
 - 4. Subsurface drainage backfill for walls and trenches.
 - 5. Excavating and backfilling trenches for utilities and pits for buried utility structures.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 UNIT PRICES

- A. Work of this Section is affected by unit prices for earth moving specified in Section 01 20 00 "Price and Payment Procedures."
- B. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
 - 1. 24 inches outside of concrete forms other than at footings.
 - 2. 12 inches outside of concrete forms at footings.
 - 3. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - 4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - 5. 6 inches beneath bottom of concrete slabs-on-grade.

1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/ 2 inches when tested by a geotechnical testing agency, according to ASTM D1586.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct preexcavation conference at Project site.
 - 1. Review methods and procedures related to earth moving, including, but not limited to, the following:
 - a. Personnel and equipment needed to make progress and avoid delays.
 - b. Coordination of Work with utility locator service.
 - c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
 - d. Extent of trenching by hand or with air spade.
 - e. Field quality control.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Geotextiles.
 - 2. Controlled low-strength material, including design mixture.
 - 3. Warning tapes.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D2487.
 - 2. Laboratory compaction curve according to ASTM D698.

1.7 QUALITY ASSURANCE

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

1.8 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.
- C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 01 50 00 "Temporary Facilities and Controls" and Section 31 10 00 "Site Clearing" are in place.
- D. Do not direct vehicle or equipment exhaust towards protection zones.
- E. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Very sandy clay to clayey sand; free of clay clods or rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and or other deleterious matter.
 - 1. Liquid Limit: Less than 35.
 - 2. Plasticity Index: Between 5 and 14.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.

2.2 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:
 - 1. Portland Cement: ASTM C150, Type I or Type II.
 - 2. Fly Ash: ASTM C618, Class C or F.
 - 3. Normal-Weight Aggregate: ASTM C33, 3/4-inch nominal maximum aggregate size.
 - 4. Foaming Agent: ASTM C869.
 - 5. Water: ASTM C94.
 - 6. Air-Entraining Admixture: ASTM C260.

2.3 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 DEWATERING

- A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

- C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
- D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of Work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs-on-grade.
 - f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1-inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
 - 1. Clearance: 12 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 - 3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
 - 4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
 - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2,500 psi, may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

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

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring, bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete."
- D. Backfill voids with satisfactory soil while removing shoring and bracing.
- E. Initial Backfill:
 - 1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1-inch in any dimension, to a height of 12 inches over the pipe or conduit.
 - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
 - 2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.
- F. Final Backfill:
 - 1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
 - 2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- G. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

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

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 - 3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1-inch.
 - 2. Walks: Plus or minus 1-inch.
 - 3. Pavements: Plus or minus 1/2-inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2-inch when tested with a 10-foot straightedge.

3.17 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 5,000 sq. ft. or less of paved area or building slab but in no case fewer than 3 tests.
 - 2. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for every 150 feet or less of trench length but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
 - 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 23 00 - EXCAVATION AND FILL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes all excavation, filling, and grading in connection with paved streets and parking lots and unpaved landscaped areas. Excavation, filling, and grading shall conform to lines and grades as shown on Plans. Contractor furnishes all materials, equipment, tools, labor, superintendence, and incidentals necessary to complete Work per Drawings and as specified herein.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Initial Backfill is placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill is placed over initial backfill to fill a trench.
- B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- C. Excavation: Removal of material encountered above subgrade elevations to lines and dimensions indicated.
 - 1. Authorized Additional Excavation is below subgrade elevations or beyond indicated lines and dimensions as Architect directs. Authorized additional excavation and replacement material paid per Contract provisions for changes in Work.
 - 2. Bulk excavation is more than 10 feet in width and 30 feet in length.
 - 3. Unauthorized excavation is below subgrade elevations or beyond indicated lines and dimensions without Architect direction. Unauthorized excavation and remedial Work directed by Architect, shall be without additional compensation.
- D. Embankment/Fill: Soil materials used to raise existing grades.
- E. Rock: Material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4-cubic yard or more in volume that exceed a standard penetration resistance of 100 blows per 2 inches when tested by a geotechnical testing agency, per ASTM D1586.
- F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other manmade stationary features constructed above or below ground surface.
- G. Subgrade: Uppermost surface of excavation or top surface of a fill/ backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

1.3 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earthmoving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Do not commence earthmoving operations until temporary sedimentation- and erosion-control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Provide borrow soil materials when sufficient satisfactory soil materials unavailable from excavations.
- B. Satisfactory Soils: Onsite material free of gravel, debris, waste, frozen materials, vegetation, and other deleterious matter or a select non-expansive material mechanically processed to produce a consistent uniform material meeting the following general requirements:
 - 1. Maximum Aggregate Size: 3.0 inches.
 - 2. Percent Retained on No. 4 Sieve: 25 to 50 percent.
 - 3. Percent Retained on No. 40 Sieve: 50 to 85 percent.
 - 4. Plasticity Index: 15 maximum.
- C. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content.
- D. Bedding Course: Naturally- or artificially-graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- E. Sand: ASTM C33; fine aggregate.

PART 3 - EXECUTION

3.1 STORAGE OF SOIL MATERIALS

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

3.2 EXCAVATION

- A. Excavation consists of removing all material from areas where subgrade or finished grade is below existing ground. Excess excavated material not required, or otherwise unsuitable according to geotechnical report, for making necessary fills for items in Project, shall be disposed by Contractor, as Architect directs, in approved waste areas. No additional compensation made for hauling or disposing waste material or excess excavation.
- B. Existing Pavement, Curbs, Gutters, Sidewalks, Etc.: All existing pavement, concrete curbs, trees, grass, or other organic materials removed as excavation, shall be classified as waste material, and not incorporated in fills unless Architect gives specific direction to do so. Where sidewalks are removed, take care to avoid damage to that portion of walk not requiring removal. Waste material shall be disposed as provided herein.
- C. Finishing: All excavation shall be to lines and grades shown on Plans. Any excavation below such grade, and consequential filling to established grade, shall be at Contractor expense. Neatly finish excavation beyond ends of intersection stubs, between curb and property line, or other transition areas, to lines and grades shown on Plans or established by Architect.
- D. Damage to Existing Pavement, Curbs, Utilities, Etc.: Take care in all excavation work to avoid damage to existing pavement, curbs, utilities, and other such installations. If these installations are damaged by Contractor forces or equipment, replace or repair as directed at expense of Contractor.
- E. Unclassified Excavation: All material excavated as part of Project.

3.3 EMBANKMENT/TOPSOIL

- A. Embankment: Constructed to lines and grades shown on Plans or directed by Architect, in approximate horizontal layers. Only place suitable material, approved by Architect, as embankment. Contractor shall obtain borrow source if necessary to complete embankment areas. Material shall meet ASTM D2487 soil classification groups SP and SM, free of rock or gravel larger than 1-inch in any dimension, debris, waste, or vegetation. Material shall have a PI less than 15. Existing surface where placing fill shall be scarified to approximately 3 inches before placing any fill material, to bond fill to existing surface. Remove and replace any unsuitable subgrade materials below finished subgrade excavation with suitable materials. No separate payment for removing and replacing such materials made and shall be incidental to subgrade preparation.
- B. Topsoil:
 - 1. All topsoil imported for planting beds shall be typical in texture of soils in Project area. Soil shall be free of nutgrass and other noxious weeds, grasses, sticks, roots, sterilants, chemicals or stones, consistent in texture characteristic of red sandy loam. Blow sand or caliche not permitted. No rocks larger than 2 inches in diameter permitted. Topsoil, source, and method of installation shall be approved by Architect.
 - 2. Minimum 12-inch depth required at all landscape areas.
 - 3. Minimum 4-inch depth required at all other areas shown on Plans.
- C. Quality Control: One field density test required for each 200 square yards of prepared subgrade.

3.4 SOIL MOISTURE CONTROL

- A. Uniformly moisten and mechanically process soil to produce material with consistent and uniform soil moisture content. Deviation in moisture content consistency is grounds for rejection of material.
 - 1. Do not place backfill or fill soil material on muddy, frozen, frosty, or icy surfaces.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and too wet to compact to specified dry unit weight.

3.5 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Mechanically process soil material until a consistent material, uniform in color, unit weight, and moisture content is produced prior to any compaction efforts.
- D. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
 - 1. Proctor samples will not be taken for performance testing before material processed to a uniform and consistent material on site. Approval of any material in submittal process does not guarantee acceptance of material in the field.
 - 2. For Pavements: Scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 3. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 - 4. Under turf or unpaved areas, scarify and recompact top 12 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
 - 5. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.
 - 6. At Architect discretion, additional proctors and rework required where compaction exceeds 103 percent of ASTM D698. Compaction result of 103 percent ASTM D698 or higher is cause for rejection.

3.6 SUBGRADE FINISHING

- A. Finish subgrade accurately to lines, grades, and cross-sections shown on Plans or established in the field. Bring subgrade in cut areas to grade by blading or hand grading. Compact surface with approved pneumatic roller followed by approved 3-wheel roller until it presents a uniform compacted appearance. Compact subgrade in fill areas with approved pneumatic roller. Follow final rolling of last layer deposited by blading and rolling with 3-wheel roller as described.
- B. Accurately form warped sections, valley gutters, and other irregularities in section shown on Plans or established in the field, in subgrade during finishing operation. Check subgrade by "teeing" from gutter to gutter on cross-section, valley gutters, with straightedge, longitudinally. Contractor shall furnish a satisfactory straightedge if required. Correct variations more than 1/2-inch from true grade or true cross-sections by loosening, adding, or removing material, reshaping, and recompacting affected area. Set "blue tops" set to finished subgrade elevations set where elevations cannot be checked as stated.

3.7 ROLLING EQUIPMENT

- A. Pneumatic Rollers: Consists of not less than 9 pneumatic-tired wheels, running on 2 axles so rear group of tires will not follow in tracks of forward group, mounted in rigid frame, and provided with loading platform or body suitable for ballast loading. Front axle shall rotate around a king pin located so roller may turn within a minimum circle. Roller, under working conditions, shall have an approximate 60-inch effective rolling width and give a minimum compression of 325 pounds per inch of width of tire tread. Roller shall be drawn by a suitable pneumatic-tired tractor or self-propelled type.
- B. Three-Wheel Roller: Shall be a 3-wheel self-propelled type, weighing not less than 10 tons, and provide a compression on rear wheels not less than 325 pounds per linear inch of width. Rear wheels shall be flat, diameter not less than 48 inches, and width not less than 20 inches.

3.8 PROTECTION

- A. Protecting newly graded areas from traffic, freezing, erosion, and free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially-completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace soil material to depth as directed by Architect. Reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent Work and eliminate evidence of restoration to greatest extent possible.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of off Owner's property.

END OF SECTION

PART 1 - SECTION 31 23 00.10 - EXCAVATION AND FILL FOR UTILITIES GENERAL

1.1 SUMMARY

- A. Section includes all excavating, backfilling, and compacting of trenches for pipe and pipe accessories and other utilities. No separate pay item for excavating, backfilling, and compacting trenches. Correct overexcavation not at Architect direction at Contractor expense. OSHA regulations and Part 3 herein will apply to all excavation and trenching.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

PART 2 - PRODUCTS

2.1 TRENCHES

- A. Excavate pipe trenches to lines and grades shown on Drawings or established by Architect. Before excavation begins in paved areas, cut, or saw existing pavement to a neat line by methods meeting Architect approval. Maximum width of trench from pipe invert to top of trench shall be as detailed on limits of excavation; indicated on Contract Drawings. Procedures for treatment of trench walls shall be as prescribed by trench safety system. In some areas of limited right-of-way or when necessary to protect existing facilities, limit slope of trench wall. Where necessary to stay within maximum width limits at top of pipe, adequately brace and sheet trench. Contractor shall be fully responsible for any damage to adjacent structures due to inadequate trench wall supporting devices.
- B. Where special pipe bedding material not required, excavate trench to an even grade so bottom of pipe will rest on bottom of trench throughout entire length of pipe. In obtaining a true and even grade, wet excavated trench bottom as necessary to facilitate compaction. Compact bottom of trench by mechanical means to consolidate all loose material disturbed during excavation. No compaction tests required on bottom of trench; however, compact entire width and length of trench so no loose material remains. Correct any part of trench excavated below grade by filling with approved materials and thoroughly compacting. If clay, rock, or other unyielding material encountered in trench bottom, remove to 6 inches below grade, refill with selected materials, and compact to minimum 95 percent maximum density and plus or minus 2 percent optimum moisture per ASTM D698 to specified grade.
- C. Dig bell holes of ample dimensions at each joint to permit jointing pipe made properly, and prevent pipe from resting on or supported by bell.
- D. Use trench-digging machinery to make trench excavations except where operation of same would cause damage to existing structures above or below ground. In such instances, employ hand methods. Contractor shall locate all existing underground lines, whether shown on Drawings, sufficiently in advance of trenching operations to prevent any damage thereto. Take extreme care to prevent such damage and Contractor fully responsible for damage to any such lines. Pothole and locate all utility lines at least 1,000 feet ahead of pipeline placement operations to allow Architect a minimum 4 working days to initiate any necessary changes in alignment and/ or grade of pipeline.

- E. No classification of excavated materials and excavate all materials encountered as required. Protect adjacent structures from damage by construction equipment. Excavated material may be stockpiled alongside trench per approved Trench Safety Plan, not endangering Work. Within street rights-of-way, remove excavated material as necessary from the street to allow traffic to pass safely. In no case is excavated material allowed to be stockpiled in street or public rights-of-way.
- F. Excavate for manholes as required, providing space for constructing structure and trench safety system if applicable.
- G. Explosives not permitted.

PART 3 - EXECUTION

3.1 TRENCH EXCAVATION SAFETY SYSTEM

- A. This item covers requirements for Contractor to provide design and construction of trench safety system for all trenches excavated. Contractor required to install a trench system to provide for safe excavation of all trenches exceeding a depth of 5 feet per OSHA standards. It is the duty and responsibility of Contractor and all subcontractors to be familiar and comply with all requirements of Public Law 91-596, 29 U.S.C. Specs. 651 et. Seq., Occupational Safety and Health Act of 1970 (OSHA), all amendments thereto, and enforce and comply with all provisions of this act. In addition, on Projects where trench excavation exceeds 5 feet, Contractor and all subcontractors shall comply with all requirements of 29 C.F.R. secs., and 1926.652 and 1926.653, OSHA Safety and Health Standards, more fully described herein.
- B. Description:
 - 1. This Section governs trench safety systems required for construction of all trench excavation utilized in Project, including all additional excavation and backfill necessitated by the safety system. Trench safety systems shall be suitable for construction of pipelines, utilities, etc., installed below grade and sufficient to fully protect public or private property including other existing utilities and structures below or above grade. Trench safety systems include but are not limited to sloping of side of excavation, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering, or diversion of water to provide adequate drainage.
 - 2. Contractor is responsible for design of systems and procedures (use of sheet piling, shoring, or other means of temporary support to protect existing buildings, streets, highways, water conveying structures, and any other structures). For existing utilities, Contractor may elect, at his cost, to remove utilities under stipulated condition that removal and subsequent replacement of utilities shall meet with approval of Architect, Owner, utility owner, and all agencies having jurisdiction of structure or property. In all cases, Contractor is fully responsible for protection of public or private property and any person(s), who, as a result of Contractor Work, may be injured.
 - 3. Successful responsible Bidder is required to submit 3 sets of trench excavation plans with a trench safety system to Owner for review within 15 consecutive days after Award of Contract.
 - 4. Plans must be designed and sealed by a Professional Engineer registered in Texas with professional experience in geotechnical engineering. Contractor is responsible for obtaining borings and soil analysis as required for design and preparation of trench excavation plan and trench safety system. Design trench excavation plan and trench safety system per OSHA standards and regulations.

5. No trenching in excess of 5 feet below existing grade allowed until trench excavation plan is reviewed and returned to Contractor. Any changes in trench excavation plan after initiation of construction will not cause an Extension of Time or Change Order but such changes will require same review process as original excavation plan.
 6. Contractor accepts sole responsibility for compliance with all applicable safety requirements. Review is only for general conformance with OSHA safety standards; and trench excavation plan review does not relieve Contractor of any/ all construction means, methods, technique, and procedures. Any property damage or bodily injury, including death arising from use of trench excavation plan, shall remain sole responsibility and liability of Contractor.
- C. Construction Methods: Accomplish trench safety systems per detailed Specifications set out in provisions of Excavations, Trenching, and Shoring, Federal Occupational Safety and Health Administration (OSHA) Standards, 29 CFR, Part 1926, Subpart P, as amended including proposed Rules published in Federal Register (Vol. 54, No. 209) on Tuesday, October 31, 1989, or subsequent revisions. Sections incorporated into these Specifications by reference include Sections 1926-650 through 1926-653. Legislation enacted by Texas Legislature (H.B. NoS. 662 and 665) with regard to Trench Safety Systems is hereby also incorporated, by reference, into these Specifications.
- D. Safety Program:
1. Contractor shall submit a safety program specifically for construction of trench excavations together with trench excavation plans for trench safety systems. Trench safety program shall be per OSHA Standards governing presence and activities of individuals working in and around trench excavation.
 2. Contractors have 3 generally accepted methods, or combinations thereof, to meet OSHA Standards for trench excavation:
 - a. Utilization of Trench Box: Utilizing a trench box must submit physical dimensions, materials, position in trench, expected loads, and strength of box. Trench box shall be designed by a Professional Engineer.
 - b. Shoring, Sheet piling, and Bracing Methods: Utilizing shoring, sheet piling, and bracing must submit dimensions and materials of all uprights, stringers, cross-bracing, and spacing required to meet OSHA requirements, all designed by a Professional Engineer.
 - c. Sloping and Benching: Utilizing sloping and benching methods shall have methods designed by a Professional Engineer.
 3. Safety program must indicate in which areas Plan will be utilized.
 4. No claims for delay permitted for Contractor delay in obtaining safety program approval.
- E. Inspection:
1. Provide a qualified person to daily inspect trench safety systems to ensure systems meet OSHA requirements. Contractor shall provide this person's name as part of post-bid, pre-award key personnel qualifications submittal. Maintain a permanent record of daily inspections.
 2. If evidence of possible cave-ins or slides is apparent, cease all Work in trench until Contractor takes necessary precautions to safeguard personnel entering trench. It is sole duty, responsibility, and prerogative of Contractor, not Owner or designated representative, to determine specific applicability of designed trench safety systems to each field condition encountered on Project.

- F. Indemnification:
 - 1. Indemnify and hold harmless Owner, employees, and agents, from any/ all damages, costs (including without limitation legal fees, court costs, and cost of investigation), judgments or claims, by anyone, including workers or general public, for injury or death of person(s) resulting from collapse/ failure of trenches constructed under this Contract.
 - 2. Acknowledge and agree this indemnity provision provides indemnity for Owner in case claims are made Owner is negligent by act/ omission in providing for trench safety, including but not limited to inspections, failure to issue stop-work orders, and hiring Contractor.
- G. Emergencies: In any emergency situation which may threaten or affect safety or welfare of persons or property, act at your discretion to prevent possible damage, injury, or loss. Any additional compensation or extension of time claimed for such action is considered in view of cause of emergency and per general conditions.

3.2 OPEN TRENCH RESTRICTION

- A. Limit stringing out pipeline ahead of trenching operations in street right-of-way, to linear footage of pipeline installed in 1 day's Work. Under no circumstances is pipeline allowed to string out or store in street rights-of-way any longer than 1 day. Except where otherwise specified, indicated on Plans or accepted in writing by Architect, maximum length of open trench, where construction is in any stage of completion shall not exceed lengths set forth. Open trench includes excavation, pipe laying, backfilling, and pavement replacement. Descriptions under area designations are general in nature and may be amended in writing by Architect due to particular or peculiar field conditions.
 - 1. Business District Areas: 300 linear feet.
 - 2. Residential Areas: One block or 300 linear feet, whichever is less.
 - 3. Undeveloped Areas: 1,000 linear feet (open trench shall not exceed length of 1 day's pipe laying).
- B. Complete backfill of all trenches before removing dewatering operations from area to prevent possibility of pipe flotation.
- C. Excavated areas considered open trench until all pavement replacements made or all trenches outside of pavement replacement areas are backfilled, compacted, and replaced to original condition per Contract Documents. Completely backfill trenches across streets and place temporary or permanent pavement within 48 hours after laying pipe.
- D. Provide substantial steel plates, properly secured in place, with adequate trench bracing used to bridge across trenches at street and alley crossings and at commercial and residential driveways, where trench backfill and temporary patches are not completed before end of Contractor regular working hours. Provide safe and convenient passage for pedestrians at all times. Architect may designate an enclosed or railed passage for safe access of pedestrian traffic at any location adjacent to construction activities as necessary. Maintain access to fire stations, fire hydrants, schools, hospitals, EMS, emergency response, homes, and businesses at all times.

3.3 BEDDING

- A. Bedding and bedding zone for pipe shall be as specified.

3.4 BACKFILLING

- A. Backfill all trenches per this Section as soon as practicable after pipe is installed with specified bedding condition. As soon as practicable after laying and jointing pipe, completion of bedding, and completion of structures, backfill trench.
- B. Backfill material immediately adjacent to pipe or bedding material shall meet gradation requirements recommended by geotechnical engineer. Material shall be free from rocks, boulders, clay or other unsuitable material(s).
- C. Placement of Backfill: If bedding requirements do not require bedding zone material to top or above pipe, carefully place first lift of backfill material under and around pipe and thoroughly compact by mechanical tamps to spring line of pipe. When first lift is compacted by mechanical tamps, second lift shall be to 1-foot above top of pipe and compacted as specified. Placing each lift will be dependent upon pipe diameter and in no case shall each lift exceed 8 inches in thickness based upon loose measure. Backfilling remainder of trench shall be done in the following manner:
 - 1. Place backfill material in trench in layers not to exceed 8 inches. Backfill material shall be moistened as necessary to obtain optimum moisture and mechanically processed to a consistent material, uniform in color, moisture, and unit weight prior to placement and compaction efforts in the trench. Compact with approved mechanical compaction equipment until required density obtained. Do not use vibratory rollers in city streets. Depending upon mechanical compaction equipment used, Architect may allow Contractor to lay thicker lifts. If Contractor feels he can achieve passing density tests based upon density requirements of Contract with thicker lifts than 8 inches by loose measure, he shall first submit proposed method of compaction, type of equipment to use, and desired lift thickness. Architect shall determine whether Contractor's proposed methods are acceptable. In utilizing existing spoil for backfill material, any spoil that contains obvious and excessive amounts of clay and/ or large cobbles (greater than 3 inches) shall not be acceptable for use in any zone. Architect shall determine whether excavated spoil is acceptable for backfill material.
 - 2. Density requirements shall be as:
 - a. For all backfill in areas to pave, obtain a density not less than 95 percent per ASTM D698 from top of subgrade to 18 inches below top of subgrade. Obtain a density 90 percent per ASTM D698 from 18 inches below top of subgrade to top of pipe bedding zone.
 - b. For all backfill not in paved areas, obtain a density not less than 90 percent per ASTM D698 from top of pipe bedding zone to ground surface.
 - c. Jetting or water ponding methods not allowed.
 - d. Slamming excavator bucket down on backfill is unacceptable for compaction. Contractor shall use sheepsfoot wheel rollers or other approved mechanical compaction techniques.
 - e. At Architect discretion, additional proctors and rework is required where compaction exceeds 103 percent of ASTM D698. Compaction result of 103 percent ASTM D698 or higher is cause for rejection.

- D. Field Quality Control:
 - 1. Take field densities of backfill every 300 linear feet of pipe installation, per ASTM D698 at the following depths:
 - a. One-third pipe height.
 - b. Springline.
 - c. Top of pipe.
 - d. Every lift thereafter to ground surface.
 - 2. Additionally, obtain 1 moisture density curve for each type of material used per ASTM D698, 1 sieve analysis, and 1 Plasticity Index for each type of imported material used per ASTM C136 and D4318.
 - 3. Sloping the backfill with an excavator to test multiple lifts is not permitted. Each lift shall pass moisture and density requirements prior to placement of subsequent lifts.
- E. Backfill and Maintenance:
 - 1. Following backfill completion, maintain trench surface in a satisfactory manner until final completion and acceptance of finished Project. Maintenance shall include blading as necessary, filling depressions caused by settlement, and other Work required to keep areas and roads in satisfactory condition.
 - 2. Repair any settlement which occurs before and during the 1-year warranty period at Contractor expense.

END OF SECTION

SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Soil treatment with termiticide.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the EPA-Registered Label for termiticide products.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Soil Treatment Application Report: Include the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Termiticide brand name and manufacturer.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes used, and rates of application.
 - 6. Areas of application.
 - 7. Water source for application.
- C. Bait-Station System Application Report: Include the following:
 - 1. Location of areas and sites conducive to termite feeding and activity.
 - 2. Plan Drawing showing number and locations of bait stations.
 - 3. Dated report for each monitoring and inspection occurrence indicating level of termite activity, procedure, and treatment applied before time of Substantial Completion.
 - 4. Termiticide brand name and manufacturer.
 - 5. Quantities of termiticide and nontoxic termite bait used.
 - 6. Schedule of inspections for 1-year from date of Substantial Completion.
- D. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located and who employs workers trained and approved by manufacturer to install manufacturer's products.
- B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- C. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.
- C. Install bait-station system during construction to determine areas of termite activity and after construction, including landscaping, is completed.

1.6 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by applicator and Contractor, certifying that termite control Work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Corporation, Agricultural Products; Termidor.
 - b. Bayer Environmental Science; Premise 75.
 - c. Control Solutions; Superc.
 - d. FMC Corporation, Agricultural Products Group; Dragnet FT.
 - e. Gaford Pest Control
 - 2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than 5 years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.2 APPLYING SOIL TREATMENT

- A. Examine substrates, areas, and conditions, with applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.
- C. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.
- D. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
 - 1. Slabs-on-Grade: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 - 2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 - 3. Crawlspace: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
 - 4. Masonry: Treat voids.
 - 5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- E. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- F. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- G. Post warning signs in areas of application.
- H. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 32 11 50 - FLEXIBLE BASE COURSE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes excavating, crushing, hauling, and spreading base material and wetting, compacting, and shaping it to form a flexible base course for paving, to lines, grades, and typical cross section shown on Plans, and as specified herein. Furnish all materials, equipment, tools, labor, superintendence, and incidentals necessary to complete Work.
- A. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.
 - 1. Section 31 23 00 "Excavation and Fill."

1.2 QUALITY CONTROL

- B. This list is a guideline for number of tests required per sequence of construction. Architect shall direct required tests and reserves the right to adjust, modify, or waive required test.
 - 1. Base Material: Retest gradation, liquid limits and plasticity index, for each 10,000 square yards of base material laid.
 - 1. Compaction Test: One field density test required for each 500 square yards of caliche base material laid.

1.3 SUBMITTALS

- C. Submit product data representative of product per Submittal Procedures and sample must be less than 12 months old.
- A. Product Data: Must submit product data for each source.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of these with requirements indicated, based on comprehensive testing:
 - 1. Atterburg limits.
 - 1. Sieve analysis.
 - 2. Proctor.
 - 3. Wet ball mill.

PART 2 - PRODUCTS

2.1 CALICHE BASE

- A. Furnish materials for constructing base course from Architect-approved source. Locate source of caliche, securing approval of source, and arrange with property Owner on which pit is located, for use of material. Strip pits of all unacceptable material and dispose stripping as agreeable to pit property Owner. Open pits to immediately expose vertical faces of all various strata of acceptable material. Unless otherwise directed, secure material in successive vertical cuts extending through all exposed strata. Any incidental costs, including securing, stripping, or crushing base material, is paid by Contractor.
- B. Screen all acceptable material, crush, and return oversized material to screened material so a uniform material is produced. Processed caliche base material, when properly slaked and tested by TxDOT standard laboratory methods, shall meet the following requirements:

Property	Test Method	Grade 1-2	Grade 3	Grade 5
Sampling	Tex-400-A			
Master gradation sieve size (cumulative % retained)	Tex-110-E			
2-1/2"		0	0	0
1-3/4"		0-10	0-10	0-5
7/8"		10-35	-	10-35
3/8"		30-65	-	35-65
#4		45-75	45-75	45-75
#40		65-90	50-85	70-90
Liquid Limit, % Max	Tex-104-E	40	40	35
Plasticity Index, Max ¹	Tex-106-E	10	12	10
Plasticity index, Min ¹		As shown on the Plans	As shown on the Plans	As shown on the Plans
Wet ball mill, % Max	Tex-116-E	40		40
Wet ball mill, % Max increase passing the #40 sieve		20		20

- D. Crushed or recycled concrete must meet TxDOT 247 Type D Recycled Materials. Tests necessary to show compliance will be required in a Submittal.
- E. Recycled material (Recycled Asphalt Pavement (RAP), etc.) not permitted unless specifically shown otherwise on Plans.

PART 3 - EXECUTION

3.1 HAULING AND PLACING

- A. Before placing any base material, shape, wet, roll, and compact subgrade to cross-sections and grades specified per Section 31 23 00 "Excavation and Fill."
- B. Place flexible base in uniform courses with compacted thicknesses no more than 8 or less than 3 inches compacted if compaction achieved. Deliver material in approved vehicles of uniform capacity and supply amount of material required to construct base course to thickness shown on Plans. Spread and shape to thoroughly mix material and prevent segregation. Sprinkling during this process required if necessary to prevent segregation. When shaping is completed, material shall be uniformly well graded and of proper thickness. Spread and shape material deposited upon subgrade the same day. In event inclement weather or other unforeseen circumstances renders impractical spreading of material during the day it is deposited, material shall be scarified, mixed and spread as directed by Architect. Correct and remove or replace all areas and nests of segregated coarse or fine materials with well-graded material. If additional or corrective binder required, it shall be furnished and applied in amount directed by Architect. Carefully and evenly incorporate such binder material with material in place by scarifying, harrowing, or other approved method.

3.2 COMPACTING AND FINISHING

- D. After material is properly spread, sprinkle, roll, and blade until thoroughly compacted. During compaction, apply water to maintain optimum moisture in material and sufficiently blade base course to ensure a uniform distribution of base materials and smooth uniform surface, true to section and grades established, after final compaction. Compact by rolling with pneumatic and steel-wheeled rollers as approved by Architect. In areas not accessible to roller, compact base material with mechanical tampers or other approved methods to secure uniform compaction over entire paved area. Throughout entire operation, maintain shape of base course by blading. Blading and rolling shall continue until course is thoroughly compacted and surface is smooth and in conformity with typical sections shown on Plans, to lines and grades established. Compact material to 95 percent maximum density, at optimum moisture, as determined by ASTM D1557. At Architect discretion, additional proctors and rework shall be required where compaction exceeds 103 percent of ASTM D1557. A compaction result of 103 percent ASTM D1557 or higher is cause for rejection.
- A. Immediately correct all irregularities, depressions, or weak spots which develop during compaction by scarifying areas affected, adding, or removing material as required, reshaping, and recompacting by sprinkling and rolling. Immediately before placing surfacing, check base for grade and cross section, and correct any deviation in excess of 1/4-inch from grade or true cross section. Set blue tops to finished base elevations to check base for proper grade and elevation.
- B. If base course is opened to traffic before surfacing, satisfactorily maintain base by wetting, blading, and rolling until wearing surface is placed thereon.

END OF SECTION

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Where Contractor elects to remove, or required to remove, and replace concrete pavement and driveway as part of construction.
 - 2. Section applies also for repair or replacement of facilities otherwise damaged by Contractor operations, including:
 - a. Concrete driveways.
 - b. Concrete curb and gutter.
 - c. Sidewalks, flatwork, and other miscellaneous concrete.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 31 23 00 "Excavation and Fill."
 - 3. Section 32 11 50 "Flexible Base Course."
 - 4. Section 32 13 73 "Concrete Paving Joint Sealants."

1.2 DEFINITIONS

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

1.3 SUBMITTALS

- A. Submit product data representative of product and less than 12 months old per Submittal Procedures.
- B. Product Data: For each type of manufactured material and product indicated.
- C. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of these with requirements indicated, based on comprehensive testing current materials:
 - 1. Cementitious materials and aggregates.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.
 - 5. Curing compounds.
 - 6. Applied finish materials.
 - 7. Bonding agent or adhesive.
 - 8. Joint fillers.

- E. Shop Drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures," showing bar schedules, stirrup spacing, bent bar diagrams, materials, steel grades, and arrangement of concrete reinforcement and methods of support.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Experienced installer who completed pavement work similar in material, design, and extent to this Project and whose Work resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment. Manufacturer must be certified per National Ready Mix Concrete Association's Plant Certification Program.
- C. Testing Agency Qualifications: Independent testing agency, acceptable to authorities having jurisdiction.
- D. Source Limitations: Obtain each type or class of cementitious material of same brand from same manufacturer's plant and each aggregate from one source.
- E. ACI Publications: Comply with ACI 301 "Specification for Structural Concrete," unless modified by requirements of Contract Documents.
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

1.5 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities and emergency services.

PART 2 - PRODUCTS

2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
- B. Use flexible or curved forms for curves of a radius 100 feet or less.
- C. Forms should be no less than 10 feet in length.
- D. Form-Release Agent: Commercially formulated form-release agent with maximum 350 grams per liter volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces nor impair subsequent treatments of concrete surfaces.
- E. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and spalling of concrete upon removal. Provide units leaving no metal closer than 1.5 inches to plane of exposed concrete surface. Provide ties so, when removed, leaves holes not larger than 1-inch in diameter in concrete surface.

2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Fabric: ASTM A185, fabricated from as-drawn steel wire into flat sheets, shall be 6 by 6 inches, 10-gauge welded-wire fabric, or as shown on Plans.
- B. Reinforcement Bars: ASTM A615, Grade 60, deformed.
- C. Joint Dowel Bars: Plain steel bars, ASTM A615, Grade 60. Cut bars true to length with ends square and free of burrs.
- D. Tie Bars: ASTM A615, Grade 60, deformed.
- E. Hook Bolts: ASTM A307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations and permit removal without damage to concrete or hook bolt.
- F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports per CRSI "Manual of Standard Practice," from steel wire, plastic, precast concrete, or fiber-reinforced concrete of greater compressive strength than concrete, and:
- G. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - 1. Space reinforcing supports at 5-foot maximum in any direction.

2.3 FIBER REINFORCEMENT

- A. Fiber reinforcement may be used in place of wire mesh only if approved by Architect and Owner.
- B. Fiber reinforcement shall be 100-percent virgin polypropylene, collated, fibrillated fibers, made for use as concrete reinforcement, containing no reprocessed olefin materials, and conforming to ASTM C1116, Type III.
- C. Specific Gravity: 0.91.
- D. Tensile Strength: 70,000 to 100,000 psi.
- E. Length: 2 inches.

2.4 CONCRETE MATERIALS

- A. Use same brand and type of cementitious material from same manufacturer throughout Project.
- B. Portland Cement: ASTM C150, Types I, II, or III or ASTM G176 IA, IIA, or IIIA for air entrained.
- C. Aggregate: ASTM C33, uniformly graded, from a single source, as:
 - 1. Class: 4M.
 - 2. Maximum Aggregate Size: 1-1/2 inches nominal.
 - 3. Coarse aggregate for Class C or D concrete shall be crushed limestone.
 - 4. Aggregate shall be graded from fine to coarse and conform to ASTM C136. Gradation for aggregate shall meet these requirements by weight:

FINE AGGREGATE		COARSE AGGREGATE	
Sieve	Percent Retained	Sieve	Percent Retained
3/8-Inch	0	1-3/4-Inch	0
No. 4	0-5	1-1/2-Inch	0-5
No. 16	20-55	3/4-Inch	30-65
No. 30	45-75	3/8-Inch	70-90

No. 50	70-90	No. 4	95-100
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5. Maximum amounts of organic impurities shall conform to ASTM C40 and C87. Maximum amounts of impurities finer than #200 sieve shall conform to ASTM C17. Maximum amounts of soft particles shall conform to ASTM C123. Maximum amounts of friable particles shall conform to ASTM C142.
6. Protect stockpiles from dusty conditions by drift fences or other methods approved by Architect. Stockpiling methods used shall not allow aggregate to roll down slope when adding to existing stockpiles. Built stockpiles in layers of uniform thickness. Equipment not permitted to operate over same lift repeatedly.
7. Coarse aggregate shall have maximum 18-percent loss when subjected to 5 cycles of magnesium sulfate soundness test (ASTM C88).
8. Wear percentage shall be no more than 40 when tested per ASTM C131 or C535.
9. Aggregates delivered to mixer shall consist of crushed stone, crushed gravel, or natural sand. Crushing shall result in a product with coarse aggregate having at least 95 percent by weight of particles with 1 or more fractured faces and 75 percent by weight of particles with 2 or more fractured faces. Aggregate shall be composed of sound, tough, durable particles and meet requirements for deleterious substances given in ASTM C33. Aggregate in any size group shall not contain more than 8 percent by weight of flat or elongated pieces (having a ratio between maximum and minimum dimensions of a circumscribing rectangular prism exceeding 5 to 1).

D. Water: ASTM C94.

2.5 ADMIXTURES

- A. Use of any material added to concrete mix shall be approved by Owner's Representative.
- B. Admixtures certified by manufacturer to contain no more than 0.1 percent water-soluble chloride ions by mass of cement and compatible with other admixtures.
- C. Air-Entraining Admixture: ASTM C260. Certified by manufacturer compatible with other required admixtures.
- D. Water-Reducing Admixture: ASTM C494, Type A.
- E. High-Range, Water-Reducing Admixture: ASTM C494, Types F or G.
- F. Water-Reducing and Accelerating Admixture: ASTM C494, Type E.
- G. Water-Reducing and Retarding Admixture: ASTM C494, Type D.

2.6 COVER MATERIAL FOR CURING

- A. Curing materials shall conform to one of these Specifications:
 1. Liquid membrane-forming compounds for curing concrete shall conform to ASTM C309 requirements, Type 2 (all resin base).
 2. White polyethylene film for curing concrete shall conform to ASTM C171 requirements.
 3. White burlap-polyethylene sheeting for curing concrete shall conform to ASTM C71 requirements.
 4. Waterproof paper for curing concrete shall conform to ASTM C171 requirements.

2.7 RELATED MATERIALS

- A. Expansion/Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
- B. Texture Surface for Ramps:
 - 1. Meet requirements of Texas Accessibility Standards.
 - 2. Color as selected by Owner.
 - 3. Surface should be non-skid.
 - 4. Durabak with Safti-Traxx Detachable Warning System by Cote-L Distribution Company or approved equal.
- C. Bonding Agent: Polyvinyl acetate or acrylic base.
- D. Sand Cushion: Clean, manufactured, or natural sand with plasticity index of 8 or less.
- E. Epoxy Adhesive: ASTM C881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

2.8 CONCRETE MIXES

- A. Prepare design mixes, proportioned per ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for trial batch method. Do not use Owner's field quality-control testing agency as independent testing agency.
- C. Proportion mixes to provide concrete with 0.45 maximum water-cementitious material ratio.
- D. Concrete Classification:
 - 1. Class A - Curb and gutter, sidewalks, curb ramps, medians, and miscellaneous slabs.
 - 2. Class C - Concrete pavement, fillets, and driveways.
- E. Mix Design:
 - 1. At least 15 days prior to beginning any concrete pavement construction, Contractor shall submit the following to Architect for approval:
 - a. Test certificates from approved commercial testing laboratory on all proposed aggregate. Certificates shall indicate material source, gradation, and loss from 5-cycle Magnesium Sulfate or Sodium Sulfate test (not to exceed 18 percent).
 - b. Mix design based on water-cement ratio.
 - c. Results of compression tests per ASTM C39 and/or flexural tests per ASTM C78, made by approved commercial testing laboratory. Tests shall be made on 6 cylinders/beams at curing times appropriate to concrete class.
 - 2. Architect will approve/reject mix design and materials based on submittals. This approval is subject to additional testing during construction.
 - 3. Mix designs for various classes of concrete shall conform to:

Class	Minimum Sacks	Maximum Gallon	Maximum Slump
	Cement per CY	Water per Sack	Inches
A	5.0	6.5	4 ± 1
C	6.0	6.0	4 ± 1

- F. Strength Requirements. Various classes of concrete shall conform to these strengths in psi as determined by average of 2 test cylinders or beams:

COMPRESSIVE			FLEXURAL
Class	7 Day	28 Day	
A	2,100	3,000	-
C	2,800	4,000	600 (28-day)

- G. Properties:
1. Air Entrainment: 5 percent, plus or minus 1-1/2 percent ASTM C260.
 2. When Approved by the Engineer, Synthetic Fiber: Use manufacturer's recommended rate, but not less than 1.0 pound per cubic yard (where applicable).

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C94.
- B. Ready-Mixed Concrete: Comply with ASTM C94 and C1116 requirements when synthetic fibers are involved. When air temperature is 85 to 90 degrees F, reduce mixing and delivery time from 90 to 75 minutes. When air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.
- C. Project-Site Mixing: Comply with requirements and measure, batch, mix concrete materials, and concrete per ASTM C94. Mix concrete materials in appropriate drum-type batch machine mixer.
 1. For mixers of 1 cubic yard or smaller capacity, continue mixing at least 1.5 but not more than 5 minutes after ingredients are in mixer, before releasing any part of batch.
 2. For mixers of capacity larger than 1 cubic yard, increase mixing time by 15 seconds for each additional 1 cubic yard.
 3. Provide batch ticket for each batch discharged and used in Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added.

2.10 CONCRETE BUMPERS (WHEELSTOPS)

- A. Cement: Portland Cement should contain minimum five sacks of cement per cubic yard ANSI/ ASTM C150, Portland Type I - Normal, gray color.
- B. Concrete Materials: ANSI/ ASTM C330; water and sand.
- C. Reinforcing Steel: ASTM A615, deformed steel bars.
- D. Air Entrainment Admixture: ANSI/ ASTM C260.
- E. Concrete Mix: Minimum 4,500 psi, 28-day strength, air entrained 5 to 7 percent, with fibermesh.
- F. Use rigid molds, constructed to maintain precast units uniform in shape, size and finish. Maintain consistent quality during manufacture.
- G. Embed two #5 reinforcing steel bars, and drill or sleeve for 2 dowels.
- H. Cure units to develop concrete quality and minimize appearance blemishes (non-uniformity, staining, surface crackling, etc.).
- I. Nominal Size: 6 inches high, 9 inches wide, 6 feet long.
- J. Profile: Rectangular cross section with sloped vertical faces, square ends.
- K. Anchoring Dowels: Cut reinforcing steel, 1/2-inch diameter, 12 inches long, pointed tip.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proofroll prepared subgrade and base surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions are corrected and subgrade and base are ready to receive pavement.
- B. Remove loose material from compacted subbase surface just before placing concrete.
- C. Remove snow, ice, frost, and trash from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen or muddy surfaces.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

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

3.3 STEEL REINFORCEMENT

- A. Comply with CRSI "Manual of Standard Practice," for fabricating reinforcement and per CRSI "Placing Reinforcing Bars," for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.4 JOINTS

- A. Construct isolation, contraction, construction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and where pavement operations are stopped for more than 1/2-hour, unless pavement terminates at isolation joints.
 - 1. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 - 2. Provide tie bars at sides of pavement strips where indicated.
 - 3. Use a bonding agent where fresh concrete is placed against hardened or partially-hardened concrete surfaces.

- C. Isolation Joints: Form of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Extend joint fillers full width and depth of joint.
 - 2. Terminate joint filler less than 1/2- or more than 1-inch below finished surface if joint sealant indicated.
 - 3. Place top of joint filler flush with finished concrete surface if joint sealant not indicated.
 - 4. Furnish joint fillers in 1-piece lengths. Where more than 1 length is required, lace or clip joint-filler sections together.
 - 5. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete is placed on both sides of joint.
- D. Longitudinal joints shall be completed as soon as it will not cause excessive raveling of the concrete but no more than 24 hours after placement and before any traffic is allowed on the pavement. A crew should be available, day or night, to complete this Work according to ACI.
- E. Driveways and Pavements - Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to radius noted on Plans. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces. Refer to Plans for joint dimensions.
- F. Sidewalks - Control Joints: Sawcut 1/8-inch control joints after curing to depth shown on Plans. Joints shall be clean, straight lines as shown on Plans. Clean concrete surface of all debris after installation.

3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to embed or cast in.
- B. Moisten subbase to provide a uniform dampened condition when placing concrete. Do not place concrete around manholes/other structures until at required finish elevation/alignment.
- C. Comply with ACI 304R requirements and recommendations for measuring, mixing, transporting, and placing concrete.
- D. Deposit and spread concrete in continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- E. Consolidate concrete by mechanical-vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete per ACI 309R recommendations.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator, keeping it away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- F. Place concrete in 2 operations. Strike off initial pour for entire width of placement and to required depth below finish surface. Lay welded-wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed. Remove and replace portions of bottom layer of concrete placed more than 15 minutes without covering by top layer or use bonding agent if approved by Architect.

- G. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on surface. Do not further disturb concrete surfaces before finishing operations or spreading dry-shake surface treatments.
- H. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement attains 85 percent of 28-day compressive strength.
- I. Cold-Weather Placement: Comply with ACI 306.1. Protect concrete Work from physical damage or reduced strength caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature falls to, or is expected to fall, below 40 degrees F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature not less than 50 nor more than 80 degrees F at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- J. Hot-Weather Placement: Place concrete per ACI 305R recommendations and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Use chilled mixing water or chopped ice to control temperature if water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor option.
 - 2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

- A. Wetting concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Begin second floating operation when bleed-water sheen disappears, and concrete surface stiffens sufficiently to permit operations. Float surface with power-driven floats or hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Light-to-Medium Broom Finish: Concrete sidewalks.
 - 2. Medium-to-Coarse-Textured Broom Finish: For concrete pavement and driveways, provide a medium-to-coarse finish by dragging float-finished concrete surface 1/16- to 1/8-inch deep with a stiff-bristled broom, perpendicular to line of traffic.
- C. Wall Finishes: Concrete walls shall be form-revealed finish. Reference Plans for forms dimension control.

3.7 CONCRETE PROTECTION AND CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow ACI 305R recommendations for hot-weather protection during curing.
- B. Evaporation Retarder: Apply to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2-pound per square foot by H before and during finishing

- operations. Apply per manufacturer-written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete, but not before free water disappears from concrete surface.
- D. Curing Methods: Moisture curing, moisture-retaining-cover curing, curing compound, or a combination as follows:
1. Moisture Curing: Keep surfaces continuously moist not less than 7 days with:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, 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, sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller per manufacturer-written instructions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control include those specified herein.
- B. Testing Services shall be performed per the following requirements:
1. Sampling Fresh Concrete: Obtain representative samples of fresh concrete per ASTM C172, except modified for slump to comply with ASTM C94.
 2. Slump: ASTM C143; 1 test at point of placement for each compressive-strength test, but not less than 1 test for each day's pour of each type of concrete. Additional tests required when concrete consistency changes.
 3. Air Content: ASTM C231, pressure method; 1 test for each compressive-strength test, but not less than 1 test for each day's pour of each type of air-entrained concrete.
 4. Concrete Temperature: ASTM C1064; 1 test hourly when air temperature is 40 degrees F and below and 80 degrees F and above, and 1 test for each set of compressive-strength specimens.
 5. Compression Test Specimens: ASTM C31; 1 set of 4 standard cylinders for each compressive-strength test, unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens unless field-cured test specimens required.
 6. Compressive-Strength Tests: ASTM C39; 1 set for each day's pour of each concrete class exceeding 5 but less than 25 cubic yards, plus 1 set for each additional 50 cubic yards. Test 1 specimen at 7 days and 2 at 28 days. Retain 1 specimen in reserve for later testing if required.
 7. When frequency of testing will provide fewer than 5 compressive-strength tests for a given class of concrete, test from at least 5 randomly-selected batches or each batch if fewer than 5 are used.

- C. Report test results in writing to Architect and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Nondestructive Testing: Architect may permit impact hammer, sonoscope, or other nondestructive device but do not use as sole basis for approval or rejection.
- E. Additional Tests: Contractor shall make additional tests of concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements not met, as directed by Architect. Contractor may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.
- F. Contractor shall pay for failing tests.
- G. Questionable Concrete:
 - 1. Concrete considered "questionable" where any of these tests evaluations occur:
 - a. Individual test strength is below specified strength.
 - b. Samples of concrete for acceptance test cylinders or acceptance test beams not representative of concrete-in-place in the pavement.
 - c. Insufficient or inadequate concrete curing.
 - d. Insufficient number of acceptance test cylinders or acceptance test beams for day's concreting were made for testing.
 - 2. Except where core tests will impair structure strength, make core test as directed by Owner at no cost to Owner to resolve questionable concrete. If core tests fail to demonstrate test strength required by Contract Documents or structural analysis does not confirm structure adequacy, Owner may, at his discretion, reject Work, require load tests, or additional construction. If structural analysis confirms pavement adequacy, Owner may, at his discretion, accept concrete with credit for full value of concrete delivered to site per general conditions.
 - 3. Contractor shall pay all costs incurred in providing additional testing or analysis to resolve acceptability of questionable concrete.
 - 4. Core Tests:
 - a. Take 3 representative cores from each member or area of concrete for each test considered questionable. Location of cores shall be as directed by Owner to least impair pavement strength. Replace damaged cores.
 - b. Obtain and test cores per ASTM C42 except if concrete in structure will be dry under service conditions, air dry cores (60 to 80 degrees F and relative humidity less than 60 percent) for 7 days before test and test dry. If concrete in structure will be more than superficially wet under service conditions, immerse cores in water at least 48 hours and test wet.
 - c. Questionable concrete considered structurally acceptable if core average is equal to or greater than 90 percent of specified strength and no single core is greater than 500 psi below specified compressive strength (50 psi below specified beam strength).

3.9 REPAIRS OF DEFECTIVE PAVEMENT SLABS

- A. Replace or repair broken slabs, random cracks, nonworking contraction joints near cracks, and spalls along joints and cracks as specified hereinafter at no cost to Owner.
- B. Broken Slabs: Entirely remove and replace pavement slabs containing multiple cracks through more than 1/4 of slab depth separating slab into 3 or more parts and pavement slabs with one or more cracks through more than 1/4 of pavement depth extending diagonally across more than 1/3 of slab either transversely or longitudinally. Repair pavement slabs containing a single diagonal crack intersecting transverse and longitudinal joints within 1/3 of width and length of slab from corner by removing and replacing smaller portion of slab. Repair broken slabs per Article 3.12 "Removal and Replacement of Defective Pavement Areas."
- C. Grooving and Repairing Cracks in Pavement Slabs: Random cracks penetrating more than 1/4 of pavement depth shall be grooved, crack filled with epoxy-resin, and groove filled with epoxy-resin grout. Groove top of crack to minimum 3/4-inch depth and not less than 3/8- nor more than 5/8-inch width by an approved grooving machine. Grooving machine shall be vertical rotary-cutting and able of following closely the path of crack and widening top of crack to required section without spalling or otherwise damaging concrete. Fill random cracks that are tight and penetrate less than 1/4 of pavement depth with epoxy-resin. When necessary, determine depth of crack penetration by inspection of cores not less than 4 inches in diameter drilled by Contractor at his expense where directed. Refill core holes with Portland cement concrete bonded to pavement with epoxy-resin grout. In addition, when a longitudinal crack is continuous across one or more slabs and penetrates more than 1/4 depth of pavement, drill core holes not less than 6 inches in diameter through full depth of slab at both ends of crack. In operation to drill cores at longitudinal-crack ends, position core bits so core removed will include no more than 3 inches of crack. Use sandblasting and high-pressure air jets to remove any fines near apparent ends of crack to permit accurate determination of crack ends. Remove all fines, dust, and other loose material on wall of cored holes by scrubbing with stiff-bristle brush, followed by washing and dewatering core hole. Refill core holes with epoxy-resin concrete. Apply a prime coat of epoxy-resin binder thinned with 3 parts toluene to 7 parts epoxy binder, by volume, and brush into vertical wall of core hole. Delay placement of epoxy-resin concrete until prime coat becomes stringy or approaches dry to touch. Place epoxy-resin concrete in layers not over 6 inches thick. Time interval between placement of additional layers shall be so temperature of epoxy-resin concrete does not exceed 140 degrees F any time during hardening.

3.10 NONWORKING (UNCRACKED) CONTRACTION JOINTS

- A. When transverse random crack terminates in or crosses a transverse contraction joint, fill uncracked portion of joint with epoxy-resin mortar or grout then route and seal crack. When a transverse random crack approximately parallels planned contraction joint and is within a distance of 25 percent of slab length from a contraction joint, route and seal crack then fill joint with epoxy-resin grout or mortar. When transverse random crack is more than 25 percent of slab length from nearest contraction joint, seal both joint and crack. Thoroughly clean joints to fill with epoxy-resin mortar or grout. Cleaning and sealing cracks and joints shall be as specified in Section 32 13 73 "Concrete Paving Joint Sealants."

3.11 SPALLING ALONG JOINTS AND CRACKS

- A. Repair spalls by making a saw cut at least 1-inch outside spalled area and to a 2-inch minimum depth. When spalled area abuts a joint, make saw cut to a 2-inch depth or 1/6 slab thickness, whichever is greater. Remove concrete between saw cut and joint or primary crack to a minimum 2-inch depth below original concrete surface, and to such additional depth necessary to expose a surface of sound, unweathered concrete uncontaminated by oils, grease, deicing salts or solutions, or other substances that inhibit performance of epoxy-resin bonding material. Remove concrete volume between saw cut and joint or primary crack using a hydraulic impact hammer, or other methods approved by Owner's Representative. Contractor shall exercise care in removing required concrete so no damage is inflicted on adjoining concrete slab. Contractor shall repair damage of adjoining concrete at his expense to satisfaction of Owner's Representative.
- B. Thoroughly clean concrete void to patch with compressed air, sandblasting, or other approved methods to remove all loose material. Apply a prime coat of epoxy-resin binder thinned with 3 parts toluene to 7 parts epoxy binder, by volume, to dry, cleaned surface of all sides of cavity, except joint or primary crack face. Apply prime coat in a thin coating and scrub into surface with a stiff-bristle brush. Delay placement of portland-cement concrete, epoxy-resin concrete, or mortar until prime coat becomes stringy or approaches dry to touch. Place epoxy concrete in cavity in layers not exceeding 2 inches thick. Time interval between placements of additional layers shall be so temperature of epoxy-resin concrete does not exceed 140 degrees F at any time during hardening. Use mechanical plate, screed, float vibrators, or hand tampers to consolidate concrete or mortar. Remove excess mortar or concrete on adjacent surfaces of hardened concrete before it hardens. After finishing operations and while epoxy-resin concrete or mortar is still tacky, uniformly spread a thin coating of portland cement on surface of repaired area and lightly brush into surface. If spalled area to patch abuts a working joint or a working crack which penetrates full depth of slab, use an insert or other bond-breaking medium to maintain working joints or cracks during repair Work. Use surface embedment of a flexible polyethylene or other suitable type hose for forming a groove along working crack to fill with appropriate type of joint-sealing material. Carefully remove hose before concrete hardens sufficiently to form a high bond. Thoroughly clean and fill groove with sealer as specified.

3.12 REMOVAL AND REPLACEMENT OF DEFECTIVE PAVEMENT AREAS

- A. Remove and replace defective pavement areas as specified herein with pavements of thickness and quality required by Specifications. Carefully remove defective pavement so adjacent pavement will not be damaged and existing reinforcement at joints left intact. When replacing a portion of unfractured slab, make a 2-inch-deep sawcut transversely across slab in required location, and remove concrete to provide an essentially vertical face in remaining portion of slab. Before placing fresh concrete, clean slab face of debris and loose concrete, then thoroughly coat with epoxy-resin grout. Epoxy-resin coating shall be approximately 1/16-inch and applied by scrubbing a thin coat of grout into surface with a stiff-bristle brush followed by a second application. Place strips of polyethylene sheeting on vertical faces of adjacent slabs at juncture with slab to patch as a bond-breaking medium. Place fresh portland-cement concrete while epoxy-resin is still tacky so grout coating is not removed. Construct longitudinal and transverse joints of replaced slab or portion thereof as indicated. Seal joints as specified in Section 32 13 73 "Concrete Paving Joint Sealants." Replaced pavements will be paid for at Contract price but no payment made for defective pavements removed nor for cost of removing defective pavements.

3.13 TOLERANCE IN SLAB THICKNESS

- A. Determine slab thickness by average caliper measurement of cores tested per ASTM C74. Owner's Representative may elect to measure thickness of concrete pavement before placement based on measurements from a string line stretched across forms or in plastic concrete behind concrete placing operation.
- B. Remove and replace areas found deficient in thickness with concrete of thickness shown on Plans at Contractor expense. If cores are used to determine concrete thickness, fill core holes with non-shrink grout by Contractor at his expense.

END OF SECTION

SECTION 32 13 73 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Expansion and contraction joints within portland cement concrete pavement.
 - 2. Joints between portland cement concrete and asphalt pavement.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

- A. ASTM C1193 - Use of Joint Sealants.
- B. ASTM D5249 - Backer Material for Use with Cold-and-Hot-Applied Joint Sealants in portland Cement Concrete and Asphalt Joints.
- C. ASTM D1751 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- D. ASTM D3405 - Joint Sealants, Hot Applied, for Concrete and Asphalt Pavements.
- E. ASTM D3406 - Joint Sealant, Hot Applied, Elastomeric Type, for Portland Cement Concrete Pavements.
- F. ASTM C920 - Elastomeric Joint Sealants.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Product Certificates: Signed by manufacturers of joint sealants certifying products furnished comply with requirements and suitable for use indicated.
- D. Compatibility and Adhesion Test Reports: From joint sealant manufacturer indicating:
 - 1. Materials forming joint substrates and joint-sealant backer materials were tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- E. Product Test Reports: From a qualified testing agency indicating joint sealants comply with requirements, based on comprehensive testing of current product formulations.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Experienced installer who specialized in installing joint sealants similar in material, design, and extent to those indicated for Project and work resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source and manufacturer.

- C. Product Testing: Obtain test results for Article 1.3.E "Product Test Reports," from a qualified testing agency, based on testing current sealant formulations within a 36-month period.
 - 1. Testing Agency Qualifications: Independent testing agency qualified per ASTM C021 to conduct testing indicated, as documented per ASTM E548.
 - 2. Test joint sealants for compliance with requirements indicated by referencing standard Specifications and test methods.
- D. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturer, for testing indicated, samples of materials that contact or affect joint sealants. Use manufacturer-standard test methods to determine if priming and other specific joint preparation techniques required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project Site in original, unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials per manufacturer-written instructions to prevent deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint sealants under these conditions:
 - 1. Ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
 - 2. Joint substrates are wet.
 - 3. Blowing dust conditions exist.
- B. Joint-Width Conditions: Do not install joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint-Substrate Conditions: Do not install joint sealants until contaminants able to interfere with adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials compatible with one another and with joint substrates under conditions of service and application, per joint sealant manufacturer based on testing and field experience.
- B. Bituminous premolded expansion joint shall conform to ASTM D1751.
- C. Elastomeric sealant for contraction joints shall be, or equivalent to, W.R. Meadows "SOF-SEAL" or "Gardox."
 - 1. Hot-poured sealant for joints between portland cement concrete and bituminous concrete shall conform to ASTM D3405.
 - 2. Hot-poured sealant for all other joints in portland cement concrete pavement shall conform to ASTM D3406.
 - 3. Cold-poured joint sealant shall conform to ASTM C920.
- D. Mix material per manufacturer recommendations.

2.2 JOINT-SEALANT BACKER MATERIALS

- A. Provide joint-sealant backer materials that are nonstaining, compatible with joint substrates, sealants, primers, and other joint fillers, and approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rod for Cold- and Hot-Applied Sealants: ASTM D5249, Type 1, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D5249, Type 2, thickness and width required to control sealant depths, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
- D. Round Backer Rods for Cold-Applied Sealants: ASTM D5249, Type 3, diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

2.3 PRIMERS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALL JOINT SEALANTS

- A. Comply with joint sealant manufacturer's written installation instructions applicable to products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with ASTM C1193 recommendations for use of joint sealants as applicable to materials, applications, and conditions indicated.

- C. Install backer materials type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths to allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that are wet before sealant application and replace them with dry materials.
- D. Install sealants by proven techniques to comply with these when backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths to allow optimum sealant movement capability.
- E. Tooling Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants per specified requirements to form smooth, uniform beads of configuration indicated, eliminate air pockets, and ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealants from surfaces adjacent to joint.
 - 2. Use tooling agents approved in writing by joint sealant manufacturer and do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.
- G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

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

3.5 PROTECTION

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

END OF SECTION

PART 1 - SECTION 33 05 00 - COMMON WORK RESULTS FOR UTILITIESGENERAL

1.1 SUMMARY

- A. Section includes general and other site utilities.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.2 UTILITY LOCATION

- A. Before any Work commences, Contractor shall notify Dig Tess for locating all utilities within Project area.
- B. Contractor shall coordinate location of existing utilities (irrigation systems, etc.) with Owner's personnel. Take care to salvage all system components to remove unless otherwise directed by Owner.

1.3 PROJECT CONDITIONS

- A. Perform site survey, research Owner's utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located as required.
- B. Locate existing structures and piping to close and abandon.

1.4 SEQUENCING AND SCHEDULING

- A. Coordinate utility down time with Owner.
- B. Coordinate with other utility work.
- C. Provide utility entity at least 72 hours advance notification.

PART 2 - PRODUCTS

2.1 REPLACING DAMAGED PRODUCTS

- A. If damage is done to Owner's utility service, Contractor shall coordinate replacement of damaged parts with Owner at no cost to Owner to a quality equal-to-or-better-than prior to construction. Repair in a timely manner to prevent excessive down-time for Owner.
- B. Any rerouting existing utilities, other than those utilities anticipated in Plans, shall be at Contractor expense and considered subsidiary to Project.

PART 3 - EXECUTION (Not Used)

END OF SECTION