

Exhibit 1 Technical Specifications

Contents

Division 1 – General Requirements

01001	Summary of Work	01001-1
01010	Project Procedures	01010-1
01040	Coordination	01040-1
01141	Use of Site	01141-1
01200	Project Meetings	01200-1
01210	Measurement and Payment	01210-1
01250	Substitution Procedures	01250-1
01300	Submittals	01300-1
01310	Construction Schedule	01310-1
01350	Project Document Tracking and Control Systems	01350-1
01380	Photographic Documentation	03180-1
01400	Contractor's Work Quality	01400-1
01410	Testing Laboratory Services	01410-1
01513	Temporary Heating Cooling Ventilating and Enclosures	01512-1
01540	Security and Safety	01540-1
01570	Temporary Controls	01570-1
01600	General Material and Equipment Requirements	01600-1
01610	Transportation and Handling	01610-1
01700	Contract Closeout	01700-1
01800	Maintenance	01800-1

Division 2 – Site Work

02050	Demolition	02050-1
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Division 3 – Concrete

03000	Concrete (For Smaller Projects)	03000-1
03013	Repair and Rehabilitation of Cast-In-Place Concrete	03013-1
03110	Concrete Forming	03110-1
03150	Concrete Accessories	03150-1

Division 4 – Masonry

04000	Masonry (For Smaller Projects)	04000-1
04012	Masonry Restoration and Cleaning	04012-1
04050	Unit Masonry Construction	04050-1
04051	Masonry Mortaring and Grouting	04051-1
04052	Masonry Anchorage and Reinforcing	04051-1
04220	Concrete Unit Masonry	04220-1

Division 5 – Metals

05053	Anchor Systems	05053-1
05120	Structural Steel Framing	05120-1
05501	Miscellaneous Metal Fabrications	05501-1

Exhibit 1
Technical Specifications

Division 6 – Wood, Plastics, and Composites

06105	Miscellaneous Rough Carpentry	06105-1
-------	-------------------------------	---------

Division 7 – Thermal and Moisture Protection

07920	Joint Sealants	07920-1
-------	----------------	---------

Division 8 – Openings

08111	Hollow Metal Doors and Frames	08111-1
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Division 9 – Finishes

09625	Concrete Floor Toppings	09625-1
09910	Painting	09910-1

SECTION 01001
SUMMARY OF WORK

PART 1- GENERAL

1.01 LOCATION AND DESCRIPTION OF WORK

- A. The Work is located at the Scott Candler Water Treatment Plant at 4830 Winters Chapel Road, Atlanta, GA 30360.
- B. The Work to be performed under this Contract includes, but is not limited to, constructing the Work described below and all related appurtenances. The Work includes, but is not limited to, the following:
 - 1. Structural repairs at Electrical Building No. 2 (EB2) outlined in Exhibit 2.
 - 2. Miscellaneous repairs at EB2 including painting conduits, replacing doors, and replacing the drop ceiling.
 - 3. Installation and calibration of Hach instrumentation equipment as required by the contract documents.
- C. Contracting Method: The Project shall be constructed under one prime Contract.

1.02 OTHER CONSTRUCTION CONTRACTS

- A. Other construction contracts have been or will be awarded by OWNER that are in close proximity to or border on the Work of this Contract. Work under these other contracts is briefly described as follows:
 - 1. Electrical conduit tracing in EB2 where a certified CONTRACTOR, will trace conduits to be impacted by structural repair work and identify which plant functions are powered by aforementioned conduits.

1.03 WORK BY OTHERS

- A. Non-Professional Services Contracted by OWNER: OWNER will procure or retain services of the following entities to perform the services indicated relative to the Project. CONTRACTOR shall coordinate and schedule the Work with, and cooperate with, the entities performing the following services for OWNER.
 - 1. Testing and Code-Required Special Inspections:
 - a. OWNER has, or will, retain the services of a qualified testing laboratory to perform testing and code-required special inspections for the Work.

1.04 WORK BY OWNER

- A. OWNER will perform the following in connection with the Work:

1. Operate all existing valves, gates, pumps, equipment, and appurtenances that will affect OWNER's operation, unless otherwise specified or indicated.

1.05 SEQUENCE AND PROGRESS OF WORK

- A. Requirements for sequencing and coordinating with OWNER's operations, including maintenance of facility operations during construction, and requirements for tie-ins and shutdowns, are in Section 01040, Coordination.

1.06 CONTRACTOR'S USE OF SITE

- A. CONTRACTOR shall share use of the Site with other contractors and others specified in Article 1.3 of this Section and others as specified in Article 1.4 of this Section.
- B. Move stored materials and equipment that interfere with operations of OWNER, other contractors, and others performing work for OWNER.
- C. Limits on CONTRACTOR's use of the Site are:
 1. As indicated in Section 01141, Use of Site.
 2. Do not use the Site for operations other than those required for the Project.

1.07 SALVAGE OF MATERIALS AND EQUIPMENT

- A. Existing materials and equipment removed and not shown or specified to be reused in the Work will become CONTRACTOR's property, except the following items that shall remain OWNER's property:
- B. Removal, Storage, Handling, Reinstallation:
 1. Air Handling Unit-7.
 2. Carefully remove in manner to prevent damage all materials and equipment shown or indicated to be salvaged and reused or to remain property of OWNER.
 3. Store and protect salvaged items shown or indicated to be used in the Work.
 4. Replace in-kind or with new items those items of materials and equipment damaged during removal, storage, or handling through CONTRACTOR's actions, negligence, or improper procedures.
- C. CONTRACTOR may furnish and install new items, with ENGINEER's approval, instead of those specified or indicated to be salvaged and reused, in which case such removed items will become CONTRACTOR's property.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01010
PROJECT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

Section includes:

- A. Access to and **Contractor's** use of the site
- B. Requirements
- C. Construction procedures

1.02 ACCESS TO AND CONTRACTOR'S USE OF THE SITE

- A. The space available to the **Contractor** for the performance of the Work, either exclusively or in conjunction with others performing other construction as part of the project, is shown on the drawings.
- B. The **County** shall continue to utilize the existing wastewater collection system and water system during assessment and construction.
 - 1. The **County** will endeavor to cooperate with the **Contractor's** operations when the **Contractor** has notified the **County** in advance of need for changes in operations in order to accommodate construction operations.
 - 2. The **Contractor** shall conduct the Work to cause the least interference with the **County's** operations.
- C. Equipment and vehicles used by the **Contractor** on the project shall be marked with the **Contractor's** name and telephone number.

1.03 COORDINATION REQUIREMENTS

- A. Coordination with **County**:
 - 1. Limit access through occupied areas to those days and times the **County** approves. Occupied areas include areas in which the **County's** regular operations will be going on or to which the **County** requires access during the construction period.
 - 2. When the following must be modified, provide alternate facilities acceptable to the **County**:
 - a) Emergency means of egress
 - b) Utilities that must remain in operation
 - c) Informational signage

3. The **Contractor** shall notify the **County** immediately of any circumstances that may jeopardize or that have interrupted utility service.
- B. Security Procedures:
1. Limit access to the site to persons involved in the work.
 2. Provide secure storage for materials.
 3. Secure completed work as required to prevent loss.
- C. Coordination of Construction:
1. Inform each party involved, in writing, of procedures required for coordination of the Work; include requirements for giving notice, submitting reports, and attending meetings.
 2. Inform the **County** in advance, with ample time, when coordination of Work is required.
- D. Utilities Notification Prior to Construction:
1. Georgia law mandates that, before beginning mechanical digging or excavation work, **Contractor** shall contact Georgia 811 by using eRequest on www.Georgia811.com or by calling 811 or 1-800-282-7411.
 2. **Contractor** may utilize EDEN (Excavation Digging Event Notification) web application that enables Members and Professional Excavators to create, manage, respond to, and edit Georgia 811 Locate Request Tickets.
 3. **Contractor** shall retain records of notification and responses during the course of the project until final Payment.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 CONSTRUCTION

- A. General Examination Requirements:
1. Prior to performing work, examine the applicable substrates and the conditions under which the work is to be performed.
 2. If unsafe or otherwise unsatisfactory conditions are encountered, take corrective action before proceeding.
 3. Notify the **County** promptly of type modifications required.

4. Before starting work that might affect existing construction, verify the existence and location of underground utilities and other underground construction.
 5. Prepare preconstruction photographic documentation in conformance with the requirements of these specifications.
- B. General Preparation Requirements:
1. The **Contractor** shall obtain, maintain, and pay for required permits.
 2. The **Contractor** shall take field measurements as required to properly conduct the work.
- C. Cleaning and Protection: Keep installed work clean, and clean again when soiled by other operations.
- D. Final Cleaning:
1. Remove materials and equipment that are not part of the work and any debris from the site prior to substantial completion.
 2. Dispose of debris in a lawful manner.
 3. Perform final cleaning after substantial completion has been certified, but before final payment.
 4. Clean entire project site and grounds.
- E. Substantial Completion:
1. Requirements for the **Contractor** achieving Substantial Completion are defined in the Contract Documents in GR-1 of the General Requirements.
 2. Substantial Completion is typically defined to include:
 - a. Completion of Work required by the Contract Documents
 - b. Operation of components and systems of the Work, including acceptance of testing and startup requirements
 - c. Closeout of quality deficiencies and non-conformances
 - d. Delivery and acceptance of spare parts, operations manuals, and vendor documentation
 - e. Completion of vendor training
 - f. Completion and delivery of "red-line" as built drawings as well as electronic files in approved format
 3. When the **Contractor** believes substantial completion has been achieved, **Contractor** shall notify the **County** in writing, requesting Substantial Completion. The **County** will verify that the contractual

documentation requirements for Substantial Completion have been completed, including closeout of open NCRs. If verified, the **County** schedule a Substantial Completion inspection and walk-through with the **Contractor**, DWM Operations, and the Designer, or will notify the **Contractor** in writing of acceptance or the reason(s) for denying Substantial Completion.

F. Final Completion:

1. Requirements for the **Contractor** achieving Final Completion are defined in the Contract Documents in GR-9 of the General Requirements.
2. After Substantial Completion, **Contractor** shall meet additional requirements for Final Completion and release of final payment. These requirements will be defined in the Contract and typically include:
 - a. Completion of punch list items by the **Contractor**
 - b. Demobilization from the project site
 - c. Submittal of warranties
 - d. Release of subcontractor or vendor liens
 - e. Turnover of remaining project documents required by the Contract, including final as-built drawings by the Design Consultant

3.02 CHANGE MANAGEMENT

A. Contract Change Process

Any firm under contract with the **County** may submit a Change Request (CR) to the **County** following the requirements of the contract. A CR may address requested changes in cost and/or schedule, as well as contract terms or scope that do not result in cost or schedule impacts.

Changes may also be initiated by the **County** in the form of a Field Order (FO). The **Contractor** shall proceed with the change unless they believe the FO entitles them to a change in contract price, time, and/or term. If so, the **Contractor** shall submit a CR within 15 days of receiving the FO.

The CR from the **Contractor** is to be accompanied by a detailed proposal describing the **Contractor's** opinion of the CR's cost, schedule, and/or contract term impacts.

If the CR is acceptable to the **County**, the **Contractor** will be directed to submit a CO to the **County** to process. If the CR is not acceptable to the **County** then the **Contractor** may negotiate the CR. If the cost and/or schedule impacts cannot be agreed, then the **County** will either instruct the **Contractor** to proceed with the change using a Unilateral Change Directive (UCD), if the change is deemed by the **County** to be needed, or the change can be terminated if the change is deemed to be not needed. If the **County** issues a UCD after failing to

agree on the price of a CO, then the pricing of the change is per the contract terms.

A UCD can be initiated by the **County** only when there is an imminent threat to public safety or health, or a potential shutdown of a vital **County** function.

- B. Amendment to the Contract If the approval of a CO requires a written, formal amendment to the contract, the **County** will process the formal amendment.

- C. Project Scope Change Impacts

A change to a Design /Build contract may materially change the scope of the project, including greater impact on the construction scope than the design scope. A design scope change may also materially impact the project configuration even if it is a no-cost change. Additionally, a change to one project's scope may have impacts to another project's scope.

So that a CO is not approved without understanding its full impacts beyond the affected contract scope, project scope change impacts shall be approved by the **County**. These must consider changes through every phase of the project, and/or impacts to other projects.

- D. Baseline

If a CO is approved, the **Contractor** will prepare a Project Baseline Change Instruction Form to formally change the project scope, baseline schedule, and baseline budget.

- E. Change Monitoring

The **Contractor** is responsible for monitoring changes to the contract. The **Contractor** will maintain a Design Change Log for each project, and will maintain a Construction Change Log that includes the change description, change status, category of change, contract, estimate of cost, estimate of schedule impact, and current process step. Change logs are updated each month and included with the Project Progress Report.

Responding to and processing changes in a timely manner is a priority. Change backlogs will be vigorously monitored and managed. Change status reports will be developed by the **Contractor** from the Change Logs to provide current status of each open change, which process step is active, and how many days remain in the process step. "Overdue" reports will be elevated to the **County** for follow-up and closure.

- F. Change Status

Changes will be identified by one of the four following status descriptions:

Proposed Change is a change that has been submitted as a CR or FO, but has not yet been negotiated. Proposed changes require closure if they are deemed to be not required, or must be resolved in a timely manner if they are deemed required.

The cost estimate and/or schedule impact of a proposed change will usually change as it goes through the contract change process. These changes must be reflected in the Change Log as they occur and included in monthly cost and schedule forecasts. Pending Change is a change that has been negotiated, but has not yet received final **County** approval. These changes must be included in monthly cost and schedule forecasts.

Approved Change is a change that has received final **County** approval. The contract scope, budget, and/or schedule will be amended to include approved changes. Approved changes will be included in monthly cost and schedule forecasts until a formal re-baselining of the project schedule and/or budget is approved.

Closed Change is a change that has been formally rejected and closed by the **County**, or withdrawn by the originator.

G. Category of Change

Changes will be categorized as follows to track the types of changes that occur over the life of the project:

- **County Requests:** any change initiated by the **County**.
- **Differing Site Conditions:** new information not reasonably available during design, or considered “unforeseeable” through due diligence on the part of the **Contractor**.
- **Design Errors:** changes due to errors or deficiencies in the design.
- **Design Omissions:** items omitted from the design that would have been included in the original bid, had they been known.
- **Regulatory Requirements:** changes mandated by regulatory agencies that are different from approved permit conditions at the time the contract was approved.
- **Other:** changes required for all other reasons, including emergency work, adjustment of bid quantities, force majeure events, incentive payments, accepted substitutions, and changes identified during value engineering.

3.03 HEALTH AND SAFETY CONSIDERATIONS

- A. Take precautions to prevent fires and to facilitate firefighting operations.
- B. Take precautions to prevent accidents due to physical hazards.
- C. Maintain working conditions in order to keep the site and adjacent public ways free of hazardous and unsanitary conditions and public nuisances.
- D. Maintain working conditions to control rodents and other pests; prevent infestation of adjacent sites and buildings due to pests on this site.

- E. Keep public streets free of debris from this Work.
- F. Provide adequate traffic control in accordance with current MUTCD standards and the approved traffic permit.
- G. When using trenches/excavations, follow OSHA standards 29 CFR 1926.650, 29CFR 1926.651, and 29 CFR 1926.652.

3.04 ENVIRONMENTAL PROTECTION

A. General

Contractor shall conduct its operation in a manner to prevent pollution of the environment surrounding the area of work and shall be responsible for furnishing necessary items for fulfilling the work described herein.

B. Material Transport

Contractor shall comply with the Official Code County of DeKalb Georgia pertaining to the duties of the **Contractor** in hauling material over **County**-owned rights-of-way. This includes, but is not limited to, approval of proposed haul routes, prevention of dropping of materials or debris on the streets from trucks arriving and leaving the site, providing a suitable vehicle inspection and cleaning installation with permanent crew, and the removal of material spilled in public areas at no additional cost to the local government agency.

C. Waste Materials

No waste or erosion materials shall enter natural or manmade water, wastewater collection systems, or stormwater drains. Erosion materials from excavations, borrow areas, or stockpiled fill shall be contained within the work area.

Contractor shall develop methods for control of waste and erosion, which shall include filtration, settlement, and manual removal to satisfy the above requirements.

D. Burning

No burning of waste shall be allowed.

E. Dust Control

The **Contractor** shall control the generation of dust by its operations. Control of dust shall be accomplished by water sprinkling or by other methods approved by the County.

F. Noise Control

The **Contractor** shall minimize the noise caused by its operations. When required by agencies having jurisdiction, noise-producing work shall be performed in less sensitive hours of the day or week as directed by the **County**.

The **Contractor** shall provide equipment that operates with the least possible noise. The use of noisy equipment is prohibited. Hoists and compressor plants shall be electrically operated unless otherwise permitted. The air intake of compressors shall be equipped with silencers, and machinery operated by gearing shall be provided with a type of gearing designed to reduce noise. Internal combustion engines shall be equipped with mufflers in good order.

Noise generated by mobile construction equipment, stationary construction, equipment, and other equipment involved in the construction of the Work shall not exceed the decibel levels indicated below. Noise generated by mobile and stationary construction equipment will be measured 3 to 6 feet from building lines, and on the A-weighting network of Type 2 general purpose sound level meter set at fast response.

	Combined Residential and Commercial
Allowable sound levels of mobile construction equipment: <ul style="list-style-type: none"> From 7 a.m. to 10 p.m., Monday thru Saturday, except legal holidays At times other than those listed above 	85 dBA
Allowable sound levels of stationary construction equipment: <ul style="list-style-type: none"> From 7 a.m. to 10 p.m., Monday thru Saturday, except legal holidays At times other than those noted above 	70 dBA 60 dBA
Night work from 10 p.m. until 7 a.m. shall require an approved special permit from the County .	The dBA level will be included in the approved permit.

- G. Use of Chemicals: Chemicals used during construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, shall show approval of either EPA or FDA. Use of such chemicals and disposal of residues shall be in conformance with instructions.
- H. Bypassing During Construction: No wastewater shall be bypassed at sewage collection or treatment facilities during project construction unless a bypassing schedule has been approved by the **County**. It shall be the responsibility of the **Contractor** to prepare and secure the approval of bypassing not specifically identified in the Contract Documents.
- I. Responsibility for Spills and Accidental Discharges: In the event the **Contractor** causes or has a spill or accidental discharge for which the **County** is fined by the State of Georgia Department of Natural Resources Environmental

Protection Division (EPD), the **Contractor** agrees to remediate the spill or discharge immediately in accordance with current EPD regulations and to pay fines assessed against the **County** and/or **Contractor**, and pay for the **County's** cost associated with efforts to remediate the situation. The **County** shall be notified immediately of such an event.

- J. Odor Control: **Contractor** shall provide approved temporary odor control measures as required to control objectionable odors resulting from its cleaning and/or bypass pumping operations. Approved temporary odor control measures, when required, shall include odor control filters, additional ventilation, and/or covering of manholes.

3.05 PROTECTION OF THE WORK

- A. Conduct construction operations so no part of the Work is subjected to damaging operations or influences that are in excess of those to be expected during normal occupancy conditions.
- B. Execute work and stockpile spoils and materials to prevent flooding of excavations, below grade construction, and adjacent properties due to rainwater runoff.
- C. Protect existing property not indicated to be removed.
- D. Provide temporary supports as required to prevent movement and structural failure as designed by a Registered Professional Engineer in the state of Georgia at the Contractor's cost.
- E. Equipment and vehicles used on DWM projects shall be clearly marked with the **Contractor's** name and telephone number. The identifying markings may be in the form of magnetic signs, decals, or painted lettering and shall be located on both sides of the equipment/vehicle. The lettering shall be legible, of a contrasting color to the background surface, and at least two inches in height. Markings shall be in place upon initiation of the work on the project site.
- F. A copy of the Project Notice to Proceed letter issued by the **County** shall be available on the job site as proof of the contractual relationship of the **Contractor** with the **County**. The letter shall be presented for review upon request by regulatory agencies or other **County** departments that visit the job site.
- G. If removal and replacement of a paved private driveway is required, the replacement shall be performed within 2 weeks of removal. The required permanent pavement replacement for public roadways shall be performed within 30 days or within 7 days if the roadway is a state highway or major County arterial roadway. Temporary surface maintenance is the **Contractor's** responsibility and shall be adequate for the volume and type of traffic loads imposed. Temporary asphalt cold mix application, steel traffic plates, etc. shall be utilized as necessary.
- H. The **Contractor** shall always maintain copies of permits and approved plans on the project site.

3.06 NOTIFICATION OF SERVICE INTERRUPTION

During progress of work under this Contract, it may be necessary to temporarily interrupt water, sewer, or other utility service to a limited number of customers in the vicinity of the work. It shall be the **Contractor's** responsibility to coordinate the service outage with the utility and to provide proper advance notification (a minimum of 48 hours) to the affected customers. Due to the nature of businesses and traffic in certain projects' areas, water outages for connections, service changeovers, and other Work may not be allowed during normal work hours. The **Contractor** shall factor these considerations into bid price submitted. Coordination, special lighting, traffic control, employee overtime, special customer notification, etc. shall be included in these considerations by the **Contractor**.

END OF SECTION

SECTION 01040
COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

- A. The **Contractor** shall coordinate execution of the Work with subcontractors, other contractors working on related **County** projects, and the **County**, as required, to maintain operation of the existing facilities and satisfactory progress of the Work.
- . Requirements of this Section shall be in addition to those stated in the General Requirements.
- . The **County** requires a written explanation of the **Contractor's** plan for coordinating and accomplishing separate phases of the Work, supplemental to

1.02 EXISTING UTILITIES

- A. Consult with the **County** on a daily basis while the **Contractor** performs demolition, excavation, or any other alteration activity. No water or sewer function, utility, or structure is to be altered, shut off, or removed unless approved in advance, and in writing, by the **County**. The **Contractor** shall give the **County** at least 48 hours advanced notice, in writing, of the need to alter, shut off, or remove such function.
- B. Coordinate the Work with the **County** and revise daily activities to avoid adversely affecting system operations. Such revisions in the proposed work schedule shall be accomplished with no additional compensation to the **Contractor**.

END OF SECTION

SECTION 01141

USE OF SITE

PART 1 - GENERAL

1.01 SUMMARY

- A. Scope:
 - 1. This Section includes requirements for use of the Site during the Project, and includes requirements for use of existing facilities, as applicable.
 - 2. CONTRACTOR shall provide all labor, materials, equipment, tools, and incidentals shown, specified, and required to comply with restrictions on CONTRACTOR's use of the Site and other areas.

1.02 USE OF PREMISES

- A. Limit use of premises at the Site to work areas shown or indicated on the Drawings and as specified in this Section. Do not disturb portions of the Site beyond areas of the Work.
 - 1. Limits:
 - a. Confine construction operations to the following areas:
 - 1) Electrical Building No. 2
 - 2) Parking area immediately adjacent to Electrical Building No. 2.
 - b. Confine storage of materials and equipment, and locations of temporary facilities to the following areas:
 - 1) Parking area immediately adjacent to Electrical Building No. 2.
 - c. Do not enter the following areas:
 - 1) Filter Complex.
 - 2) Areas outside of the work areas indicated in Paragraph 1.2.A.1.a of this Section and outside of work areas indicated on the Drawings, including outside the Project areas indicated on the "key plan" in the Drawings.
 - 2. Access to Site, Access Roads, and Parking Areas: Refer to Section 01540, Security and Safety.
- B. Use of Existing Buildings and Structures: Maintain existing buildings and structures in weather-tight condition throughout construction unless otherwise indicated in the Contract Documents. Protect buildings, structures, and occupants during construction.

- C. Promptly repair damage to premises caused by construction operations. Upon completion of the Work, restore premises to specified condition; if condition is not specified, restore to pre-construction condition.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 – GENERAL

1.01 SUMMARY

- A. The **County** shall schedule and administer a preconstruction meeting, and may schedule periodic progress meetings, and specially called meetings throughout progress of the Work. The **County** shall set the agenda for the meetings and preside at the meetings. The **Contractor** shall make physical arrangements for the meetings pursuant to the **County's** requirements. Meetings are not a pay item.
- B. Representatives of the **Contractor**, subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

1.02 PRECONSTRUCTION MEETING

- A. The **County** shall schedule a Preconstruction Meeting prior to the start of construction.
- B. The Preconstruction Meeting shall be attended by the following:
 - 1. **County's** representative(s)
 - 2. **Contractor's** Project Manager and Superintendent
 - 3. Others as appropriate or required by the **County**
- C. The Preconstruction Meeting will generally have the following agenda:
 - 1. Designation of responsible personnel
 - 2. Distribution and discussion of list of major subcontractors and suppliers
 - 3. Projected construction schedule with critical Work sequencing
 - 4. Major equipment deliveries and priorities
 - 5. Procedures and processing of:
 - a. Submittals
 - b. Requests for Information (RFIs)
 - c. Change Documents

1. Requests for Proposals (RFPs)
2. Work Authorizations
3. Proposed Change Order Requests (CORs)
 - a. Field Decisions and Clarification Memos
 - b. Applications for Payment
 - c. Change Orders
4. Procedures for maintaining Record Documents (**Section 01350 - Project Document Tracking and Control Systems**)
5. Periodic Meeting Schedule
6. Mobilization Form Submittal – Contractor shall complete and submit a Mobilizations Request form after the following have been completed:
 - a. NTP Received
 - b. Preconstruction Meeting completed and minutes reviewed and accepted
 - c. Safety Plan, Construction Quality Plan, and Permit/Easement Plan submitted to and approved by **County**

1.03 PERIODIC PROGRESS MEETINGS

- A. Project Progress Meetings shall be held monthly throughout the project duration. The **County** may alter the timing of, or add supplemental, scheduled periodic progress meetings, at its discretion.
- B. The Project Progress Meetings shall be attended by the following:
 1. **County's** representative(s)
 2. **Contractor's** Project Manager, Superintendent, and other appropriate representative(s)
 3. Others as appropriate or required by the **County**
- C. The Progress Meetings will generally have the following agenda:
 1. Review Work progress since last meeting
 2. Discussion of Construction Schedule for next period
 3. Status of major equipment and material deliveries

4. Construction problems affecting progress
5. Field observations, including Safety Report(s)
6. Status of pending RFIs and changes
7. Stakeholder complaints/public outreach
8. Status of permits and easements
9. Status of invoicing
10. Other business

1.04 OTHER MEETINGS

A. Schedule Progress Meetings

As per **Section 01310 - Construction Schedule**, during weekly progress meetings, the **Contractor** shall submit a Look-Ahead Schedule. This schedule shall cover four weeks: the immediate past week, the current week, and the forthcoming two weeks. This schedule shall include activities that are complete, started, incomplete or underway, or scheduled to be performed during this four-week timeframe. Results of the Progress meetings shall be reported in the Project Progress Meetings.

B. Specially called meetings may be requested by either party or by other affected entities. Requests shall be made through the **County**, which shall coordinate the meeting schedule. Specially called meetings shall be held as warranted by:

1. Unforeseen developments during construction or as needed to coordinate special events, such as tie-ins or system shutdowns
2. Concerns regarding individual project performance and adherence to the schedule of construction

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01210

MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.01 BASE BID

Payment for Work under this item shall be based on the lump sum bid and shall include the labor, materials, equipment, and incidentals, including the temporary facilities, required to construct the Project as shown on the Drawings and as specified.

1.02 UNIT PRICE ITEMS

Measurement for payment for Work performed under these items shall be for permanent facilities. Payment shall be based on the actual quantity installed, and shall be based on the unit price bid for the particular item. Payments made shall include labor, materials, equipment, and incidentals required to construct the Work in accordance with the Drawings and Specifications. Any unexpended portion of these Bid Items shall be credited to the **County** on the Final Pay Estimate.

1.03 ALLOWANCES

Measurement and payment for Work performed under this item, when authorized by the **County**, the **County** shall determine the method of payment for any Work so authorized. Any unexpended portion of the Allowance amount shall be credited to the **County** on the Final Pay Estimate.

PART 2 – BID ITEMS (Refer to Attachment D)

2.01

ITEM	DESCRIPTION
CY	Cubic Yards
LS	Lump Sum
SF	Square Feet

2.02 Mobilization & Demobilization- LS (Bid Item 1 & 2)

Measurement for payment will be lump sum not to exceed 3% of the bid items 1-19. Payment will constitute full compensation for all costs associated with mobilization and demobilization as directed by the County for the project. Payment will be remitted for mobilization of up to a maximum of 50% of the amount bid upon the Owner's verification that the Contractor has fully provided all necessary labor, equipment, materials, administrative items, etc. necessary to commence the Work. The remainder of the amount bid will be remitted upon satisfactory demobilization and restoration of the various project areas upon completion of the Work, provision of all project record documentation and any other close-out type of documentation required at the end of the contract including any term renewal or extensions. No additional or separate payment will be made for mobilization or demobilization for the purposes of contract renewal or extension.

2.03 Temporary Protection- LS (Bid Item 3)

Measurement for payment will constitute full compensation for installation labor, equipment and materials required to furnish and install the work complete as referenced in the contract documents.

2.04 Demolition- LS (Bid Item 4)

Measurement for payment will constitute full compensation for installation labor, equipment and materials and all costs associated with and required for demolition and removal of structural, mechanical, and electrical items/equipment and ancillary equipment referenced in the contract documents.

2.05 Temporary Roof Truss Shoring Supports – LS (Bid Item 5)

Measurement for payment will constitute full compensation for installation labor, equipment and materials required to furnish and install the work complete as referenced in the contract documents.

2.06 Concrete – LF (Bid Item 6)

Measurement for payment will constitute full compensation for installation labor, equipment and materials and repair of concrete floor slabs, pre-cast wall panels, CMU wall crack repairs and all associated concrete referenced in the contract documents.

2.07 Masonry –Replace CMU- SF (Bid Item 7)

Measurement for payment will constitute full compensation for installation labor, equipment and materials and all costs associated with required for demolition and removal of damaged CMU and CMU removed by demolition.

2.08 Masonry – Drill & Grout – EA (Bid Item 8)

Measurement for payment will constitute full compensation for installation labor, equipment and materials required to furnish and install reinforcing dowls and pilaster blocks and all associated drilling and grouting referenced in the contract documents.

2.09 Metals - New Truss Base Plates – EA (Bid Item 9)

Measurement for payment will constitute full compensation for installation labor, equipment and materials required to furnish and install new truss base plates and all associated installation referenced in the contract documents.

2.10 Metals - Pre-Cast Wall Panel Lateral Support Anchors- EA (Bid Item 10)

Measurement for payment will constitute full compensation for installation labor, equipment and materials required to furnish and install new Pre-Cast Wall Panel Lateral Support Anchors and all associated installation referenced in the contract documents.

2.11 Thermal & Moisture Protection – Wall Insulation- SF (Bid Item 11)

Measurement for payment will constitute full compensation for installation labor, equipment and materials required to furnish and install insulation for all wall repairs and replacements for the work complete as referenced in the contract documents.

2.12 Thermal & Moisture Protection – Wall Expansion Joint- LF (Bid Item 12)

Measurement for payment will constitute full compensation for installation labor, equipment and materials required to furnish and install wall panel expansion joint repairs/replacement, for all walls for the work complete as referenced in the contract documents.

2.13 Finishes – Ceiling Replacement - SF (Bid Item 13)

Measurement for payment will constitute full compensation for installation labor, equipment and materials required to furnish and install the work complete as referenced in the contract documents.

2.14 HVAC Modifications- LS(Bid Item 14)

Measurement for payment will constitute full compensation for installation labor, equipment and materials required to furnish and install the work complete as referenced in the contract documents. Payment shall include the evaluation of existing conditions and new work plans for use in the calculation of heating, ventilation, and air conditioning (HVAC) loads to be used in design and selection of systems and equipment for upgrade or replacement. Payment shall also include temporary relocation and reinstallation of HVAC and associated equipment.

2.15 Electrical – CMU Wall Removal & Modifications- LS (Bid Item 15)

Measurement for payment will constitute full compensation for installation labor, equipment and materials required to trace existing cables to be removed, demolish existing conduit and cable located on wall to be repaired , and restore electrical systems due to wall demolition and repairs. Payment shall constitute the work complete as referenced in the contract documents.

Owner witnessed factory testing (also referred to as Factory Acceptance Tests – FAT) shall be performed in accordance with industry best practice standards and the activities/parameters agreed with the Owner.

2.16 Commissioning and Testing (Bid Item 16)

Payment will constitute full compensation for the performance of the equipment being tested to the satisfaction of the Owner before commissioning and in accordance with applicable General requirements referenced in the contract documents, however no partial completion shall be given. Testing and commissioning of the combined generator sets after installation is also required to demonstrate compliance with the full range of specified outputs against the specified efficiency requirement.

2.17 Hach instrumentation equipment Installation & SCADA Connection- EA (Bid Item 17 &18)

Measurement for payment will constitute full compensation for installation labor and equipment required to install the work complete as referenced in the contract documents. Final system design and preparation of submittals and record drawings are also required. In addition, payment shall include any required project engineering, electrical design, mechanical design, drafting to perform final system design and to prepare submittals and record drawings. Payment shall also include labor for HMI software applications development and graphics design and PLC control strategy design and programming.

2.19 Hach instrumentation equipment Calibration- EA (Bid Item 19)

Measurement for payment will constitute full compensation for installation labor and equipment required to calibrate the analyzers as referenced in the contract documents. Provide installation supervision calibrations, startup, training, etc. as required by manufacturer's instructions and or specifications.

2.20 Electrical installation or terminations for Hach instrumentation equipment - EA (Bid Item 20)

Measurement for payment will constitute full compensation for the labor, equipment and materials required to furnish and install the work complete. Provide installation of conduit, wire, etc. as required by manufacturer's instructions and or specifications.

2.21 Owner's Directed Allowance – LS (Bid Item 21)

An Owner Directed Allowance has been established as the value of this item. This allowance shall be used to pay for miscellaneous work to be accomplished at the direction of the County. It shall include items of work consistent with and related to the project which are not included in the named bid items, but which may be necessary to the successful completion of the Agreement. It is expected that work under this item will be accomplished utilizing construction items established under the other sections of these specifications. All work performed under this section shall comply with the various sections of these specifications which are appropriate to the specific items involved. No work will be allowed under this section without the prior written approval of the County. This work shall be further described, by the County, in written form and/or on modifications to the drawings or on supplemental drawings. This allowance may be used to pay the costs, where the amounts are determined as specified in the General Requirements, and as directed by the County.

END OF SECTION

sections of these specifications which are appropriate to the specific items involved. No work will be allowed under this section without the prior written approval of the County. This work shall be further described, by the County, in written form and/or on modifications to the drawings or on supplemental drawings. This allowance may be used to pay the costs, where the amounts are determined as specified in the General Requirements, and as directed by the County.

END OF SECTION

SECTION 01250

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Scope: Section includes:
 - 1. Administrative and procedural requirements for selecting materials and equipment for the Project.
 - 2. Procedural requirements for substitutions of materials and equipment.
 - 3. Procedural requirements for substitute construction methods or procedures, when construction methods or procedures are specified.
- B. A proposed substitute will not be accepted for review if:
 - 1. Approval would require changes in design concept or a substantial revision of the Contract Documents.
 - 2. Approval would delay completion of the Work or the work of other contractors.
 - 3. Substitution request is indicated or implied on a Shop Drawing or other submittal, or on a request for interpretation or clarification, and is not accompanied by CONTRACTOR's formal and complete request for substitution.
- C. If proposed substitute is not approved, CONTRACTOR shall provide the specified materials, equipment, method, or procedure, as applicable.
- D. Approval of a substitute does not relieve CONTRACTOR from requirement for submitting Shop Drawings and other submittals in accordance with the Contract Documents.
- E. ENGINEER and OWNER have the right to rely upon the completeness and accuracy of the information included in CONTRACTOR's request for approval of a substitute, and CONTRACTOR accepts full responsibility for the completeness and accuracy thereof.
- F. When approved substitute is defective or fail to perform in accordance with the Contract Documents, responsibility for remedying the defect or failure resides solely with CONTRACTOR and Supplier.

1.02 SUBSTITUTE MATERIALS AND EQUIPMENT

- A. Procedure

1. Submit requests for substitution in accordance with requirements for furnishing submittals, as indicated in Section 01 33 00, Submittal Procedures.
2. Submit separate request for each proposed substitute.
3. Submit request for substitution using forms attached to this Section. Complete all information requested on each form, and enclose with the forms supplementary information as required. In addition to requirements of the General Conditions and information required on substitution request forms, include with each substitute request the following:
 - a. Identification of the materials and equipment (as applicable), including manufacturer's name and address.
 - b. Manufacturer's literature with description of the materials and equipment, performance and test data, and reference standards with which materials and equipment comply.
 - c. Samples, when appropriate.
 - d. Name and address of similar projects on which the materials and equipment were used, date of installation, and names and contact information (including telephone number) for the facility operations and maintenance manager.

1.03 SUBSTITUTE CONSTRUCTION METHODS OR PROCEDURES

- A. The provisions of the General Conditions, as may be modified by the Supplementary Conditions, regarding substitute items of materials and equipment are hereby extended to apply to substitute construction methods or procedures.
- B. Procedure:
 1. Submit requests for substitution in accordance with requirements for furnishing submittals, as indicated in Section 01 33 00, Submittal Procedures.
 2. Submit separate request for each proposed substitute.
 3. Submit request for substitution using forms attached to this Section. Complete all information requested on each form, and enclose with the forms supplementary information as required. In addition to requirements of the General Conditions and information required on substitution request forms, include with each substitute request the following:
 - a. Detailed description of proposed method or procedure.

- b. Itemized comparison of the proposed substitution with the specified method or procedure.
- c. Drawings illustrating method or procedure.
- d. Other data required by ENGINEER to establish that proposed substitution is equivalent to specified method or procedure.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 ATTACHMENTS

- A. The documents listed below, and attached following this Section's "End of Section" designation, are part of this Specification Section.
 - 1. Substitution Request Form (two pages).
 - 2. Product Substitution Checklist (one page).

END OF SECTION

SUBSTITUTION REQUEST

Project: _____ Substitution Request Number: _____

From: _____
To: _____ Date: _____

Engineer Project. No. _____
Contract For: _____
Re: _____

Specification Title: _____ Description: _____
Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitute: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 1 to 4 years old ☐ 5 to 10 years old ☐ More than 10 years old

Differences between proposed substitute and specified item: _____

☐ Point-by-point comparative data attached — REQUIRED BY THE CONTRACT DOCUMENTS

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Engineer: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

Savings to Owner for accepting substitute: _____ (\$ _____)
(attach detailed, itemized estimate) _____

Proposed substitute changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.
(clarify whether change is to Substantial Completion, Milestone, or time for readiness for final payment) _____

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

SUBSTITUTION REQUEST

(Continued)

☐ Substitute product, method, or procedure is subject to payment of licensing fee or royalty (check if "yes" and attach information)

☐ Substitute product, method, or procedure is patented or copyrighted (check if "yes" and attach information)

The undersigned certifies:

- Representations in the General Conditions and in Section 01 25 00, Substitution Procedures, regarding substitutions are valid.
 - Same or better warranty and guarantee will be furnished for proposed substitution as for specified item.
 - Same maintenance service and source of replacement parts, as applicable, is available.
 - Proposed substitute will have no adverse effect on other trades and will not affect or delay Progress Schedule.
 - Cost data as stated above is complete. Claims for additional costs or time related to accepted substitution which may subsequently become apparent are waived.
 - Proposed substitute does not affect dimensions and functional clearances.
 - Payment will be made for Engineer's review and changes, if any, to the design and Contract Documents, and construction costs caused by the substitute.
 - Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.
-

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: ☐

ENGINEER'S REVIEW AND ACCEPTANCE (OR NON-ACCEPTANCE) WILL BE DOCUMENTED IN A FIELD ORDER OR CHANGE ORDER, AS APPROPRIATE.

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ Engineer
☐ Other:

PRODUCT SUBSTITUTION CHECKLIST

Re: _____

Date: _____

Engineer Proj No.: _____ Manufacturer's Project No.: _____

Filing No.: _____ Contract For: _____

Item Equivalence:

- ☐ Is the submitted item equivalent to the specified item? _____
- ☐ Does it serve the same function? _____
- ☐ Does it have the same dimensions? _____
- ☐ Does it have the same appearance? _____
- ☐ Will it last as long? _____
- ☐ Does it comply with the same codes, and standards and performance requirements? _____
- ☐ Has the item been used locally, and where are the projects? _____

- ☐ Has a problem occurred with the item, and what was the remedy? _____

Effect on the Project:

- ☐ Will the substitute affect other aspects of the construction? _____
- ☐ Are any details affected and are changes required? _____
- ☐ What is the cost of the changes? _____
- ☐ Who pays for the required changes? _____
- ☐ Are Contract Times affected? _____

Effect on the Warranty:

- ☐ How does the proposed warranty differ from the specified warranty? _____

- ☐ Does the manufacturer have a track record of standing behind the warranty? _____

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Preparing and processing of submittals for review and action.
 - 2. Preparing and processing of informational submittals.
- B. Submit the following for the County's review and action:
 - 1. Shop drawings
 - 2. Product data
 - 3. Samples
 - 4. Submittals indicated as "for approval"
- C. Submit the following as informational submittals:
 - 1. Structural design information required by the contract documents
 - 2. Certificates
 - 3. Coordination drawings
 - 4. Reports
 - 5. Qualification statements for manufacturers/installers
 - 6. Submittals indicated as "for information only"
- D. Specific submittals are described in individual sections.
- E. Do not commence Work that requires review of any submittals until receipt of returned submittals with an acceptable action.
- F. Do not allow submittals without an acceptable action marking to be used for the project.
- G. Submittals shall be submitted to the County using the County's Document Tracking and Control System (DTCS) as outlined in Section 01350 – Project Document Tracking and Control System. No email submittals shall be allowed for approval. One copy of each submittal shall be uploaded by the Contractor into the software program named by the County. The County may determine that certain submittals also shall be submitted in hard copy form.

1.02 DEFINITIONS

- A. "Shop drawings" are drawings and other data prepared by the entity that is to do the Work, specifically to show a portion of the Work.
- B. "Product data submittals" are standard printed data that show or otherwise describe a product or system, or some other portion of the Work.
- C. "Samples" are actual examples of the products or Work to be installed.
- D. "Informational submittals" are those identified in the Contract Documents as for information only.

1.03 FORM OF SUBMITTALS

- A. Submittals shall be uploaded to the County's DTCS in PDF format unless otherwise specified by the County.
- B. If the County requests a submittal in hard copy, then the following formats apply:
 - 1. Sheets larger than 8-1/2 by 14 Inches:
 - a. Maximum sheet size: 24 by 36 inches (except for full-size pattern or template drawings).
 - b. Number of copies:
 - 1) Submittals for review: Three blue or blackline prints
 - 2) Informational submittals: Three blue or blackline prints
 - 2. Small sheets or pages:
 - a. Minimum sheet size: 8-1/2 by 11 inches
 - b. Maximum sheet size for opaque copies: 11 by 17 inches
 - c. Number of copies shall be the same as for larger sheets
 - 3. Samples:
 - a. Two sets of each shall be submitted with the original submittal.
 - b. One set shall be returned.
 - c. If additional sets are needed by other entities involved in Work represented by the samples, these shall be submitted with original submittal.

1.04 COORDINATION OF SUBMITTALS

Coordinate submittals and activities that shall be performed in sequence or of different types for the same product or system so that the County has enough information to properly review each submittal.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 TIMING OF SUBMITTALS

- A. Transmit each submittal at the time indicated on the approved construction schedule.
- B. Deliver each submittal requiring approval in time to allow for adequate review and processing time, including resubmittals if necessary; failure of the Contractor in this respect shall not be considered as grounds for an extension of the contract time.
- C. Deliver each informational submittal prior to start of the Work involved, unless the submittal is of a type that cannot be prepared until after completion of the Work; submit promptly.
- D. If a submittal must be processed within a certain time in order to maintain the progress of the Work, state so clearly on the submittal.
- E. If a submittal must be delayed for coordination with other submittals not yet submitted, the County may, at its option, either return the submittal with no action or notify the Contractor of the other submittals that shall be received before the submittal can be reviewed.

3.02 SUBMITTAL PROCEDURES - GENERAL

- A. Contractor review: Sign each copy of each submittal certifying compliance with the requirements of the contract documents.
- B. Notify the County, in writing and at time of submittal, of points upon which the submittal does not conform to the requirements of the contract documents, if any.
- C. Preparation of submittals:
 - 1. Label each copy of each submittal with the following information:
 - a. Project name.
 - b. Date of submittal
 - c. Contractor's name and address
 - d. Supplier's name and address
 - e. Manufacturer's name
 - f. Specification section where the submittal is specified
 - g. Numbers of applicable drawings and details
 - h. Other necessary identifying information

2. Submittals to receive County's action marking: Provide blank space on the label or on the submittal itself for action marking: minimum 4 inches wide by 5 inches high.
- D. Transmittal of submittals:
1. Submittals shall be accepted from the Contractor only.
 2. Submittals received without a transmittal form shall be returned without review or action.
 3. Transmittal form: The Contractor shall use a form acceptable to the County, with space provided on the form for:
 - a. Project name
 - b. Submittal date
 - c. Transmittal number
 - d. Specification section number
 - e. To:
 - f. From:
 - g. Contractor's name
 - h. Subcontractor's and supplier's names
 - i. Manufacturer's name
 - j. Submittal type (shop drawing, product data, sample, informational submittal)
 - k. Description of submittal
 - l. Action marking
 - m. Comments
 4. The Contractor shall complete a separate transmittal form for each submittal, also including the following:
 - a. Other relevant information
 - b. Requests for additional information

3.03 SHOP DRAWINGS

- A. Content: Include the following information:
1. Dimensions, at accurate scale
 2. All field measurements that have been taken, at accurate scale
 3. Names of specific products and materials used

4. Details, identified by contract document sheet and detail numbers
 5. Compliance with the specific standards referenced
 6. Coordination requirements, including the relationship to adjacent or critical Work
 7. Name of preparing firm
 8. Design calculations
- B. Preparation:
1. Reproductions of contract documents are not acceptable as shop drawings.
 2. Copies of standard printed documents are not acceptable as shop drawings.
 3. Documents shall be identified as indicated for submittals.
 4. Space for County's action marking shall be adjacent to the title block.

3.04 PRODUCT DATA

- A. Submit product data submittals for each system or unit of Work as one submittal.
- B. When product data submittals are prepared specifically for this Project (in the absence of standard printed information), submit such information as shop drawings, and not as product data submittals.
- C. Content:
1. Submit manufacturer's standard printed data sheets.
 2. Identify the particular product being submitted; submit only pertinent pages.
 3. Show compliance with properties specified.
 4. Identify which options and accessories are applicable.
 5. Include recommendations for application and use.
 6. Show compliance with the specific standards referenced.
 7. Show compliance with specified testing agency listings; show the limitations of their labels or seals, if any.
 8. Identify dimensions, which have been verified by field measurement.
 9. Show special coordination requirements for the product.

3.05 SAMPLES

- A. Samples:

1. Provide samples that are the same as the proposed product.
 2. Where selection is required, provide the full set of options.
- B. Preparation:
1. Attach a description to each sample.
 2. Attach name of manufacturer or source to each sample.
 3. Where compliance with specified properties is required, attach documentation showing compliance.
 4. Where there are limitations in availability, deliveries, or other similar characteristics, attach descriptions of such limitations.
 5. Where selection is required, the first submittal may be a single set of options; after return of submittal with selection indicated, submit standard number of sets of selected item.
- C. Keep final sample set(s) at the Project Site, available for use during progress of the Work.

3.06 REVIEW OF SUBMITTALS

- A. Submittals for approval shall be reviewed, marked with appropriate action, and returned. Submittals are reviewed for conformance with project design concept and for compliance with standard of quality established in the Contract Documents. This review shall not relieve the Contractor from responsibilities for correctness of detail and dimension, nor from deviation from Contract Document requirements, except as noted and accepted in writing by the County at the time of submittal.
- B. Informational submittals shall be reviewed.
- C. Action markings for submittals for approval shall be as follows:
1. NO EXCEPTIONS TAKEN (NET): Indicate that the submitted item is released for manufacture
 2. MAKE CORRECTIONS NOTED (MCN): Indicate that the submitted item is released for manufacture with the submittal complying with the comments
 3. AMEND AND RESUBMIT (AAR): Indicates that the submittal shall be revised or a new submittal complying with the comments made shall be prepared.
 4. REJECTED (REJ): Indicates that the submitted item does not comply with contract requirements and that another selection shall be made and the submittal process repeated.

5. SUBMIT SPECIFIED ITEM(s) (SSI): Indicates that the submittal shall submit specified item(s) based on the specifications or as stated by the County

3.07 RETURN, RESUBMITTAL, AND DISTRIBUTION

- A. Submittals shall be returned to the Contractor through the DTCS.
- B. The Contractor shall address resubmittals in the same manner as original submittals, with changes other than those requested by the County, clearly indicated.
 1. Exception: Transmittal number for resubmittal shall be the number of the original submittal plus a letter suffix.
 2. Resubmittals shall be submitted within 14 days of Contractor's receipt of rejected submittal.
- C. Distribution: The Contractor shall make one copy for project record documents and file in the DTCS.

END OF SECTION

SECTION 01310

CONSTRUCTION SCHEDULE

PART 1 – GENERAL

1.01 SCOPE

- A. Timely performance is of the essence on this Project. The **Contractor** may schedule its Work to complete the Project or any part of the Project earlier than is stipulated in the Contract and the milestone requirements. However, under no circumstances shall the **Contractor** be entitled to added compensation for delays that occur during the originally stipulated contract period.
- B. The **County** has purchased the **Contractor's** entire scheduled time period by virtue of this Contract and further stipulates that only those delays that meet the tests set forth in GR-6 of the General Requirements shall be considered for adjustment and only to the extent that they delay the Work past the originally contractually stipulated milestones.

1.02 PROCEDURES

- A. The Work under this Contract shall be planned, scheduled, executed, reported, and accomplished using the Precedence Diagramming Critical Path Method (CPM). The Work required by this section includes the requirement to prepare, maintain, and update the detailed schedules as described in this section. The CPM schedules shall be prepared in such a manner as to permit the orderly planning, organization, and execution of the Work and be sufficiently detailed to accurately depict all the Work required by the Contract. **Contractor** shall resource (labor, material, and equipment) and cost load its schedule as specified herein.
- B. **Contractor** hereby agrees that in the process of preparing its baseline schedule and monthly updates, it shall consult with all key subcontractors and suppliers to obtain concurrence with the feasibility and achievability of **Contractor's** planned start dates, sequencing, durations, and completion dates. A copy of the computer input files, in PRX or XER format, shall be submitted on USB flash drive(s) containing fully detailed logs with each submittal. The procedures, technical details, and **Contractor's** participation and responsibilities shall be as hereinafter described.
- C. **Contractor** is responsible for determining the sequence of activities; the time estimates for the detailed construction activities; and the means, methods, techniques and procedures to be employed. The schedules identified herein shall represent the **Contractor's** best judgment of how it shall prosecute the Work in compliance with the Contract requirements. **Contractor** shall maintain a current and accurate schedule that is properly and timely monitored, updated, and revised as Project conditions may require and as required by the Contract Documents.

- D. **Contractor's** Construction Schedule shall be prepared using the latest version of Oracle Primavera P6 Enterprise Project Portfolio Management (P6) Release 8. Any and all costs incurred by the **Contractor** in researching, training, and/or educating its personnel in CPM and/or P6 (or the utilization of outside consultants) shall be part of the **Contractor's** bid price and not reimbursed separately by the **County**
1. The Project Network Schedule Diagram, mathematical analyses, written narrative, and monthly updates will be reviewed by the **County**. Items will be reviewed for compliance with these Specifications and accurate reporting by the **Contractor** of Work in place, resource loading, and Work activity durations.
 2. The **Contractor** shall submit to the **County** an accepted final CPM construction schedule and final schedule of values, including allowance Items, allocated to the CPM schedule activities within 45 days of Notice to Proceed. Requirements for the final CPM construction and final schedule of values are further described hereinafter. **Contractor's** Application for Payment shall not be approved until the final CPM Schedule and Schedule of Values have been accepted. The Contract Baseline Schedule submittal shall not show any progress until it is accepted by the **County**

1.03 STANDARDS

- A. Definition: CPM, as required by this Section, shall comply with the standards outlined in the Associated General **Contractors'** publication, "Construction Planning and Scheduling," unless specifically changed by this Section.
- B. PM Construction Schedule: The **Contractor's** CPM Construction Schedule shall include a graphic time scaled logic network, computerized tabular reports, and resource loading as described below. To be acceptable, the schedule shall demonstrate the following:
1. A logical succession of Work from start to finish. This logical succession, when accepted, is the **Contractor's** Work plan and, contrary to normal CPM standards, is designated as early start/early finish solely to accommodate the P6 software.
 2. Clear definition of each activity including cost, manpower, equipment, and material quantities as resources. The assigned dollar value (cost loading) of each activity shall cumulatively equal the contract price.
 3. Proper interfacing of related activities including submittals, major material and equipment deliveries, procurement, required permits, and other constraints, such as equipment or manpower/crew availability. Submittal dates shall include review periods and permit schedules shall include agency review and issue dates. The narrative shall explain the rationale for all constraints, lags, and unusual relationships.

4. Agreement with the interim milestones, schedule coordination requirements, and completion dates shall be as indicated in the Contract Documents.

C. CPM Graphic Logic Network

1. The CPM graphic logic network or diagram shall be in the form of a time-scaled diagram of the customary precedence diagram and may be divided into a number of separate pages with suitable notation relating the interface points among the pages. Individual pages shall not exceed 34 inches by 44 inches. At a minimum, notation on each activity line shall include activity descriptions, total float, and durations.
2. All construction activities and procurement shall be indicated in a time-scaled format, and a calendar shall be shown on all sheets along the entire sheet length. Each activity shall be plotted so the beginning and completion dates of said activity can be determined graphically by comparison with the calendar scale. A legend shall be included to clearly distinguish between critical and non-critical path activities and progress to date.

- D. Duration: The duration indicated for each activity shall be in units of whole working days and shall represent the single best time considering the scope of the Work and resources planned for the activity including time for holidays and inclement weather. The calendar for the network shall be in calendar days. Except for certain non-labor activities, such as submittal preparation and review, curing concrete, delivering and fabrication of materials, or other activities described specifically in the Contract, activity durations shall not exceed 14 days, be less than one day, nor exceed \$50,000 in value, unless otherwise accepted by the **County**.
- E. The Interim Schedule and Contract Baseline Schedule shall show dependencies (or relationships) between each activity. Each activity shall have a successor and predecessor, except for the project start and finish milestone. The use of date constraints shall be limited to Contract milestones and Contract completion dates only, unless approved by the **County**.
- F. Contract Baseline Schedule shall contain or be able to demonstrate that the following items have been addressed: 1) the Project's name; 2) the **Contractor's** name; 3) revision or edition number; 4) activities of completed Work; e) activities relating to different areas of responsibility, such as subcontracted Work that is distinctly separated from that being done by the **Contractor** directly; 5) labor resources distinguished by craft or crew requirements; 6) equipment and material resources distinguished by equipment and material requirements; 7) distinct and identifiable subdivisions of Work, such as cleaning, pre-liner installation inspection, CIPP installation; 8) locations of Work within the contract limit lines that necessitate different times or crews to perform; 9) outage schedules for existing utility services that will be interrupted during the performance of the Work; 10) phases; and 11) interim milestones and the Contract completion dates.

- G. Computerized Tabular Reports: Reports shall include the following for each activity depicted in the schedule.
 - 1. Activity ID
 - 2. Activity description
 - 3. Duration (original and remaining)
 - 4. Early start date
 - 5. Early finish date
 - 6. Total float
 - 7. Percent complete
 - 8. Activity cost and resources
 - 9. Actual start date
 - 10. Actual finish date
- H. Project Information: Each report shall be prefaced with the following summary data:
 - 1. Project name
 - 2. **Contractor**
 - 3. Type of tabulation (initial or updated)
 - 4. Project duration
 - 5. Project scheduled completion date
 - 6. Projected completion date

1.04 ACCEPTANCE

- A. The finalized CPM Construction Schedule shall be acceptable to the **County** when it provides an orderly progression of the Work from Notice to Proceed to Final Completion in accordance with the Contract requirements, adequately defines the **Contractor's** Work plan, provides a workable arrangement for processing submittals in accordance with the requirements, and properly allocates resource values for manpower, major materials, equipment and costs to each activity (free of unbalances in resources) as determined by the **County**. Manpower may be represented as composite crews in the CPM construction schedule. The network diagram and tabular reports, when accepted by the **County**, shall constitute the CPM construction schedule until revised and re-accepted.
- B. When the CPM Construction Schedule has been accepted, the **Contractor** shall submit to the **County**:
 - 1. Three copies of the CPM graphic logic network
 - 2. Three copies of a computerized, tabular report in which activities have been sequenced by early starting date

3. Two copies of the schedule on a USB Flash Drive
 4. Three copies of the narrative
- C. The **County**'s review and acceptance of the **Contractor**'s CPM Construction Schedule is for conformance to the requirements of the Contract Documents only. Review and acceptance by the **County** of the **Contractor**'s CPM Construction Schedule does not relieve the **Contractor** of any of its responsibility whatsoever for the accuracy or feasibility of the CPM Construction Schedule, or of the **Contractor**'s ability to meet interim milestone dates and the Contract completion date, nor does such review and acceptance expressly or impliedly warrant, acknowledge, or admit the reasonableness of the logic, durations, and resource value loading of the **Contractor**'s CPM Construction Schedule.
- D. The **Contractor** shall participate in a conference with the **County** to review the **County**'s comments on the schedule and evaluation of the proposed network diagram, mathematical analyses, and monetary value of activities. The intent is to reach a clearer understanding of the CPM and achieve consensus on any revisions to be made. Any revisions necessary as a result of this review shall be resubmitted to the **County** within 10 calendar days after the conference. The accepted schedule shall then be used by the **Contractor** for planning, organizing, and directing the Work, and for reporting progress. If the **Contractor** desires to make changes in its method of performing the Work, it shall notify the **County** in writing, stating the reason for the changes. The **Contractor** shall receive written acceptance of the change prior to putting the change into the accepted schedule.

1.05 QUALIFICATIONS

- A. The **Contractor** shall demonstrate competence in the use of CPM scheduling through the submission of a fully compliant CPM construction schedule with the initial CPM submission. In the event the **Contractor** fails to so demonstrate competence in the CPM scheduling, the **County** may direct the **Contractor** to employ the services of a scheduling firm that can demonstrate competence. The **Contractor** shall comply with such directive.
- B. The **Contractor** shall use the services of a scheduler who has verifiable training and credentials in preparing and maintaining computerized CPM Construction Schedules using P6 software as specified herein. The scheduler shall qualify within the planning period.
1. Required Experience: Performed CPM scheduling on at least two completed construction projects of value at least 75 percent as large as this one and having at least 75 percent as many schedule items as this one. Scheduling of both projects shall have been done using the latest version of P6 Release 8 or equal.
 2. Submit to the **County** the following:
 - a. Descriptions of at least two projects of the value and complexity above.
 - b. Copy of a CPM schedule from one of the previous projects.

- c. Names and telephone numbers of facility **County** representative, design engineer, and construction manager for each project.
- d. Evidence supporting the above qualifications.

1.06 SUBMITTAL REQUIREMENTS

- A. Initial submittal, revisions, and monthly updates of the network diagram, mathematical analyses, and written narrative shall be submitted in three hard copies and two data copies on a USB flash drive. Submittals shall not be accepted unless they are complete as described herein.
- B. The **Contractor** shall submit the following:
 - 1. A CPM time scaled logic network, computer generated using the latest version of P6 Release 8.
 - 2. Computerized tabular reports:
 - a. Activity sort by early start, organized by facility or area
 - b. Predecessor/successor listing
 - c. Activity code dictionary
 - d. Resource code dictionary
 - 3. Basis of schedule narrative describing the logic and reasoning of the schedule. The narrative shall summarize the overall approach to construction sequencing, including but not limited to: 1) anticipated lost days due to weather; 2) the rationale for all constraints, lags, and unusual relationships; 3) the definition of labor and crews; 4) a list and durations for all major pieces of equipment and resources; and 5) Work proposed to be performed on any other than single-shift 5-day workweek basis
 - 4. Resource value allocation by activity.
 - 5. Breakdown of specific cost amount for each component of multi-component activities in the CPM schedule in spreadsheet format (using Microsoft Excel) showing component unit quantities as well as costs. Such breakdown, when accepted by the **County**, shall constitute the schedule of values for the Project.
 - 6. USB flash drive copy of entire schedule, narrative, and spreadsheet.

PART 2 – PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 SCHEDULE ORIENTATION SESSION

- A. **Contractor** shall, upon notification from the **County**, attend a Schedule Orientation Session relating to the schedules and reports requirements for this Contract. The Schedule Orientation Session is designed to review in detail, the

objectives of the schedules and reports requirements and the requirements. **Contractor** shall arrange for its Project Manager, Superintendent, and Scheduler to attend the Schedule Orientation Session.

- B. The following items shall be discussed during the Schedule Orientation Session:
- 1) the procedures and requirements for the preparation of the Contract Baseline Schedule, and monthly updates by **Contractor**; b) how the requirements of the Contract Documents will be monitored and enforced by the **County**; c) how long-lead items and time requirements for the Work by subcontractors shall be identified and included in the Contract Baseline Schedule; d) testing and startup; e) coding and logic for the Contract Baseline Schedule; and f) identification and scheduling of shop drawings and other submittals.

3.02 SCHEDULE OF VALUES

A. Submittals

1. **Contractor** shall allocate a dollar value for each activity on the Contract Baseline Schedule. The dollar value for the activity shall be the cost of the Work, including labor, materials, and equipment. Allowances shall be loaded on activities specifically included for this purpose. No activity on the Contract Baseline Schedule shall exceed a value of \$50,000, unless approved by the **County**. The sum of all activity costs shall equal the Contract Price. **Contractor** shall revise the resource and value loading as necessary to gain the acceptance of the **County**
2. The final schedule of values shall incorporate all comments associated with the **Contractor's** schedule/schedule of values submittals.
3. Submit documentation to support the values with data that shall substantiate their correctness, as requested by the **County**.
4. The schedule of values, when accepted by the **County**, shall be used as the only basis for the **Contractor's** applications for payment. The total price paid for mobilization shall be as approved by the **County**, but in no case shall it exceed 4 percent of the total Part I and Part 2 bid amount.
5. The schedule of values shall be derived from the assigned progress schedule activity values and identified by activity ID.

B. Form and content of Schedule of Values

1. Identify the schedule of values submittal with:
 - a. Title of Contract and location
 - b. Contract Number
 - c. Name and address of **Contractor**
 - d. Date of submission
2. The **Contractor's** Schedule of Values shall list the installed value of the component parts of the Work in sufficient detail to serve as the basis for computing values for progress payments during construction.

3. Identify accounts with the location code and area code as defined in the P6 Release 8 format and list the number and title of the respective major Section of the Specifications.
4. All accounts in the Schedule of Values shall be derived from the activities in the progress schedule. Account data pertaining to the Schedule of Values shall, at a minimum, include the following for each account:
 - a. CPM Activity number
 - b. **County's** Standard Code listed on the Bid Schedule
 - c. Account representative quantities (linear feet of CIPP, linear feet of cleaning, tons of debris, etc.), unit costs, person-hours, item and account dollar value
 - d. WBS code (as used by Primavera Project Planner scheduling software), including location, responsibility and area codes.
 - e. Specification Section Number
 - f. Account Type: Lump Sum (LS), Unit Price (UP), Allowance (AL), or Change Order (CO)
- C. Unit Price Accounts (UP): Payment for Unit Price Accounts shall be based upon actual quantities of Work performed in compliance with the Contract Documents, as verified and accepted by the **County**. Whenever the actual quantity differs from the estimated quantity on the Unit Price Accounts, the **Contractor** shall notify the **County** in writing. Quantity over- and under-runs shall be tracked on the Schedule of Values.
- D. Allowance Accounts (AL): Payment for Allowance Accounts shall be based upon invoices submitted by the **Contractor** subject to conditions and limitations of the Contract Documents. Refer to Section 01210 - Measurement, and Payment, for requirements. The Allowance shall be adjusted to the actual amount paid for such services, and adjusted by CO, either at the end of that phase of the Work or at the completion of the Work. The **County** shall have sole discretion on determining when to make adjustments to the Allowance.
- E. A new account will be added to the Schedule of Values for approved CO work. Payment for Time and Expense CO work shall be based upon the General and Supplementary Conditions of these Specifications.
- F. The sum of all Account Values listed in the Schedule of Values shall equal the total Contract Price, excluding allowance Items.

3.03 MONTHLY APPLICATION FOR PAYMENT

- A. Monthly Application for Payment: **Contractor** shall provide monthly Schedule Update, monthly Payment Report, and monthly Narrative Report as its monthly Application for Payment package.
- B. Monthly Schedule Update: The **Contractor** shall submit, at intervals of 30 calendar days, an update of all activities in the as-planned CPM schedule.

Update shall be created by updating the mathematical analyses and the corresponding computerized network diagram of the Schedule.

1. The schedule shall be updated by entering the following: Actual start and completion dates of completed activities and the actual start date and remaining duration of activities in progress.
 2. The updated network diagram shall be submitted in the same format as noted in Section 1.02 - Procedures, with the calendar starting from the date of the update.
 3. The updated mathematical analysis shall be submitted in the same format noted in Section 1.02 - Procedures.
 4. The schedule update shall include an update of the cash flow projections in the same format as the original approved submittal.
 5. The schedule update shall state the percentage of the Work actually completed and scheduled as of the report date.
- C. The Monthly Payment Report shall show the activities or portions of activities completed during the reporting period, their total monetary values and the monetary values earned as a basis for the **Contractor's** Application for Payment. A mutually agreed upon percent complete shall be assigned to each completed and partially completed activity to be used for calculating the monetary value earned to date. For activities underway, the percent complete shall not be related to the remaining duration.
- D. A monthly narrative report shall be submitted, including, but not limited to, the following:
1. Description of Work accomplished.
 2. Summary of safety and quality issues occurring during the month and corrective actions taken.
 3. **Contractor** evaluation of actual progress versus progress planned.
 4. If the project is behind schedule, progress along all paths with negative float, along with the reasons for the delay.
 5. A description of all revisions made to the schedule, including: all accepted added, deleted, and revised activities; all logic revisions; and all duration revisions.
 6. A description of the problem areas, current and anticipated delaying factors and their impact, and an explanation of corrective actions taken or proposed.
- E. If the **Contractor** fails to submit any of the required components of the Application for Payment, the **County** shall withhold approval of the Application for Payment until such time as the **Contractor** submits the required components.

3.04 PROGRESS MEETINGS AND LOOK-AHEAD SCHEDULES

- A. For the weekly progress meetings, the **Contractor** shall submit a Look-Ahead Schedule. This schedule shall cover 4 weeks: the immediate past week, the current week, and the forthcoming 2 weeks. This schedule shall include all activities that are complete, started, are incomplete or underway, or scheduled to be worked during this 4-week timeframe. This schedule shall list all activities from the accepted CPM construction schedule that are complete, are scheduled for Work during the period, are currently planned to be worked, even if out of sequence, and Work that is unfinished but scheduled to be finished. Actual start and completion dates shall be provided for the Work that has been completed the prior week; forecast start and finish dates shall be provided for the Work that is in process or upcoming.
- B. The **Contractor** shall review the Project Schedule and progress of Work and comparison with the latest approved baseline schedule. This shall include an analysis of Work accomplished since previous meeting, offsite fabrication status and issues, material delivery status and issues, actual and potential schedule slippage, problems arising from proposed changes, and other factors that might affect the Work
- C. Each activity noted above shall be identified by activity number corresponding to the accepted CPM Construction Schedule and detailed description of the activity.
- D. The Look-Ahead Schedule shall be delivered to the **County** 24 hours prior to the weekly progress meeting.
- E. The Look-Ahead Schedule shall be in a format approved by the **County**.
- F. Tabular reports for manpower and equipment resources shall be provided for and with each Look-Ahead Schedule.

3.05 CPM CONSTRUCTION SCHEDULE REVISIONS

- A. The **County** may direct and, if so directed, the **Contractor** shall propose, revisions to the CPM construction schedule upon occurrence of any of the following instances:
 - 1. The actual physical progress of the Work falls more than 5 percent behind the accepted CPM Construction Schedule, as demonstrated by comparison to the accepted monthly CPM Construction Schedule updates or as determined by the **County** if a current accepted CPM Construction Schedule does not exist.
 - 2. The **County** considers milestone or completion dates to be in jeopardy because of "activities behind schedule." "Activities behind schedule" are those that have not or cannot be started or completed by the dates shown in the CPM Construction Schedule, regardless of the existence of positive float on the activity.
 - 3. A CO has been issued that changes, adds, or deletes scheduled activities, or that affects the time for completion of scheduled activities.

- B. When instances requiring revision to the CPM construction schedule occur, the **Contractor** shall submit the proposed revised CPM Construction Schedule within 10 working days after receiving direction from the **County** to provide such schedule. No additional payment shall be made to the **Contractor** for preparation and submittal of proposed revised CPM Construction Schedules. However, if the **County** accepts the proposed revised CPM Construction Schedule, it shall replace and supersede all previous CPM Construction Schedules and substitute for the next monthly CPM Construction Schedule update that would otherwise be required.
- C. Revisions to the CPM Construction Schedule shall comply with all of the same requirements applicable to the original schedule.

3.06 SCHEDULE RECOVERY

- A. If a revised CPM Construction Schedule accepted by the **County** requires the **Contractor** to employ additional manpower, equipment, hours of Work or Work shifts, or to accelerate procurement of materials or equipment, or any combination thereof, as schedule recovery measures to meet Contract milestones, the **Contractor** shall implement such schedule recovery measures without additional charge to the **County**.
- B. Furthermore, if efforts to recover are not deemed effective as determined by the **County**, or if prior to submittal of the recovery schedule, the **County** determines that critical milestones are in jeopardy, the **County** may direct the **Contractor** to implement the above or any other recovery efforts at no additional costs to the **County**.

3.07 TIME IMPACT ANALYSIS REQUIREMENT

- A. When the **Contractor** experiences delays and a time extension is requested, the **Contractor** shall submit to the **County** a written Time Impact Analysis illustrating the influence of all changes or all delays on the current Project completion date. The time impact analysis shall be constructed on an As-Built Schedule Analysis approach. The As-Built Schedule that is created shall incorporate all actual start and finish dates, actual durations of activities, and actual sequences of construction (referred to as the As-Built Logic) current as of the time the Time Impact Analysis is performed. This Time Impact Analysis shall incorporate all delays (including **County**, **Contractor**, and third party delays without exception) in the timeframe that they actually occurred with actual logic ties.

The As-Built Schedule data shall be obtained from the most recent approved monthly schedule update. The As-Built Schedule shall be created as an early start schedule with the actual start and finish dates coinciding with the early start and finish dates from the most recent approved monthly schedule update. The As-Built Schedule shall show the original activity durations equal to the actual duration and the actual logic driving all activities. The **County** shall validate this As-Built Schedule. All requests for time extension shall be based upon an analysis of this As-Built Schedule. The critical path shall be established and all **County**-caused delays on the critical path shall be identified. The time extension

shall be based solely upon the cumulative duration of all **County** and third-party-caused delays that are on the critical path. Any time extensions to the project's Interim Milestone Dates, if any, shall be non-compensable time extensions only.

- B. Each Time Impact Analysis shall demonstrate the estimated time impact based on the events of delay, the status of construction at that point in time, and the event time computation of all activities affected by the change or delay. The event times used in the analysis shall be those included in the latest approved update of the project schedule, in effect at the time the change or delay was encountered.

END OF SECTION

SECTION 01350

PROJECT DOCUMENT TRACKING AND CONTROL SYSTEM

PART 1 - GENERAL

1.01 SCOPE

- A. The **Contractor** shall utilize the **County's** Project Document Tracking and Control System (DTCS). The primary function of the system is to facilitate timely processing and approval of contract documentation in coordination with the overall Project Schedule established by these Specifications and the **Contractor**. The **Contractor** shall utilize this system for document tracking and control. The software will:
1. Facilitate communication between the **County** and **Contractor**.
 2. Support turnaround time with regard to responses and approvals.
 3. Provide a central location for Project information to support Project participants in performing their tasks based on the latest Project data.
 4. Provide a standard system of project administration with accountability.
- B. The **Contractor** shall utilize the web-based system that resides on the DWM server to generate documents in the proper format for submission to the **County**. The **Contractor** shall access the system using a compatible web browser from the **Contractor's** administrative field office location, and/or other locations where Work associated with the Project is being performed.
- C. The **Contractor** shall be required to generate Project documents and records utilizing the aforementioned system. The **Contractor** shall be required to transmit and submit the Project documents within the system to the **County**.
- D. The **Contractor** shall utilize a high-capacity scanner capable of scanning 24 x 36 documents, double-sided, onsite for the entire duration of the Project. Documents shall be scanned in and attached to the appropriate Contract Manager document, including submittals, shop drawings, operations & maintenance manuals, and other documents requested by the **County**.
- E. The **Contractor** shall utilize the document control system to create and maintain Project documents, including, but not limited to the following:
1. Company Directory: Addresses, Phone Numbers, Personnel Contacts, etc.
 2. Drawings Log: Current Drawing revision log
 3. Submittals Integrated with Project Schedule through Activity codes
 4. Transmittals
 5. Risk Register

6. Requests for Information (RFIs)
 7. Requests for Proposal (RFPs)
 8. Work Authorization Requests (WARs)
 9. Work Authorizations (WAs)
 10. Change Order Requests (CORs)
 11. Change Orders (COs)
 12. Daily Reports (Daily Diaries)
 13. Field Decisions, Field Orders (FOs), and Clarification Memos
 14. Notice of Non-Compliance
 15. Construction issue memos
 16. Punch lists
 17. Meeting Minutes and agendas
 18. Correspondence
 19. Work Plans
 20. Startup Plans
 21. Equipment Operations & Maintenance training
 22. Spare parts lists
- F. The **Contractor** shall utilize the complete capabilities of the DTCS to meet the requirements of this Section. The **Contractor** shall provide a highly trained and experienced construction project controls person knowledgeable in construction Work sequencing, productivity, scheduling, and application of the Primavera P6 software system. This person, along with the **Contractor's** management team, shall work closely with the **County** to deliver the documents outlined in this Section.
- G. Software Support: The **Contractor** shall be required to establish an internet connection using DSL or better to connect to the DTCS to permit the forwarding and receipt of documents.
- H. The **Contractor** shall meet with the **County** within 15 days after the Contract is awarded to discuss access requirements and the **Contractor's** plan to utilize DTCS and execute the document control functions herein.
- I. Access through the internet to the DTCS shall be operational within 30 days following the pre-construction meeting date. This shall be operational from the **Contractor's** administrative field office location.

1.02 COMPANY DIRECTORY

The **Contractor** and the **County** shall monitor and manage the Company Directory. The directory shall include Company name, Company abbreviation, contact names, address, phone numbers, and e-mail addresses.

1.03 DRAWING LOG

The **County** will maintain a log of initial "issued for construction" drawings in the DTCS. Information shall include drawing number, title and revision number. In addition to logging the initial project drawing list, the **County** will maintain a log on the DTCS of subsequent revisions to these drawings and any sketches resulting from clarification memos, RFPs, WARs, WAs, RFIs, Field Orders, and Change Orders (COs). It shall be the **Contractor's** responsibility to utilize the latest drawings and sketches in the performance of the Work.

1.04 SUBMITTALS/SHOP DRAWINGS

- A. Requirements: This section specifies supplemental requirements to GR-24 and **Section 01300 - Submittals**, related to the processing of submittals and shop drawings. The Contractor shall utilize the DTCS to log and track submittals, as well as generate associated transmittal letters.
- B. Submittals and Product Data: A list of required submittals shall be entered into the DTCS by the Contractor. Submittals shall be incorporated into packages, with numbering as follows: XXXXX-YYY, where X denotes the applicable specification section and Y denotes the individual submittal number for that particular specification section, beginning with 001. The Contractor shall log and track submittals utilizing the DTCS. Each review cycle shall be entered into the DTCS. The Contractor shall identify as activities in the CPM schedule, to include data submittals, as well as those involving complex reviews and long lead deliveries, and procurement items required for construction activities. Submittal schedule information shall be updated monthly with the Contractor's updated project CPM schedule.
- C. Samples: A list of required sample submittals shall be entered into the DTCS by the Contractor. Sample submittals shall be identified as individual submittals within the submittal packages, with numbering as specified above.
- D. Guarantees/Warranties: A list of required Guarantee/Warranty submittals shall be entered into the DTCS by the Contractor. These submittals shall be identified as individual submittals within the submittal packages with numbering as specified above.
- E. Work Plans, Startup Plans, O&M Submittals, and Spare Parts: Testing, Startup, and O&M submittals shall be entered into the DTCS by the Contractor. These submittals shall be identified as individual submittals within the submittal packages identified with numbering as specified above.
- F. Submittal Procedures: The Contractor shall prepare submittal packages utilizing the submittal numbering system, description, and packaging conventions

described above. Submittals prepared by the Contractor that fail to follow the conventions described above, will be returned "amend and resubmit." Should the Contractor determine that a submittal is required and is not covered by the listing within the DTCS, the Contractor shall consult with the County to determine the submittal number, description, and packaging that shall be required.

1.05 CORRESPONDENCE

The **County** shall monitor and manage the correspondence, Non-Compliance Notices, Field Decisions and Clarification Memos, and Construction Issue Memo logs. The **Contractor** shall generate Project correspondence within the DTCS, and forward the correspondence to the **County**.

1.06 TRANSMITTAL LOG

The **Contractor** and the **County** will monitor and manage the transmittal log. Project transmittals shall be created electronically, automatically sequentially numbered, and logged into the DTCS system as they are created. The **Contractor** shall utilize the system to create transmittals for items transmitted to the **County**, Resident Inspection Staff, and other contractors.

1.07 RISK MANAGEMENT PLAN AND RISK REGISTER

Contractor shall provide a detailed and specific description of their approach to the management of risks associated with the Project, including permitting, design, construction, and testing and the **County's** operation and maintenance of the Project. Such risks shall include those allocated under the Contract to the County as well as those allocated to the **Contractor**.

Contractor is to develop and maintain a Risk Management Plan that can be used by the **County** to understand and evaluate the **Contractor's** understanding of the biggest risks and challenges to the Project, and how it intends to mitigate such risks. The **Contractor** shall provide sufficient information to enable the **County** to understand this evaluation. The Risk Management Plan shall include:

- A. A detailed risk register that identifies Project risk, the likelihood of such risk manifesting itself on the Project, the severity of such risk and a mitigation plan for such risk.
- B. An identification of and elaboration upon features of the **Contractor's** Design (if Design-Build type delivery) and Construction Plan that the **Contractor** considers unique and/or innovative relative to reducing or eliminating Project risk.

The **Contractor, County and Construction Manager** will review the Risk Register during the Project's progress meetings. The **Contractor** shall update the project Risk Register and provide these updates to the project team through the DTCS system on a monthly basis.

1.08 REQUESTS FOR INFORMATION & ANSWERS

The **Contractor** shall be responsible for generating RFIs on the DTCS system. The **Contractor** shall notify the **County** when an RFI is submitted. The **County** will monitor

and manage the RFI log. The **County** will generate an Answer document in response to each RFI and forward them to the **Contractor**. The DTCS shall track "Ball in Court" for RFIs and Answers, as well as date of original generation and response date. In addition, the RFIs shall reference the relative Specification Section and Drawings. The DTCS shall identify the date of the request and the originator, responsible party for a response and the date of the response.

1.09 CHANGE DOCUMENTS

Change documents include Request for Proposals (RFPs), Work Authorization Requests (WARs), Work Authorizations (WAs), Change Orders Requests (CORs), and Change Orders (COs). Change documents will be monitored and managed by the **County** utilizing the DTCS. The DTCS shall track "Ball in Court" status of change documents.

1.10 DAILY REPORTS

The **Contractor** is responsible for creating daily reports (daily diaries) utilizing the DTCS. The **Contractor** shall enter the Daily Reports into the DTCS by 10:00 a.m. of the subsequent day that the **Contractor** or any subcontractor performs Work. Daily reports shall be logged into the DTCS by the **Contractor**. The **Contractor** shall also provide one signed hard copy of daily reports on a weekly basis. Required information shall include the **Contractor**, Date, Day, Temperature, Precipitation, Sky, Wind, Work Activity, Equipment, Field Force, Visitors, Materials, and Scheduled Activities utilizing the Primavera schedule activity codes. Daily reports that fail to link Work activities to the active Project schedule shall not be acceptable.

1.11 PUNCH LISTS

The **County** will monitor and manage punch lists, and will create punch lists to be forwarded to the **Contractor**. The **Contractor** shall address the punch list items that have been assigned to the **Contractor** and forward updates to the **County**. Once accepted as complete, the **County** will access the punch list in the DTCS and close it out.

1.12 MEETING MINUTES AND AGENDA

The **County** will monitor and manage the meeting minute process. The **County** will forward meeting minutes to the **Contractor** electronically. The **County** will log the meeting minute items into the DTCS within 3 days of the meeting date.

1.13 PROGRESS PAYMENTS /REQUISITIONS FOR PAYMENT

The **Contractor** is responsible for creating progress payment applications directly from the project scheduling software and then forwarding them to the **County** electronically, along with hard copies, by 4:00 p.m. at the end of each update/billing period. The **Contractor** shall also simultaneously provide a separate submittal of the updated progress schedule (P6 or latest version at the time of purchase), as specified in **Section 01 31 00 - Construction Schedule**, Schedule of values shall be developed as defined in **Section 01 31 00 - Construction Schedule** within the Pay Application and shall be coordinated with the **County's** Project Manager. Maintenance of the "As-Built" record documents by the **Contractor** shall be verified before processing shall be approved.

Failure of a **Contractor** to maintain project record documents, maintain current and properly prepared daily reports, or submit the project schedule update per **Section 01 31 00 - Construction Schedule** shall be just cause for withholding the monthly or final payment.

END OF SECTION

SECTION 01380

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

The **Contractor** shall clearly document site conditions along the entire project site prior to the start and upon the completion of the project/contract by use of digital video recording. The cost of the photographic documentation shall be included in the Contract Price.

The **Contractor** shall submit monthly color progress photos along the entire line of the active Work site. Monthly record progress photographs shall be submitted with monthly payment requisition. Photographs shall document construction within roadways, rights-of-way, and easements.

The **Contractor** shall engage the services of an experienced professional photographer, approved by the **County**, to take videos, color photographs of the site as directed by the **County**.

1.02 PROCEDURES

- A. The digital video recording and periodic still photographs shall be taken from identifiable reference points along the Work corridor. The same reference points shall be used through the life of the project/contract to achieve an accurate record of construction.
- B. The **Contractor** shall adequately document areas of sensitivity such as landscaped areas, lake or stream banks, or areas surrounding existing structures.
- C. Each photograph, video, or digital file of such submitted shall be dated, identified, and captioned, referencing the location, project name, project number, and pertinent information to clearly describe the scene.
- D. Recording shall be done with adequate lighting. Written authorization by the **County** to proceed with video documentation at any areas shall be done with consideration of existing environmental conditions. The designee of the **County** will accompany the photographer during the video and photo sessions.
- E. **Contractor** shall notify **County** of the time and place for video recording and digital photography. **Contractor** shall provide access and accommodation to the **County** representative during the photographic documentation process. The **County** reserves the right to reject any photograph that is not clear or definitive. Any

photograph so rejected shall be subtracted from the total exposures required under this Contract.

- F. The daily construction photographs shall be the permanent visual record of the pre-construction conditions, daily construction site activities, and the completion of construction Work. The **Contractor** shall submit to the **County** no fewer than four record photos for each activity ID listed in the project schedule per the last schedule update. Applicable photos shall accompany each Pay Application.

1.03 VIDEOS

- A. The project corridor shall be documented by digital video recordings.
- B. All digital video recordings shall be in color and shot with a 1080 HD (1920 x 1080) using MPEG-4 program stream encoding (ISO-IEC 14496-14) camera and shall be a clear, stable image with no interference. Black and white recordings shall not be accepted. The video shall be provided on Digital Video Discs (DVDs) or USB Flash Drives and shall conform to currently recognized standards for video recordings. Specifically, the recordings shall be in focus and properly illuminated with good contrast. The picture shall be clear and possess accurate color levels and balance (tint) without outside interference. All recordings shall also include a clear and distortion free audio narration that clearly identifies all, important features of the project, including stationing along pipeline construction, and is in synchronization with the video. The recording shall bear a continuous "date and time stamp" that is electronically recorded by the camera.
- C. A record of the contents of each recording shall be provided on a run sheet, identifying each chapter segment of the recording. The run sheet shall be provided in paper copy as well as on the flash drive or hard drive.

1.04 PHOTOGRAPHS

- A. The file format for digital photographs shall be Tagged Image File Format (TIFF).
- B. Digital cameras shall produce records with true optical resolution. Images shall not be resized or interpolated to a higher resolution from a lower resolution.
- C. Photographic images shall be provided as 8 bit per channel RGB color images.
- D. Digital camera files shall be captured as 12 megapixel files or greater in size with a minimum pixel array of 5,000 pixels by 3,500 pixels.

- E. One set of digital images shall be furnished on a DVD. All disks shall have a label that includes project information as well as the date, and whether these are pre-construction, construction, or post-construction photographs.
- F. The information below shall be printed on a sheet of paper in a clear sleeve to be included in the binder holding the DVD+R. The information shall also be provided in a Microsoft Excel spreadsheet that shall be included on the DVD. Additionally, this information shall be embedded in each digital photo file using the IPTC/XMP (International Press Telecommunications Council's/Adobe Extensible Metadata Platform) Standard.
 - 1. Project number
 - 2. Project name
 - 3. Contract number and description
 - 4. Photo number
 - 5. View and description, indicating:
 - a. Location of camera
 - b. General description of what the photograph represents
 - 6. Whether this is a pre-construction, construction or post-construction photograph
 - 7. Date picture was taken
 - 8. Name of photographer
 - 9. County witness
- G. The **Contractor** shall transmit one electronic copy of each photo to the Engineer for use in preparing descriptions. The photos with descriptions will be returned to the **Contractor** for printing and mounting.
- H. Binders shall be equipped with a pocket suitable for storing the photo DVDs. The materials shall meet the requirements of ISO 18902:2013 "Imaging materials - Processed Imaging Materials – Albums, Framing and Storage Materials."

1.05 SUBMITTALS

- A. The **Contractor** shall furnish to the **County** for approval one copy of the video digital file taken of existing conditions prior to start of the Project and before the submittal of the first request for payment. The video digital file shall be assembled upon completion of the Project and shall be furnished to the **County** for approval prior to submittal of the final request for payment.

No pay requests shall be processed before the submittal of the respective video records.

- B. **Contractor** shall utilize **County's** Project Document Tracking and Control System to submit videos and progress photographs in electronic format for the duration of the project in accordance with **Section 01 35 00 - Project Document Tracking and Control Systems**.

PART 2 - PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 USE OF PHOTOGRAPHS AND VIDEOS

- A. Upon their creation, the photographs, prints, DVDs, and videos resulting from the Work under this Contract shall become the exclusive property of the **County**.
- B. Neither the **Contractor** nor the photographer nor the video recording firm shall retain any rights pertaining to the photographs, prints, CDs/DVDs, or videos, nor shall they reproduce or otherwise publish or disseminate any of the photographs, aerials, prints, CDs/DVDs, or videos taken under this Contract without the prior written approval of the **County**.
- C. The photographs, prints, CDs/DVDs, and videos shall be considered "Work made for hire" under applicable provisions of the Copyright Act, and the **County** shall be the copyright owner thereof and of the aspects, elements, and components thereof in which copyright protection might subsist. To the extent that such materials do not qualify as "Work made for hire," the **Contractor** hereby irrevocably transfers, assigns, and conveys exclusive copyright ownership in and to such materials to the **County**, free and clear of any liens, claims, or other encumbrances. The agreements between the **Contractor** and the photographer and videotaping firm shall include a provision containing these requirements.

END OF SECTION

SECTION 01400

CONTRACTOR'S WORK QUALITY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. **Contractor's** Quality Assurance / Quality Control Requirements
- B. Experience and Qualifications of Supply and Service Companies
- C. Quality of Materials, Equipment, and Work
- D. Defective Work, Equipment, or Materials
- E. Welding Certification and Welding Inspection
- F. **Contractor's** Surveyor
- G. Field Measurements

1.02 PAYMENT

No separate payment shall be made for performing any Work of this Section and costs thereof shall be deemed incidental to the Work and included in the prices bid for the Contract, unless otherwise specified in the Detailed Specifications.

1.03 RELATED SECTIONS

Section 01 41 00 - Testing Laboratory Services.

1.04 DESCRIPTION

- A. Experience and Qualifications of Supply and Service Companies: The **Contractor** shall require subcontractors, materialmen, and equipment service providers to comply with the accepted Health, Safety & Security Plan, and Quality Assurance requirements under the Contract.
- B. Quality of Materials, Equipment and Work
 - 1. All materials, fixtures, fittings, supplies, and equipment furnished under this Contract shall be new, of standard first grade quality, of the best workmanship, correctly designed, and be intended for the use for which they are offered. Materials or equipment that, in the opinion of the **County**, are inferior or of a lower grade than indicated, specified or required, or are obsolete, shall not be accepted.
 - 2. All Work of assembly, installation, and construction shall be done in a neat, first-class, and skillful manner. If the quality of the material, fixtures, fittings, supplies, equipment or Work required by the Drawings does not agree with that required by the Specifications, the better quality

shall be supplied. In asking for prices on, or placing orders for, materials, fixtures, fittings, supplies, and equipment intended for use or installation under this Contract, the **Contractor** shall provide the manufacturer or dealer with such complete information from these Specifications as may in any case be necessary. In every case, it shall quote in full to each such manufacturer or dealer the text of this subparagraph, as well as the text of such other portions of the Specifications, as are appropriate.

3. At all times while Work under this Contract is being performed, the **County** shall have access to all parts of the **Contractor's** or manufacturers' plants or other locations where the forgings, plates, materials, fixtures, fittings, supplies, or any other articles required under this Contract are manufactured, assembled, tested, or inspected. The **County** shall be permitted to witness any or all of these operations, as the **County** may deem necessary to determine that the Work is being performed in accordance with the Specifications and the approved shop drawings. The cost, if any, of providing such access shall be considered part of the normal expense of conducting business and therefore non-reimbursable.
4. The **County** shall be furnished with full facilities for inspecting the Work and ascertaining that it is being done strictly in accordance with the requirements of the Specifications, Drawings, and the intent of this Contract.
5. The **Contractor** shall provide a suitable space for the **County** and the **County's** authorized representatives conveniently located near that part of each plant where materials or equipment to be furnished under this Contract are being manufactured, assembled, or shop tested. Each space shall be furnished with facilities for the making and the keeping of records and correspondence. The reasonable use of a photocopier, telephone, and fax shall be provided, as required by the **County**. Long distance communications shall be made using **County** mobile telephones at no cost to the **Contractor**.
6. The **Contractor** shall give notice in writing to the **County** sufficiently in advance of its intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction in the event that the **County** intends to perform Witness Shop Testing and Quality Assurance Inspection. Such notice shall contain the date of commencement and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, the **County** will: decide upon its intent to inspect the Work or notify the **Contractor** that inspection will be waived. In those instances where the **County** inspector(s) arrive at the agreed-upon location, at the agreed-upon date and time, and find that the article(s) to be inspected are not ready for inspection, the inspector(s) shall return to

their home office and the expenses incurred shall be borne by the **Contractor** and shall be deducted from the **Contractor's** next payment, unless otherwise determined by **County**.

7. Inspection of the Work by the **County** is made solely for the benefit of the **County**. The inspection of the Work shall not relieve the **Contractor** of any of its obligations to fulfill the Contract as herein prescribed, and defective Work shall be repaired or replaced at the **Contractor's** sole expense.

C. Defective Work, Equipment, or Materials

1. All defective or imperfect Work, equipment, or materials furnished by the **Contractor** that is discovered before the Final Acceptance of the Work, or during a warranty period, shall be removed immediately even though it may have been overlooked by the **County** and approved for payment. The **Contractor** shall repair such defect, without compensation, in a manner satisfactory to the **County**.
2. Unsuitable materials and equipment shall be rejected, notwithstanding that such defective Work, materials, and equipment may have been previously overlooked by the **County** and accepted or approved for payment.
3. If any workmanship, materials, or equipment are rejected by the **County** as unsuitable or not in conformity with the Specifications or Drawings, the **Contractor** shall promptly replace such materials and equipment with acceptable materials and equipment at no additional cost to the **County**. Equipment or materials rejected by the **County** shall be tagged as such and shall be immediately removed from the site.
4. The **County** may order tests of imperfect or damaged Work equipment, or materials to determine the required functional capability for possible acceptance, if there is no other reason for rejection. The cost of such tests shall be borne by the **Contractor**, and the nature, tester, extent, and supervision of the tests shall be as determined by the **County**. If the results of the tests indicate that the required functional capability of the Work, equipment, or material was not impaired, the Work, equipment, or materials may be deemed acceptable, in the discretion of the **County**. If the results of such tests reveal that the required functional capability of the questionable Work, equipment, or materials has been impaired, then such Work, equipment, or materials shall be deemed imperfect and shall be replaced. The **Contractor** may elect to replace the imperfect Work, equipment, or material instead of performing the tests.
5. If, in the making of any test, it is ascertained by the **County** that the material or equipment does not comply with the Contract, the **Contractor** will be notified thereof, and it will be directed to refrain from delivering said material or equipment, or to promptly remove it from the site or from the

Work and replace it with acceptable material without cost to the **County**. Upon rejection of any material or equipment submitted as the equivalent of that specifically named in the Contract, the **Contractor** shall immediately proceed to furnish the named material or equipment.

D. Welding Certification and Welding Inspection

1. For Work performed within the limits of the **County**, field welding required under this Contract shall be performed by certified welders:
 - a. Certification for Welding – For field and shop welding, the following welding qualification provisions shall apply:
 - i. For field welding, required permits and safety plans shall be in place and adhered to.
 - ii. For shop welding: welding shall be performed in accordance with the relevant Work-specific requirements in the Specifications and Drawings.
 - iii. If existing certification is not approved or not submitted, then the welders/welding shop/tack welders shall be qualified in accordance with the above procedures and tests, as administered by an inspection agency approved by the **County**. The costs associated with the required tests for certification and/or retests, if any, shall be borne by the **Contractor**. The **County** shall be given a notice of not less than 5 business days prior to such tests and may elect to witness any or all of these tests. The costs associated with witnessing these tests shall be borne by the **Contractor**.
 - b. Any deviation from the above shall not be permitted without a written waiver from the **County** or its designee.
2. All welding, including welder certification, shall be performed in accordance with the requirements of AWS D1, ASME IX (and the applicable construction code), and as approved by the **County**.
3. Welding inspection shall be in accordance with the latest rules of the American Welding Society, and the following shall apply:
 - a. All welds shall be inspected visually in accordance with Section V of the ASME Code.
 - b. All stainless-steel partial penetration groove welds shall be inspected and approved by means of Liquid Penetrant Examination (PT) in accordance with Appendix 8 of Section VIII, Division 1 of the ASME Code. Welds failing the inspection shall be made good and re-inspected by PT.

- c. All carbon steel partial penetration groove welds shall be inspected and approved by means of Magnetic Particle Examination (MT) in accordance with Appendix 6 of Section VIII, Division 1, of the ASME Code. Welds failing the inspection shall be made good and re-inspected by MT.
- d. On full penetration welds, both the root pass and the final weldment shall be inspected by means of MT or PT as applicable.
- e. Unless otherwise approved, inspection of welds shall be conducted by an inspection agency approved by the **County**.
- f. Unless waived by the **County**, full-penetration welds shall be inspected by Radiographic Examination (RT) in accordance with ASME Code, Section VIII, Division I, Paragraph UW-51.
- g. The **County** may elect to witness any or all of the welding inspection. Notice shall be given to the **County** not less than 5 business days prior to welding and inspection of those items specifically designated by the **County**. The costs associated with the welding inspection by the **County** inspectors and any additional testing required by the **County** shall be borne by the **Contractor**.

E. **Contractor's Surveyor**

- 1. The **Contractor** shall retain the services of a licensed land surveyor to perform survey Work, including, but not limited to, establishing line and grade, in advance of the construction; and to perform other surveying services for the Work included under the Contract. The surveyor shall be subject to the approval of the **County**. Survey drawings shall be submitted to the **County** for approval.
- 2. The **Contractor** shall erect, install, and maintain survey platforms, targets, benchmarks, and similar facilities to be used by the **County** in the performance of its inspection services; and shall perform survey Work required before, during, and after construction.

F. **Field Measurements**

- 1. The Contractor shall take the necessary measurements in the field to determine the exact dimensions for Work and verify pertinent data and dimensions shown on the Contract Drawings

1.05 QUALITY ASSURANCE / QUALITY CONTROL PLAN

- A. The **Contractor** shall establish and execute a Quality Assurance/Quality Control (QA/QC) Plan for the services and equipment that will be supplied under this Contract. The plan shall provide the **Contractor** with adequate measures for verification and conformance to defined requirements by its personnel and

subcontractors, fabricators, suppliers, and vendors. The **County's** review and acceptance of the **Contractor's** QA/QC plan shall not relieve the **Contractor** from any of its obligations for the performance of the Work. The **Contractor's** assigned QA/QC personnel are subject to the **County's** review and continued acceptance. No Work covered by the QA/QC plan shall start until the **County's** written acceptance of the **Contractor's** QA/QC plan has been obtained.

- B. The **Contractor's** quality control organization with lines of authority and reporting structure. The Construction Quality staffing shall include a Construction Quality Manager and a supporting staff as applicable to the project. The reporting structure shall clearly provide for direct reporting access by the Construction Quality Manager to the **Contractor's** principal officers.
- C. The names, qualifications (in resume format), duties, responsibilities, and authorities of the Construction Quality Manager and staff. Construction Quality personnel qualifications (in resume form), including copies of each member's applicable certificates of training and/or qualification.
- D. A copy of a letter to the Construction Quality Manager signed by a principal officer of the **Contractor's** firm that describes the responsibilities of the Construction Quality Manager and establishes his/her authority, including authority to stop Work that does not conform with the Contract Documents. The Construction Quality Manager shall issue letters of direction to other Construction Quality staff outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the CIP PMT and CM.

1.06 SUBMITTALS

- A. Within 15 days after the commence Work date given in the Notice to Proceed (NTP), the **Contractor** shall provide its QA/QC plan to the **County** for approval. At a minimum, the plan shall consist of the following quality elements:
 - 1. Responsibilities
 - 2. Management and Production Instructions
 - 3. Material Control
 - 4. Marking and Material Identification
 - 5. Setup and Operational Procedures
 - 6. Non-Conformances
 - 7. Painting
- B. Additionally, when required by the **County**, the **Contractor** shall submit the following information prior to his entering into a supply or service subcontracts:

1. Contract number, supplies or services to be provided and a general description of the proposed item(s), such as trade name, type, etc.
2. The name and address of the manufacturer or service company and the location of the plant where supplies will be manufactured and tested as required, or at which the services will be performed.
3. Experimental and test data required to support the claimed performance of the supplies.
4. A description of the testing plant, including the hydraulic, electrical and other facilities, in sufficient detail to show that the plant is adequately equipped for performing the tests, if such testing is required.
5. All additional information that the **County** may deem necessary in order to determine the ability of the supply or service company to produce the item as called for by the Specifications.

PRODUCTS

(NOT USED)

SECTION 2 - EXECUTION

2.01 QUALITY DEFICIENCY AND NON-CONFORMANCE DOCUMENTATION

Quality Deficiencies and Non-Conformances are defined as documentation, drawings, material, and equipment or Work not conforming to the specified requirements or procedures. The **County** will implement and maintain a three-tier non-conformance process, as follows:

- A. Deficiency Notice (DN) – The lowest level of non-conformance reporting. It documents the deficient condition and provides the **Contractor** 72 hours, or before the Work is covered, to correct the issue before it is elevated to the next level of reporting. It is issued for deficiencies that can be easily corrected without an engineering resolution. An example would be incorrect formwork dimensions observed prior to placement of concrete.
- B. Non-Conformance Report (NCR) - The second level is an NCR that documents deficient Work that has not been corrected, or that would require an engineering solution to remedy. NCRs shall be answered in writing by the **Contractor** within 24 hours. The **Contractor** shall not be allowed to progress items for payment if it has open NCRs.
- C. Corrective Action Request (CAR) – The highest level of non-compliant reporting. CARs are issued for programmatic and repetitive non-compliant conditions. Examples of CARs would be using the wrong drawing revision in the field (programmatic) and a condition where the same type of Work has multiple NCR issues over a short period of time (repetitive). CARs

cannot be answered by the **Contractor** field staff. They shall be transmitted to the **Contractor's** senior level management for response.

END OF SECTION

SECTION 01410

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 SCOPE

- A. Testing shall be performed to determine that materials provided for the Work meet the specified requirements, in accordance with the requirements of the Specifications. Such testing includes, but is not necessarily limited to:
 - 1. Cement
 - 2. Aggregate
 - 3. Concrete
 - 4. Concrete block
 - 5. Pipe
 - 6. Steel and metals
 - 7. Welding
 - 8. Soil compaction
 - 9. Bituminous pavement
- B. Requirements for testing may be described in various sections of these Specifications; where no testing requirements are described, however if the **County** decides that testing is required to demonstrate compliance with specified material or performance standards, the **County** shall require testing to be performed under current pertinent standards for testing.
- C. Employment of a testing laboratory shall in no way relieve the **Contractor** of its obligation to perform Work meeting the requirements of the Contract.
- D. The independent testing laboratory shall be selected and paid by the **Contractor** and approved in writing by the **County** before any testing services are performed.
- E. The **Contractor** shall pay directly for the services of the independent testing laboratory, approved by the **County**, for all testing required under this Contract.

1.02 LABORATORY DUTIES

- A. Cooperate with **County** and **Contractor**.
- B. Provide qualified personnel promptly on notice.
- C. Perform specified inspections, sampling, and testing of materials and methods of construction.

1. Comply with specified standards, ASTM, other recognized authorities and as specified.
 2. Ascertain compliance with requirements of Contract Documents.
- D. Promptly notify the **County** and **Contractor** of irregularity or deficiency of Work that is observed during performance of services.
- E. Promptly submit three copies (two copies to **County** and one copy to **Contractor**) of report of inspections and tests in addition to those additional copies required by the **Contractor**, including:
1. Date issued
 2. Project title and number
 3. Testing laboratory name and address
 4. Name and signature of inspector
 5. Date of inspection or sampling
 6. Record of temperature and weather
 7. Date of test
 8. Identification of product and Specification section
 9. Location of Project and test
 10. Type of inspection or test
 11. Results of test
 12. Observations regarding compliance with Contract Documents
- F. Perform additional services as required.
- G. Laboratory shall not be authorized to:
1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Approve or accept any portion of Work.

1.03 CONTRACTOR RESPONSIBILITIES

- A. Cooperate with laboratory personnel; provide access to Work and/or manufacturer's requirements. Contractor shall not charge for downtime due to required testing.
- B. Provide to laboratory, preliminary representative samples, in required quantities, of materials to be tested.
- C. Furnish copies of mill test reports.

- D. Furnish required labor and facilities:
 - 1. To provide access to Work to be tested
 - 2. To obtain and handle samples at the site
 - 3. To facilitate inspections and tests
 - 4. Build or furnish a holding box for concrete cylinders or other samples as required by the laboratory
- E. Notify laboratory sufficiently in advance of operation to allow for the assignment of personnel and schedules of tests.
- F. Laboratory Tests: Where such inspection and testing are to be conducted by an independent laboratory agency, the sample or samples shall be selected by such laboratory or agency or the **County** and shipped to the laboratory by the **Contractor** at **Contractor's** expense.
- G. Copies of the correspondence between the **Contractor** and testing agencies shall be provided to the **County**.

1.04 QUALITY ASSURANCE

Testing, when required, shall be in accordance with all pertinent codes and regulations and with procedures and requirements of ASTM.

1.05 PRODUCT HANDLING

Promptly process and distribute all required copies of test reports and related instructions to insure all necessary retesting or replacement of materials with the least possible delay in progress of the Work.

1.06 FURNISHING MATERIALS

The **Contractor** shall be responsible for furnishing all materials necessary for testing.

1.07 CODE COMPLIANCE TESTING

Inspections and tests required by codes or ordinances or by a plan approval authority, and made by a legally constituted authority, shall be the responsibility of and shall be paid for by the **Contractor**, unless otherwise provided in the Contract Documents.

1.08 CONTRACTOR'S CONVENIENCE TESTING

Inspection or testing performed exclusively for the **Contractor's** convenience shall be the sole responsibility of the **Contractor**.

1.09 SCHEDULES FOR TESTING

- A. Establishing Schedule
 - 1. The **Contractor** shall, by advance discussion with the testing laboratory, determine the time required for the laboratory to perform its tests and to

issue each of its findings, and make all arrangements for the testing laboratory to be onsite to provide the required testing.

2. Provide all required time within the construction schedule.
- B. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the testing laboratory as required.

1.10 TEST AND CERTIFICATIONS

- A. General: As a minimum, the following tests shall be performed and the following certifications provided:
1. Cement: Certified test results by cement manufacturer or by independent laboratory shall be furnished as required by the **County**.
 2. Aggregate and Mortar Sand: Certified test results by aggregate producer or by independent laboratory shall be furnished as required by the **County**.
 3. Concrete
 - a. At least five standard 6-inch cylinders shall be taken each day for each 100 cubic yards or fraction thereof for each class of concrete used.
 - b. The number of cylinders, the point of sampling, and the method of securing the samples shall be determined by the **County**.
 - c. All samples shall be taken to the testing laboratory for laboratory curing.
 - d. Two of the laboratory cured samples shall be tested at 7 days, two samples tested at 28 days; one sample held in reserve.
 - e. Test all concrete in accordance with ASTM C31-69, C39-71, and C-172.
 - f. Slump Tests
 - 1) Perform slump tests on the job in accordance with ASTM standards.
 - 2) One slump test shall be performed for each 25 cubic yards of concrete.
 - 3) More slump tests shall be performed if deemed necessary by the **County**.
 - g. Perform air entrainment tests in accordance with the following standards:
 - 1) Field tests - ASTM C 173
 - 2) Laboratory tests - ASTM C 231

- B. Precast and Concrete Block for Buildings
 - 1. Block and precast may be visually inspected on the site by the **County**.
 - 2. The **County** reserves the right to have the concrete block tested by an independent laboratory.
- C. Steel and Miscellaneous Metal: Reinforcing steel, structural steel, and miscellaneous metal may be inspected visually on the site by the County.
- D. Welding: 1 percent minimum of all structural welds during construction shall be inspected either visually or by an independent laboratory as required by the County.
- E. Compaction of Earthwork
 - 1. The compaction shall be tested by an independent laboratory.
 - 2. The testing shall be performed in a manner in accordance with these Specifications.
- F. Bituminous Concrete: The material testing for the bituminous concrete shall be performed by an independent laboratory as deemed necessary by the County.

1.11 TAKING SPECIMENS

Unless otherwise provided in the Contract Documents, all specimens and samples for tests shall be taken by the testing laboratory or the **County**.

1.12 TRANSPORTING SAMPLES

The **Contractor** shall be responsible for transporting all samples, except those taken by testing laboratory personnel, to the testing laboratory.

END OF SECTION

SECTION 01513

TEMPORARY HEATING, COOLING, VENTILATING, AND ENCLOSURES

PART 1 – GENERAL

1.01 SUMMARY

A. Scope:

1. General CONTRACTOR shall provide temporary heating, cooling, ventilating, and enclosures during the Project. Provide temporary heating, cooling, ventilating, and enclosures through Final Completion of the entire Project and removal of temporary field offices and sheds.
2. Install, maintain, and remove temporary heating, cooling, ventilating, and enclosures.
3. Cost Responsibility for Fuel and Electricity for Temporary Heating, Cooling, and Ventilating:
 - a. Cost of fuel used for temporary heating, cooling, and ventilating, shall be paid by General CONTRACTOR.
4. Maintain (including cleaning and replenishment) temporary heating, cooling, and ventilating facilities and enclosures, and continuously provide consumables as required.
5. Temporary utilities and temporary facilities shall be adequate for the Site and Project requirements.
6. Provide temporary facilities and temporary utilities in compliance with Laws and Regulations and, when applicable, requirements of utility owners.

B. Each prime contractor is responsible for protecting its own work from weather and the elements.

1.02 DEFINITIONS

A. The following terms are defined for use in this Section:

1. Temporary Enclosure: Preliminary enclosure of a portion of the structure or entire building sufficient to prevent entrance or infiltration of precipitation, wind, and other elements, and prevent undue heat loss from within the enclosed area.
2. Permanent Enclosure: State of construction at which all construction elements necessary to protect the area from moisture, weather, and heat transfer have been provided in accordance with the Contract Documents, either for a portion of the building or structure or its entirety.

3. Temporary Partition: Enclosure of a portion of the building or structure sufficient to separate construction activities from Occupied Areas, including minimizing heat loss from Occupied Areas and migration of dust and moisture into Occupied Areas.
4. Occupied Areas: Areas occupied by OWNER's personnel, electronics, or storage areas used by OWNER, including offices, lunch rooms, locker rooms, toilet rooms, and rooms containing computers, microprocessors, and control equipment.

1.03 DESCRIPTION OF SYSTEM

- A. Provide temporary heating, cooling and ventilating of enclosed areas necessary to:
 1. Facilitate progress of the Work.
 2. Protect the Work and other materials and equipment from precipitation, humidity, dampness, excessive heat, and cold.
 3. Prevent condensation of moisture on the surfaces of materials and equipment.
 4. Raise and maintain temperature of ground, surfaces, materials, and equipment as required for proper execution of the Work and protection of materials and equipment.
 5. Provide suitable ambient temperatures and humidity levels for installing and curing materials and equipment.
 6. Provide adequate ventilation to comply with Laws and Regulations for safe working environments, and as required for proper installation of materials and equipment.
 7. Allow beneficial occupancy of the Work or portion thereof prior to Substantial Completion, including heating and air conditioning, when applicable.
- B. Temporary Partitions:
 1. Provide Temporary Partitions required to effectively separate Occupied Areas from construction activities.
 2. Provide Temporary Partitions required to protect Occupied Areas from noise, dust, and other hazards and nuisances associated with construction activities.
- C. Temperature Required:
 1. Except where otherwise specified, temporary heating and cooling shall maintain temperature between 50 degrees F and maximum design temperature specified by equipment manufacturer.

2. Maintain temperature of Occupied Areas between 65 degrees F and 70 degrees F with relative humidity less than 75 percent.
 3. Required temperature range for certain Work, including preparation of materials and surfaces, installation or application, and curing as applicable, shall be in accordance with the Contract Documents applicable to such elements of the Work and Supplier's recommended temperature range for the application or installation.
 4. Storage Areas: Required temperature range shall in accordance with the Contract Documents and Supplier's storage instructions for each material or equipment item, including Section 01 66 00, Product Storage and Handling Requirements.
 5. Provide Temporary Enclosures required for maintaining required temperature and humidity levels.
- D. Ventilation Required:
1. General:
 - a. Prevent accumulation in construction areas of hazardous and nuisance levels or concentrations of dust and particulates, mist, fumes and vapors, odors, and gases.
 - b. Temporary ventilation shall not exhaust to or disperse hazardous and nuisance substances into Occupied Areas or areas where construction work is in progress.
 - c. Discharge exhaust to locations that do not result in harmful or nuisance exposure to people, operations of other contractors, OWNER's operations, or damage to property.
 - d. Properly ventilate spaces where hazardous or volatile materials are stored.
 2. Provide adequate ventilation for:
 - a. Curing installed materials.
 - b. Maintaining humidity levels required for suitable conditions for the Work.
 - c. Cooling areas around electrical components to less than 100 degrees F.

1.04 USE OF OWNER'S SYSTEMS

- A. Existing Heating, Cooling and Ventilating Systems:
1. Do not use systems in existing structures or buildings for temporary heating and ventilating without OWNER's written permission and basis mutually agreed upon by the parties for proportionate sharing of costs.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for temporary systems may be new or used; shall be adequate for purposes intended; shall not create unsafe conditions; and shall comply with Laws and Regulations and orders of authorities having jurisdiction.
- B. Provide all required temporary facilities, including piping, wiring, and controls. Provide required temporary utilities and consumables.
- C. Portable Space Heaters:
 - 1. When used, portable space heaters that burn oil, natural gas, or propane shall comply with Laws and Regulations and shall have the following:
 - a. Safety controls against explosion, overheating, and carbon monoxide accumulation.
 - b. Appropriate vents.
 - c. Adequate combustion air.
 - 2. Do not use electric heaters for temporary heating.
- D. Provide Temporary Enclosures to protect the Work and materials and equipment.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install temporary heating, cooling, ventilating, and enclosures in neat, orderly, manner, and make structurally, mechanically, and electrically sound throughout.
- B. Location of Temporary Systems:
 - 1. Locate temporary heating, cooling, and ventilating systems to provide uniform distribution of heat and uniform air movement through each area served.
 - 2. Temporary systems shall not interfere with or provide hazards or nuisances to: the Work under this and other contracts, movement of personnel, traffic areas, materials handling, storage areas, finishes, and work of utility owners and others.
- C. Modify and extend temporary systems as required by progress of the Work.
- D. Protect permanently-installed, direct-radiation units, such as convectors and finned pipes, with temporary sheet metal enclosures.

3.02 USE

- A. Maintain temporary systems to provide safe, continuous service at required times, safe working conditions, and required temperature, humidity levels, and air quality emissions.
- B. Properly supervise operation of temporary heating, cooling, and ventilating equipment:
 - 1. Enforce compliance with Laws and Regulations, permits, and orders of authorities having jurisdiction.
 - 2. Enforce safe practices.
 - 3. Prevent abuse of services.
 - 4. Prevent damage to finishes.
 - 5. Ensure that temporary facilities and equipment do not interrupt continuous progress of construction.
- C. At end of each work day, check temporary heating and cooling systems and verify that sufficient fuel is available to maintain heating and cooling until work is resumed at the Site. Provide fuel and consumables when supply on-hand is insufficient.

3.03 REMOVAL

- A. Completely remove temporary facilities, temporary utilities, equipment, and materials when no longer required. Repair damage caused by temporary facilities and their removal and restore the Site to condition in accordance with the Contract Documents; if restoration of damaged areas is not specified, restore to preconstruction condition.
- B. Where temporary services are disconnected from existing, permanent utility, provide suitable, gastight cap or blind flange, as applicable, on service line, in accordance with requirements of the utility owner.
- C. When permanent heating, cooling, and ventilating facilities were used for temporary heating, cooling, and ventilating, upon Substantial Completion provide new replaceable-type filters and consumables, and clean permanent filters.

END OF SECTION

SECTION 01540

SECURITY AND SAFETY

PART 1 - GENERAL

1.01 SECURITY PROGRAM

- A. The **Contractor** shall protect the Work, including field office trailers and contents, from theft, vandalism, and unauthorized entry.
- B. The **Contractor** shall initiate a site security program at the time of mobilization onto the Work site that provides adequate security for material stored and installed onsite.
- C. The **Contractor** shall maintain the security program throughout the Contract duration.
- D. The **Contractor** and subcontractors shall be wholly responsible for the security of its storage compound and laydown areas, and for plant, material, equipment, and tools at times.
- E. The **Contractor** shall provide the **County** with a list of 24-hour emergency phone numbers, including chain of command.
- F. The **Contractor** must cooperate with Owner on all security matters and must promptly comply with any project security arrangements established by the Owner or Program Manager.
- G. It is the **Contractor's** obligations to comply with all applicable governmental requirements and regulations and to undertake reasonable actions to establish and maintain secure conditions at any job site.
- H. The **Contractor** shall be solely responsible for the safety and security of materials, equipment, their employees, their subcontractors and or any person who enters County's premises for any reason(s) related to this contract.
- I. The **Contractor** shall comply with the site safety and security program at all times on the Owner's facilities.
- J. The **Contractor** shall only allow entry to authorized persons with proper Owner-approved identification. All Contractor and Subcontractor employees will be required to have personnel working at these facilities photographed for an Owner-provided identification (ID) badge before they start work.
- K. The **Contractor** shall not allow cameras on-site or photographs to be taken, except those required to perform the Work in accordance with the Contract Documents or otherwise approved by Owner. Photos taken on the County property for any reason (mishaps, near misses, accidents etc.) are prohibited from being used for Social Media and Training references unless authorized by the County.

- L. It is the responsibility of the **Contractor** to ensure all articles of possible personal or monetary value found by the Contractor's employees are turned into the Owner or Program Manager.
- M. The **Contractor** shall be responsible for maintaining satisfactory standards of employees' competency, conduct, courtesy, appearance, honesty and integrity, and shall be responsible for taking such disciplinary action with respect to any employee, as may be necessary.
- N. The **Contractor** shall provide the County with a list of 24-hour emergency phone numbers, including a chain of command.
- O. **Contractors** with non-English speaking employees shall provide an English-speaking person, who has the ability to translate or communicate vital project specific or safety information.

1.02 PROJECT SAFETY

A. DRUG AND ALCOHOL POLICY

Any person under the influence of /or in possession of, distributing and/or selling control substances and/or alcohol will be removed from the site immediately. Prescription medication is allowable if it is contained in its original package and does not affect an employee's performance. DWM has a zero tolerance Drug and Alcohol policy.

B. COMPETENT PERSON REQUIREMENTS

Contractor and their Subcontractor shall have a Competent Person on the project for all operations as required by OSHA Standards.

- 1. A competent person identified and on-site before any scaffold erection may begin and/or modified.
- 2. A competent person identified and on-site before any excavation may begin and/or modified.
- 3. A competent person identified and on-site before any Confined Space may begin.
- 4. A competent person identified and on-site before any rigging operation may begin.
- 5. A competent person identified to erect and inspect concrete formwork. OSHA defines a competent person as one who is capable of identifying existing and predictable hazards in surroundings or working conditions that are unsanitary, hazardous or dangerous to employees, and who has the authority to take prompt corrective measures to eliminate them.

C. COMMUNICATIONS

- 1. Contractor shall Plan and execute all work in a manner, which complies with the stated objectives of their Project Safety Program.

2. Contractor employees and their subcontractors shall complete a Project Site-Specific Health and Safety Orientation identifying projects hazards, detailing these specified project rules and DeKalb County Watershed Management Project Rules (**See Section C**). Employees shall complete this orientation before starting work.
3. Contractor shall create and maintain for project(s) an emergency action plan (EAP) which addresses the notification of the closet police, fire or ambulance and rescue services.
4. In case of a utility line break please contact 911 in addition to DWM Dispatch at 770-270-6243, the utility owner (Sewer, Water, Gas, Cable, and Electrical) and your project contract public relation representative. Please note: Gas Sewer and Electrical lines are considered Hazardous. Prompt emergency actions must follow immediately.
5. Contractors are required to have on file in the job trailer, a copy of their company's Safety Program and Hazard Communication Program.
6. All accidents must be reported to DWM Management immediately after occurrence. Accident reports and investigation forms must be completed and a copy to DWM Safety within 24 hours of an accident. All incidents or near misses must be reported to DWM Safety immediately for proper investigation and corrective actions to ensure prevention.
7. Contractor's accident/incident report shall contain (but not be limited too) the following:
 - a. Name of person injured
 - b. Date and time of injury
 - c. Name(s) of all witnesses
 - d. Details of the accident
 - e. Root Cause analysis of accident
 - f. Action taken to prevent re-occurrence of incident/accident
 - g. Nature/Extent of injury
 - h. Name of doctor/ emergency provider
8. All contractor personnel requiring medical attention shall be drug screened in accordance with the County's policy.
9. Tool Box Talks must be completed at least weekly. The toolbox talk must be documented with the signatures of all employees attending. Topics should include information relative to ongoing or upcoming operations and previous week's accidents.
10. Subcontractors must maintain and have available first aid and bloodborne pathogens kit.

11. Contractors and their subcontractors are responsible for transportation and payment for treatment of their employees. It is the responsibility of each contractor to arrange for medical treatment of his or her injured employees.
12. Contractors and Subcontractors are responsible for the conduct of their employees and housekeeping of the construction/project site.
13. Any damage to existing or stored property or materials will financially be the sole responsibility of the offending subcontractor(s).

D. DISCIPLINARY POLICY

1. Contractor employees must work safely as a condition of employment on this project. DeKalb County reserves the right to remove any contractor employees from this project for unsafe behavior or failure to follow safe work practices. Insubordination or any act that causes an Immediately Dangerous to Life and Health (IDLH) situations will not be tolerated and will result in automatic removal.

E. PROJECT SITE

1. Vehicle parking is in designated areas only- Forward First Policy.
2. Report all unsafe site conditions to DWM Management for which the contractor does not have the resources or is not responsible to implement corrective action.
3. Only trained, certified and authorized employees shall operate forklifts, aerial lifts, cranes, machinery, heavy equipment, tools, and vehicles. All equipment shall be operated in accordance with manufacturer's specifications and all other applicable laws/standards. The operator must have certification cards on their person.
4. Cell phones are not allowed to be used onsite except for supervisors and management.
5. All subcontractors shall have warning devices on moving equipment and trucks in the proper working order while on site.

F. ELECTRICAL

Subcontractors must use either an assured grounding program and/or Ground Fault Circuit Interrupters (GFCI) for protection from shock/electrocution.

G. HAZARDOUS COMMUNICATION PROGRAM

Contractors are required to have on file with DWM and project job trailer, a copy of their company's Hazard Communication Program. Hazard Communication programs must include an inventory list of hazardous materials, explanation of their labeling system, and all corresponding safety data sheets (SDS) and name of the program coordinator. Contractor shall make the inventory list of hazardous materials available upon request by the County.

1.03 ENTRY CONTROL

- A. The **Contractor** shall restrict entry of unauthorized personnel and vehicles onto the Project site.
- B. The **Contractor** shall allow entry only to authorized persons with proper identification.
- C. The **Contractor** shall maintain an Employee Log and Visitor Log and make the log available to the **County** upon request. This log shall be submitted to the **County** bi-weekly, or as necessary.
- D. The **Contractor** shall require visitors to sign the Visitor Acknowledgment of the Program Site Rules/Visitor Log, which includes a release form. Copies of these forms shall be submitted to the **County** bi-weekly and maintained in the **Contractor's** security files on-site. See **Section A**.
- E. The **Contractor** shall require each employee to sign the Employee Acknowledgment of Project Site Rules Log included in **Section C**. Employees, subcontractor employees, and lower-tier **Contractor** employees will receive a new employee orientation. Signing the Employee Log by the employee is certifying that the orientation training has been received.
- F. The **County** has the right to refuse access to the site or request that a person or vehicle be removed from the site if found violating any of the Project safety, security, or conduct rules.

1.04 BARRICADES, LIGHTS, AND SIGNALS

- A. The **Contractor** shall furnish and erect such barricades, fences, lights, and danger signals and shall provide such other precautionary measures for the protection of persons or property, and of the Work as necessary. Barricades shall be painted in a color that is visible at night. From sunset to sunrise, the **Contractor** shall furnish and maintain at least one light at each barricade and sufficient numbers of barricades shall be erected to keep vehicles from being driven on or into any Work under construction.
- B. The **Contractor** shall be held responsible for damage to the Work and any resulting injuries due to failure of barricades, signs, and lights. Whenever evidence is found of such damage, the **Contractor** shall immediately remove the damaged portion and replace it at the **Contractor's** cost and expense. The **Contractor's** responsibility for the maintenance of barricades, signs, and lights shall not cease until the Project has been accepted by the **County**.

1.05 RESTRICTIONS

The **Contractor** shall not allow cameras on site or photographs taken without approval of the **County**, except as required under **Section 01 38 00 – Photographic Documentation**.

1.06 CONTRACTOR SAFETY/HEALTH AND SECURITY PLAN

- A. Within 30 days of Notice to Proceed, and prior to the performance of any Work, the **Contractor** shall prepare and submit a Contract-specific Health, Safety, and Security Plan signed by an officer of the **Contractor's** organization. Adequacy is the responsibility of the **Contractor**.
- B. The **County** will review the **Contractor's** Health, Safety, and Security Plan for the adequacy of the plan. The plan shall:
 - 1. Identify the person(s) responsible for implementation and enforcement of Health, Safety, and Security rules and regulations for this Project.
 - 2. Address safe Work procedures for the activities within the **Contractor's** scope of Work.
 - 3. Include a new employee orientation program to address job- and site-specific rules, regulations, and hazards.
 - 4. Include the **Contractor's** Drug-Free Work Place Policy describing the substance abuse prevention and testing program.
 - 5. Include provisions to protect the **Contractor's** employees, other persons, and organizations possibly affected by the Work from injury, damage, or loss.
 - 6. Comply with current Fed/OSHA regulations; the Health, Safety, and Security Plan; the facility safety program (when applicable); and locally accepted safety codes, regulations, and practices.
 - 7. Include a site-specific emergency action and evacuation plan.
 - 8. Include Hazard Communication/Right-To-Know Program.
 - 9. Include security procedures for the **Contractor's** Work, tools, and equipment.
 - 10. Include the capability of providing the **County** with documentation to show compliance with the plan, plus accidents, and investigation reports.
 - 11. Address other contract-specific requirements, including the Unique Requirements of these specifications.
- C. Prior to the start of Work, **Contractor** shall provide Job Safety Analyses (JSAs) for unique Work activities necessary to prosecute the scope of Work.
- D. Review of the **Contractor's** Health, Safety, and Security Plan by the **County** shall not impose any duty or responsibility upon the **County** for the **Contractor's** performance of the Work in a safe manner.
- E. The **Contractor** shall be fully responsible for the safety and health of its employees, its subcontractors, and lower tier contractors during performance of its Work.

- F. The **Contractor** shall provide the **County** with safety reports, training records, competent person list, and accident reports prepared in compliance with Fed/OSHA and the Project Health, Safety, and Security Plan.

1.07 PROJECT SAFETY COORDINATOR

- A. The **Contractor** shall be responsible for the safety of the **Contractor's** and **County's** employees, the **County's** personnel and other personnel at the Work site. The **Contractor** shall identify a Project Safety Coordinator (PSA) on the job with an appropriate office on the job site to maintain and keep available safety records and up-to-date copies of pertinent safety rules and regulations.
- B. The Project Safety Coordinator shall:
1. Comply with applicable health and safety requirements of governing legislation.
 2. Schedule and conduct safety meetings and safety training programs as required by law and included in the **Contractor** Health, Safety, and Security Plan for personnel engaged in the Work.
 3. Post appropriate notices regarding safety and health regulations at locations that afford maximum exposure to personnel at the job site.
 4. Post the name(s), address and hours of the nearest medical doctor(s), names and addresses of nearby clinics and hospitals, and the telephone numbers of the fire and police departments.
 5. Post appropriate instructions and warning signs with regard to hazardous areas or conditions.
 6. Have proper safety and rescue equipment adequately maintained and readily available for any contingency. This equipment shall include such applicable items as: proper fire extinguishers, first aid kits, safety ropes, and harnesses; stretcher, life preservers, oxygen breathing apparatus, resuscitators, gas detectors, oxygen deficiency indicators, explosion meters; and other equipment mandated by law.
 7. Inspect each Work crew at least once daily in accordance with an Inspection Checklist Report Form to make sure that workers are wearing their appropriate personal safety equipment; machines, tools, and equipment are in safe operating condition; Work methods are not dangerous; and the Work site and Work methods are free of hazards.
 8. Submit to the **County**, upon request, copies of inspection checklist report forms; safety records, safety inspection reports, and certifications from regulating agencies and insurance companies.
 9. Immediately notify the **County** of a serious accident, followed by a detailed written report within 24 hours. "Serious accident" is defined as that requiring an absence of Work of more than two days and/or hospitalization.

10. Immediately notify the **County** in the event of a fatal accident.
11. Immediately notify the **County** of any accident claim against the **Contractor** or any subcontractor, followed by a detailed written report on the claim, and its resolution.
12. Review safety aspects of the **Contractor's** submittals as applicable.

1.08 IDENTIFICATION BADGES AND SECURITY

- A. All **Contractor's** employees and subcontractors' staff who will be working on-site shall be issued an ID badge by the **County**.
- B. Special Circumstances. The **County** can grant/permit a **Contractor** the right to badge their employees and subcontractors. However, the badge template shall be approved by **DWM** Safety Division. The ID badge shall include worker's name, date of issue, picture, and company affiliation.
- C. It is the **Contractor's** responsibility to collect the ID badge from any employee who is been discharged or resign prior to completion of the project as well as at completion of the project. **Contractors** shall return all ID badges to the **DWM** Safety Division within 48 hours. The **Contractor** shall be charged a fee of \$25.00 per badge for any badges not returned at completion of the project. For ID badges lost during the term of the project, there will be a reissued fee of \$15.00 per ID badge. The **Contractor** shall deduct these charges from its periodic or closeout payment request or the **County** shall deduct them.
- D. The **Contractor** shall be responsible for maintaining a safe "drug-free" work environment.
- E. The **Contractor** shall develop a Security Plan for use on the job site during construction. The Plan shall encompass at a minimum such topics as the use of pre-employment background checks for specific project staff, drug tests, crime prevention and anti-theft procedures, workplace violence, and methods to secure project documents. The staff working on the site shall be familiar with the requirements of the Security Plan.
- F. County Ordinances prohibit the carrying of weapons on County property/jobsites. The County Police Department shall be notified of any person bringing weapons to the jobsite; they shall be removed immediately and prosecuted.
- G. Persons on the jobsite shall report any suspicious activity by workers or by others at the jobsite area first to the Project Management, and/or DeKalb County Police and/or Fire Department by calling 911 and immediately to the Engineering and Construction Management Service Division Head.

1.09 REMOVAL

- A. The **Contractor** shall remove equipment and devices when no longer required and repair damage caused by installation.

- B. Should the **Contractor** dismiss employees who have been given access to the DWM facilities while the contract is in force, the Contractor will advise the DWM Security Office.
- C. The Owner may request the **Contractor** to immediately remove from the premises and/or dismiss any employee found unfit to perform duties due to one or more of the following reasons:
 - 1. Neglect of duty, absenteeism, security or safety problems and sleeping on the job.
 - 2. Disorderly conduct, use of abusive or offensive language, quarreling, intimidation by words, actions or fighting.
 - 3. Theft, vandalism, immoral conduct or any other criminal action.
 - 4. Selling, consuming, possessing, or being under the influence of intoxicants, alcohol or illegal substances, which produce similar effects while on duty.
 - 5. Involved in a vehicle accident while on the Owner's property or driving the Owner's equipment. No employee, Contractor, or Subcontractor will be extended privileges to drive the Owner's equipment on the Owner's property if driving privileges have been withdrawn by the person's State of residence.
- D. All employees will be required to sign in and out on a designated log sheet.
- E. All employees shall be required to wear at all times in an observable location, above the waist, on outer clothing, an appropriate photo I.D. badge to be furnished by the Contractor and approved by the Owner.
- F. No one under age sixteen is permitted at work sites after normal working hours. Contractor's employees are allowed on work sites only during the specified hours and only when working on this contract. No Contractor employee will be allowed on sites when not specifically working on this Contract's predetermined times and dates.
- G. All employees and agents of the Contractor must read the Project Site Rules statement and sign a log acknowledging understanding of project site rules provided in **(Sections A & C)**.

1.10 (DWM) Contractor Badge Procedures

The ID badge will provide proof of authorization to be on the construction site, and aid DWM staff in affirming the contractor's employee has received safety training prior to the start of work at DWM project, site or facility.

A. GENERAL REQUIREMENTS

1. All individuals working on any DeKalb County Department of Watershed Management – construction projects, sites, and facilities shall be required to wear a County issued ID badge.
2. Contractors and subcontractors working on (DWM) projects, sites and facilities must have their assigned badge on their person at all times.
3. All contractors and subcontractors personnel without a current badge will not be allowed to continue to work at a (DWM) project, site or facility.
4. All workers must obtain and display an identification badge issued by the County's Safety Representative **before** reporting to work on any (DWM) construction project.
5. Although a contractor may only be required to visit our sites/property on an infrequent basis, badging is still a requirement.
6. Contractors and subcontractors vendors or their transient onsite visitors, which are not full-time employees of the site, shall be escorted while onsite as a visitor by a Department of Watershed Management badged contractor.
7. Contractors shall maintain a daily sign-in sheet/record/log of their daily workers under its supervision which includes subcontractor's vendors or their transient onsite visitors.

B. TRAINING REQUIREMENTS

1. Contractor and subcontractor employees are required to attend safety training prior to receiving a badge.
2. The **Contractor** is responsible for conduction and/or arrangement of their employee's training.
 - a. OSHA 10-hour, OSHA 30 hour or project site-specific safety training along with the contractor receiving a copy of DeKalb County Project Site Rules will suffice the training requirements to receive a badge and start work on the (DWM) construction project(s), site or facility.
 - b. OSHA 10 hour and 30-hour safety training received within 12 months prior to the start of work on the (DWM) construction project(s), will qualify as current.
 - c. Whereas the OSHA 10 hour and 30-hour training does not expire, the actual date of training must be less than 12 months prior to the start of work on the (DWM) construction project(s) to qualify as "current,"
 - d. In the case where the OSHA 10 hour and 30-hour date of training are more than 12 months prior to the start of work on the (DWM)

construction project(s), project site-specific safety verification of training is required.

- e. Contractor's training should include general construction safety and the specific safety concerns/hazards employees may encounter at the Watershed Management construction site.
- f. DMW' Safety Division shall review a copy of the contractor's project site-specific safety training topics outline prior to the contractor's employees were approved for badging.
- g. Contractor and subcontractor employees are required to read, understand and agree to abide by DeKalb County Project Site Rules. See **Sections A & C**.

C. VERIFICATION OF TRAINING

- 1. The contractor's management representative shall complete, sign and send a copy of each of their employee or their subcontractor's employee a copy of (DWM) Verification of Training Form. **See Section E.**
- 2. (DWM) Verification of Training Document will be sent to VOTD@DeKalbcountyga.gov prior to the contractor's employee badging date of appointment.
- 3. The contractor's/subcontractor's employee shall review and verify that the information on their individual (DWM) Verification of Training document is correct.
- 4. The contractor's employee shall also sign (DWM) Verification of Training Form verifying the information on the document is correct. The (DWM) Verification of Training Document signature statement is as follows:

"I have read, understand and agree to abide by the DEKALB COUNTY PROJECT SITE RULES. I have received a personal copy for my use and reference. Furthermore, I understand that knowingly or purposely falsifying records is grounds for being denied access to the project site."

D. VERIFICATION OF IDENTITY REQUIREMENTS

- 1. The contractor and subcontractor employees must provide documentation to DeKalb County to verify their identity and authorization to work.
- 2. DeKalb County only accepts Form I-9 acceptable documents with accompanying photo.
- 3. I-9 acceptable documents must be from List A and List B (Examples)
 - a. ID cards issued by federal, state, local governmental agencies
 - b. TWIC (Transportation Worker Identification Credential)

- c. Driver License or Identification card issued by a state motor vehicle department with a photo that clearly identifies the individual.
- E. DWM MANAGEMENT SITE INSPECTIONS AND AUDITS

Field verification will be done randomly by the DWM Safety staff to ensure employees were trained and following County, OSHA & State regulations.
- F. BADGING OFFICE ADDRESS IS AS FOLLOWS

**DeKalb County Watershed Management,
Safety Division
1641 Road haven Drive, Stone Mountain, GA 30083
Badging hours are Tuesdays & Thursdays from 9:00 am to 12:00 pm.**
- G. BADGE EXPIRATION DATE

Badges are valid until the expiration date of the prime contractor's contract.
- H. TRANSFER CONTRACTORS

If a worker changes companies or projects, the badge must be surrendered and a new badge will be issued if needed.

If applicable, the new employer will provide the employee certification that the safety training is completed. Only those employees registered in the badging system are eligible to receive a badge. After verification by the safety representative, the badging database will be updated and a new badge issued.
- I. SPECIAL CIRCUMSTANCES:

The County can grant/permit a Contractor the right to badge their employees and subcontractors. However, the badge template shall be approved by the DWM Safety Division. The ID badge shall include the worker's name, picture, and company affiliation.
- J. ADDITIONAL TRAINING REQUIREMENTS:

Additional training requirements may be requested if there is a change in the contractor's scope of work or responsibilities.
- K. BADGE REPLACEMENT

The contractor must notify DMW's Safety Division immediately if a badge is lost, stolen or an employee is no longer employed with the contractor.
- L. BADGE COLLECTION/ RETURN POLICY

It shall be the **Contractor's** responsibility to collect the ID badge from any employee who is discharged or resigns prior to completion of the project as well as at the completion of the project. The **Contractor** shall return the ID badges to the **DMW' Safety Division** within 48 hours of their collection. The **Contractor** shall be charged a fee of \$25.00 per badge for any badges not returned at the

completion of the project. For ID badges lost during the term of the project, that shall be reissued, there shall be a charge of \$15.00 per ID badge. The **Contractor** shall deduct these charges from its periodic or closeout payment request or the **County** shall deduct them.

SECTION A

VISTOR ACKNOWLEDGMENT OF THE PROJECT SITE RULES

By signing this Visitor's Log, I acknowledge that I understand and agree to abide by the project rules outlined below.

- In consideration of my receipt of a visitor's pass as issued by the **County** directly or indirectly for the **County**, I waive on behalf of myself, my heirs, employer, legal representatives and assigns and hereby release and discharge the **County**, each of its directors, officers, employees, representatives, and agents from any and all claims, actions, causes of action, or any charge of any kind whatsoever that may arise or could arise in the future as a result of my being present at the facility including injury, death, or property damage whether or not caused by the fault or negligence of any of the parties released hereunder.
- I further acknowledge that I have been briefed on specific hazards, hazardous substances that are on site, and the site emergency action procedure.

PROHIBITED ACTIVITIES

- Unauthorized removal or theft of County property
- Violation of safety or security rules or procedures
- Possession of firearms or lethal weapons on jobsite
- Acts of sabotage
- Destruction or defacing of County property
- Failure to use sanitary facilities
- Knowingly or purposely failing to report accidents/incidents or job-related injuries
- Being under the apparent influence of drugs, alcohol, or other intoxicants or in possession of drugs, alcohol, or other intoxicants on the job site
- Wearing shorts or tennis shoes on the job site
- Failure to wear required personal protective equipment (PPE)
- Gambling, fighting, threatening behavior or engaging in horseplay on the job site
- Smoking in unauthorized areas on the job site
- Open fire cooking or making unauthorized fires on job site
- Selling items or raffles without authorization

- Use of unauthorized cameras on the job site
- Use of radio or television in the construction area
- Failure to park personal vehicle in authorized parking area
- Failure to wear designated identification [Site Specific]
- Failure to use designated gates
- Condoning or knowingly allowing a person to engage in or work around a patently unsafe or environmental compromising act or condition
- Knowingly or purposely falsifying records, documents or providing false testimony

I have read, understand, and agree to abide by the PROJECT SITE RULES. Furthermore, I understand failure to abide by these rules is grounds for being denied access to the project site. I have received a personal copy for my use and reference.

PRINT NAME

SIGNATURE

DATE

SECTION B

VISITOR LOG

THE SIGNING OF THIS LOG ACKNOWLEDGES I HAVE READ, UNDERSTAND, AND AGREE TO ABIDE BY THE PROJECT RULES OUTLINED ABOVE. **THIS IS NOT A VEHICLE ACCESS PERMIT.**

SIGNATURE	PRINT NAME	COMPANY/PERSON VISITED	DATE	IN	OUT
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm

SECTION C

EMPLOYEE ACKNOWLEDGMENT OF THE PROJECT SITE RULES

By signing this Employee Log, I acknowledge that I understand and agree to abide by the project rules outlined below.

PROHIBITED ACTIVITIES

- Unauthorized removal or theft of County property
- Violation of safety or security rules or procedures
- Possession of firearms or lethal weapons on jobsite
- Acts of sabotage
- Destruction or defacing County property
- Failure to use sanitary facilities
- Failure to report accidents or job-related injuries
- Under the apparent influence of drugs, alcohol, or other intoxicants or in possession of drugs, alcohol or, other intoxicants on the property
- Wearing shorts or tennis shoes on the jobsite
- Failure to wear a hardhat/safety glasses and safety vest
- Gambling at any time on the project
- Fighting, threatening behavior, or engaging in horseplay on the project
- Smoking in unauthorized areas on the project
- Open fire cooking or making unauthorized fires on project property
- Selling items or raffles without authorization
- Use of unauthorized cameras on the project
- Use of radio or television in the construction area
- Failure to park personal vehicle in authorized parking area
- Failure to wear designated identification [Site Specific]
- Failure to use designated gates

I have read, understand, and agree to abide by the PROJECT SITE RULES.
Furthermore, I understand failure to abide by these rules is grounds for being denied access to the project site. I have received a personal copy for my use and reference.

PRINT NAME

SIGNATURE

DATE

SECTION D

EMPLOYEE LOG

BY SIGNING THIS LOG ACKNOWLEDGMENT, I HAVE READ AND UNDERSTAND, AND AGREE TO ABIDE BY THE PROJECT RULES OUTLINED ABOVE AND ANY STATE, FEDERAL, LOCAL, OR ANY OTHER CONTRACT OBLIGATIONS THAT MAY APPLY. I FURTHER ACKNOWLEDGE THAT I HAVE BEEN ORIENTED AS TO THE SITE-SPECIFIC HAZARDS, ANY HAZARDOUS SUBSTANCES I MAY BE EXPOSED TO WHILE ON THE SITE, AND THE SITE/COMPANY EMERGENCY ACTION PROCEDURES, BY A REPRESENTATIVE OF THE COMPANY.

EMPLOYEES (PRINT)	SIGNATURE	COMPANY NAME	DATE

*Signature of Company
Representative*

Date Signed:

SECTION E

DeKalb County Government Training Verification Form

Appointment Date: _____ (Tues./Thurs. 9am-12pm)

Primary Contractor: _____

DeKalb Contract #: _____

Subcontractor Name: _____

Contract End Date: _____

☐ **Course Name: Site Specific Safety Training in accordance with OSHA 29 CFR 1926 & 1910**
Successfully Completed: ☐ Yes ☐ No ☐ In Progress
Date Completed: _____

☐ **Course Name: OSHA 10 Hour**
Successfully Completed: ☐ Yes ☐ No ☐ In Progress
Date Completed: _____

☐ **Course Name: OSHA 24 HAZWOPER**
Successfully Completed: ☐ Yes ☐ No ☐ In Progress
Date Completed: _____

☐ **Course Name: OSHA 30 Hour**
Successfully Completed: ☐ Yes ☐ No ☐ In Progress
Date Completed: _____

☐ **Course Name: OSHA 40 HAZWOPER**
Successfully Completed: ☐ Yes ☐ No ☐ In Progress
Date Completed: _____

I HAVE READ, UNDERSTAND AND I HAVE BEEN PROVIDED A COPY OF THE DEKALB PROJECT SITE RULES. FURTHERMORE, I UNDERSTAND THAT KNOWINGLY OR PURPOSELY FALSIFYING RECORDS IS GROUNDS FOR BEING DENIED ACCESS TO THE PROJECT SITE. BY MY SIGNATURE BELOW, I AFFIRM THE ABOVE INFORMATION IS ACCURATE AND TRUE TO THE BEST OF MY KNOWLEDGE.

Employee's Name (Print):

Employee's Name (Sign):

Authorized Representative (Print):

Authorized Representative (Sign):

END OF SECTION

SECTION 01570

TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Scope:
 - 1. CONTRACTOR shall provide and maintain methods, materials, equipment, and temporary construction as required for controlling environmental conditions at the Site and adjacent areas during construction.
 - 2. Maintain controls until no longer required. Provide temporary controls at all times when CONTRACTOR is working at the Site.
 - 3. Temporary controls include, but are not limited to, the following:
 - a. Noise controls.
 - b. Dust controls.
 - c. Pollution controls.

1.02 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable provisions and recommendations of the following:
- B. Informational Submittals: Submit the following:
 - 1. Procedural Submittals:
 - a. Proposed dust control measures, when submittal is requested by ENGINEER.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 NOISE CONTROL

- A. Noise Control – General:
 - 1. CONTRACTOR's vehicles and equipment shall minimize noise emissions to greatest degree practicable. When necessary, provide mufflers and silencers on construction equipment, and provide temporary sound barriers onsite when necessary.

2. Noise levels shall comply with Laws and Regulations, including OSHA requirements and local ordinances.
3. Noise emissions shall not interfere with the work of OWNER, facility manager, or others.

3.02 DUST CONTROL

A. Dust Control – General:

1. Control objectionable dust caused by CONTRACTOR's operation of vehicles and equipment, clearing, demolition, cleaning, and other actions. To minimize airborne dust, apply water or use other methods subject to acceptance of ENGINEER and approval of authorities having jurisdiction.
2. CONTRACTOR shall prevent blowing and movement of dust from exposed soil surfaces and access roads to reduce onsite and off-Site damage, nuisances, and health hazards associated with dust emissions.

B. Dust Control Methods:

1. Dust control may be achieved by irrigation in which the dust-prone area of the Site shall be sprinkled with water until the surface is moist.
2. Apply dust controls as frequently as required without creating nuisances such as excessive mud and ponding of water at the Site. Do not use water for dust control when water will cause hazardous or objectionable conditions such as ice, mud, ponds, and pollution.
3. Provide dust control that is non-polluting and does not contribute to tracking-out of dirt and dust onto pavement.

C. Removal of Dust and Dirt from Travelled Surfaces:

1. Remove dust and dirt from roadways, drives, parking areas, and other travelled surfaces not less than the frequency indicated in Section 01800, Cleaning.
2. Perform dust and dirt removals from travelled surfaces by mechanical sweeping or other method acceptable to ENGINEER.

3.03 POLLUTION CONTROL

A. Pollution Control – General:

1. Provide means, methods, and facilities required to prevent contamination of soil, water, and atmosphere caused by discharge of noxious substances from or caused by construction operations.
2. Equipment used during construction shall comply with Laws and Regulations.

B. Spills and Contamination:

1. Provide equipment and personnel to perform emergency measures required to contain spills and to remove contaminated soils and liquids.
 2. Excavate contaminated material and properly dispose of off-Site, and replace with suitable compacted fill and topsoil.
- C. Protection of Surface Waters and Ground Water:
1. Provide and maintain special measures to prevent harmful substances from entering surface waters and ground water. Prevent disposal of wastes, effluents, chemicals, and other such substances in or adjacent to surface waters and open drainage routes, in sanitary sewers, or in storm sewers, and in ground water.
- D. Atmospheric Pollutants:
1. Provide and maintain systems for controlling atmospheric pollutants related to the Work.
 2. Prevent toxic concentrations of chemicals and vapors.
 3. Prevent harmful dispersal of pollutants into atmosphere.
- E. Solid Waste:
1. Provide and maintain systems for controlling and managing solid waste related to the Work.
 2. Prevent solid waste from becoming airborne, and from discharging to surface waters and drainage routes.
 3. Properly handle and dispose of solid waste.

3.04 REMOVAL OF TEMPORARY CONTROLS

- A. Removals – General:
1. Upon completion of the Work, remove temporary controls and restore Site to specified condition; if condition is not specified, restore Site to pre-construction condition.
 2. After soils are permanently stabilized, remove from the Site temporary erosion and sediment controls.

END OF SECTION

SECTION 01600

GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The **Contractor** shall use the latest version of the manufacturer's product line of installed materials and equipment at the time of purchase. The **Contractor** shall not purchase materials and equipment that have been outdated by newer versions at the time of purchasing. Materials and equipment that show any signs of extended storage such as corrosion, scratches, and dents shall not be accepted.
- B. The **Contractor** shall use equipment for performing the Work that conforms to the latest version of applicable safety standards including, but not limited to, OSHA requirements. **Contractor** shall not exceed or ignore any requirements or recommendations of the equipment manufacturer. Equipment not meeting requirements of this Section shall be barred from use on the project.
- C. The **Contractor** shall install material and equipment that meets or exceeds the latest applicable code requirements, including, but not limited to: Underwriters Laboratory, Standard Building Code, and OSHA, as well as requirements of these Specifications. Where there is conflict with requirements of the Contract Documents and code requirements, the **Contractor** shall comply with the more stringent requirements with no additional compensation to the **Contractor**.

PART 2 - MATERIALS AND EQUIPMENT

2.01 ANCHOR BOLTS

- A. The **Contractor** shall use anchor bolts that are ANSI Type 316 stainless steel unless otherwise specified or indicated, and shall conform to requirements of this Section and the material articles in the appropriate Sections where they are used.
- B. The **Contractor** shall use anchor bolts supplied by the manufacturer or fabricator of the specific material or equipment to be installed.
- C. Design criteria for anchor bolts:
 - 1. When the size, length, or load carrying capacity of an anchor bolt, expansion anchor, or concrete insert is not shown on the Drawings, provide the size, length and capacity required to carry the design load times a minimum safety factor of four.
 - 2. Determine design loads as follows:
 - a. For equipment anchors, use the design load recommended by the manufacturer and approved by the **County**.

- b. For pipe hangers and supports, use half the total weight of pipe, fittings, valves, accessories, and water contained in full pipe, between the hanger or support in question and adjacent hangers and supports on both sides.
- c. Allowances for vibration are included in the safety factor specified above.
- d. Anchors shall develop ultimate shear and pull-out loads of not less than the following values in concrete:

Bolt Diameter (Inches)		Min. Pull-Out Load (Pounds)
$\frac{1}{2}$	4,500	6,300
$\frac{5}{8}$	6,900	7,700
$\frac{3}{4}$	10,500	9,900

- 3. Embedment depth shall be minimum 6 inches for epoxy anchors and 4 inches for steel expansion anchors, unless noted otherwise on the drawings.

D. Anchor Type and Manufacturer

- 1. Where epoxy anchors are noted on the drawings, provide ANSI Type 316 stainless steel threaded rod with Speed Bond #1 epoxy injection as manufactured by Prime Resins, Inc. or approved equal.
- 2. For other applications, provide ANSI Type 316 steel expansion anchors from one of the following manufacturers:
 - a. Hilti, Incorporated
 - b. Ramset, Incorporated
 - c. Approved equal
- 3. Install anchors per manufacturer's recommendations and this Section. Drilled anchorage holes are to be blown out with compressed air before installing anchor.

2.02 CONNECTION BOLTS

- A. Materials shall be as specified in other Sections of the Specifications, or as shown on the Drawings. Where materials are not specified or shown on the Drawings, they shall be of ANSI Type 316 stainless steel, with ANSI Type 316 stainless steel nuts and washers.
- B. Unless otherwise specified, stud, tap, and machine bolts and nuts shall be ANSI Type 316 stainless steel and shall conform to the requirements of ASTM Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners, Designation A307-80. Hexagonal nuts of the same quality of metal as the bolts shall be used. Threads shall be clean cut and shall conform

to ANSI Standard B1.1-1989 for Unified Inch Screw Threads (UN and UNR Thread Form).

2.03 CONCRETE INSERTS

Concrete inserts for hangers shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts for hangers shall be of a type that permits adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. Inserts shall be galvanized, then epoxy phenolic primed and top coated with PVC, using thermal bond process.

2.04 SLEEVES

- A. Unless otherwise indicated on the Drawings or specified, openings for the passage of pipes through floors and walls shall be formed of sleeves of standard-weight, stainless-steel pipe. The sleeves shall be of ample diameter to pass the pipe and its insulation, if any, and to permit such expansion as may occur. Sleeves shall be of sufficient length to be flush at the walls and the bottom of slabs and to project 4 inches above the finished floor surface. Threaded nipples shall not be used as sleeves.
- B. Sleeves in exterior walls below grade or in walls to have liquids on one or both sides shall be as detailed on the Approved Drawings and specified in other sections.
- C. Sleeves shall be set accurately before the concrete is placed or shall be built in accurately as the masonry is being built.

2.05 ELECTRICAL EQUIPMENT ENCLOSURES

Items of electrical equipment that are furnished with process equipment shall conform to the requirements specified under the appropriate electrical sections of the specifications. Enclosures for electrical equipment such as switches, starters, etc., shall conform to the requirements specified under the appropriate electrical sections of the specifications.

2.06 EQUIPMENT DRIVE GUARDS

Equipment driven by open shafts, belts, chains, or gears shall be provided with acceptable all-metal guards enclosing the drive mechanism. Guards shall be constructed of epoxy paint coated, galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps that will permit easy removal for servicing the equipment. The guards shall conform to applicable safety codes and regulations.

2.07 NAMEPLATES

- A. The **Contractor** shall provide each piece of equipment, with the exception of the items mentioned below, with a substantial nameplate of non-corrodible metal, securely fastened in place and clearly and permanently inscribed with the manufacturer's name, model or type designation, serial number, principal rated

capacities, electrical or other power characteristics, and similar information as appropriate.

- B. This requirement shall also apply to standard, manually operated gate, lobe, check, and plug valves.
- C. Each process valve shall be provided with a substantial tag of noncorrodible metal securely fastened in place and inscribed with an identification number in conformance with the tag numbers indicated on the Process and Instrumentation Drawings.

2.08 LUBRICANTS

During testing and prior to acceptance, the **Contractor** shall furnish lubricants necessary for the proper lubrication of equipment furnished under this Contract.

2.09 PROTECTION AGAINST ELECTROLYSIS

Where dissimilar metals are used in conjunction with each other, the **Contractor** shall provide suitable insulation between adjoining surfaces to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators, or washers, or other approved acceptable materials.

2.10 TRANSPORTATION, HANDLING, STORAGE, AND PROTECTION

- A. Packing and Shipping:
 - 1. Product and materials shall be shipped and handled in ways that shall prevent damage.
 - 2. Equipment shall be protected against damage from moisture, dust, handling, or other cause during transport from manufacturer's premises to the project site. Bearing housing, vents, and other types of openings shall be wrapped or otherwise sealed to prevent contamination by grit and dirt.
 - 3. Ship equipment, material, and spare parts in assembled units except where partial disassembly is required by transportation regulations or for protection of components.
 - 4. Pipe and appurtenances shall be handled, stored, and installed as recommended by the manufacturer. Pipes shipped with interior bracing shall have the bracing removed only when recommended by the pipe manufacturer.
 - 5. Stiffeners shall be used where necessary to maintain shapes and to give rigidity.
 - 6. Each item or package shall be marked with the number unique to the specification reference covering the item. Spare parts shall be packed in containers bearing labels clearly designating contents and pieces of equipment for which intended.

B. Acceptance at Site:

1. Damaged items shall not be permitted as part of the Work except in cases of minor damage that have been satisfactorily repaired and are acceptable to the **County**.
2. Damage shall be corrected to conform to the requirements of the Contract before the assembly is incorporated into the Work.
3. The **Contractor** shall bear the costs arising out of dismantling, inspection, repair, and reassembly.

C. Storage and Protection:

1. During the interval between the delivery to the site and installation, equipment and materials shall be stored in an enclosed space affording protection from weather, dust, and mechanical damage and providing favorable temperature, humidity, and ventilation conditions to protect against equipment deterioration. Manufacturer's recommendations shall be adhered to in addition to these requirements.
2. Equipment and materials to be located outdoors may be stored outdoors if protected against moisture condensation and ultraviolet (UV) degradation. Equipment shall be stored at least 6 inches above ground. Temporary power shall be provided to energize space heaters or other heat sources for control of moisture condensation. Space heaters or other heat sources shall be energized without disturbing the sealed enclosure.

2.11 UNIT RESPONSIBILITY

- A. Equipment systems made up of two or more components shall be provided as a unit by the responsible manufacturer. Unless otherwise specified, the **Contractor** shall obtain each system from the supplier of the driven equipment, and the supplier shall provide components of the system to enhance compatibility, ease of construction, and efficient maintenance. The **Contractor** shall be responsible to the **County** for performance of systems in accordance with the provisions of the General Requirements of the Contract Documents.
- B. Where the detailed specifications require the **Contractor** to furnish a certificate of unit responsibility, such certificate shall be executed by the manufacturer. No other submittal material shall be processed until the Certificate of Unit Responsibility has been received and has been found to be satisfactory.

END OF SECTION

SECTION 01610

TRANSPORTATION AND HANDLING

PART 1 - GENERAL

1.01 SCOPE

- A. The Contractor shall provide transportation of equipment, materials, and products furnished under these Contract Documents to the Work site. In addition, the Contractor shall provide preparation for shipment, loading, unloading, handling, and preparation for installation, as well as other Work and incidental items necessary or convenient to the Contractor for the satisfactory prosecution and completion of the Work.
- B. Equipment, materials, and products damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the County prior to being incorporated into the Work. Acceptance of damaged goods is at the discretion of the County.

1.02 TRANSPORTATION

- A. Equipment shall be suitably boxed, crated, or otherwise protected during transportation.
- B. Where equipment will be installed using existing cranes or hoisting equipment, the Contractor shall confirm that the weights of the assembled sections do not exceed the actual capacity of the cranes or hoisting equipment.
- C. Small items and appurtenances such as gauges, valves, switches, instruments, and probes that could be damaged during shipment shall be removed from the equipment prior to shipment, packaged, and shipped separately. Openings shall be plugged or sealed to prevent the entrance of water or dirt.

1.03 HANDLING

- A. Equipment, materials, and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation.
- B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Eyebolts or lifting lugs furnished on the equipment shall be used in handling the equipment. Shafts and operating mechanisms shall not be used as lifting points. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds that permitted by standard industry practice.
- C. Under no circumstances shall equipment or products such as pipe, structural steel, castings, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground.

- D. Slings and chains shall be of size and capacity rating to safely support the weights of items to be unloaded. Slings and chains shall be regularly inspected and tagged as in good conditions in accord with OSHA requirements. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SUMMARY

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

1.02 RELATED DOCUMENTS

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures
 - 2. Final completion procedures
 - 3. Warranties
 - 4. Final cleaning
 - 5. Repair of the Work
 - 6. Specific closeout and special cleaning requirements for the Work in those Sections

1.03 SUBMITTALS

Submit the following shop drawings in accordance with Section 01 30 00 - Submittals:

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.
- D. Certificates of Release: From authorities having jurisdiction.
- E. Certificate of Insurance: For continuing coverage.
- F. Field Report: For pest control inspection.
- G. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.04 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following: a minimum of (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting County unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Divisions 02 through 16 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Divisions 02 through 50 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by the County. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain the signature of an authorized County representative for receipt of submittals.
 - 5. Submit test/adjust/balance records.
 - 6. Submit sustainable design submittals required in Division 01 (sustainable design requirements Section) and in individual Division 02 through 50 Sections.
 - 7. Submit changeover information related to County's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following: a minimum of (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise the County of pending insurance changeover requirements.

2. Make final changeover of permanent locks and deliver the keys to County. Advise the County's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct County's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section - Training.
 6. Advise County of changeover in heat and other utilities.
 7. Participate with County in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Remove labels that are not permanent labels.
 10. Complete final cleaning requirements, including touchup painting.
 11. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, County will either proceed with inspection or notify Contractor of unfulfilled requirements. County will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by County, that shall be completed or corrected before certificate shall be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection shall form the basis of requirements for final completion.

1.05 STARTING OF SYSTEMS

- A. Conform to the requirements of sections within Division 1.
- B. Coordinate schedule for start-up of various equipment and systems.
- C. Notify County (seven) days prior to start-up of each item.

- D. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- E. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
- F. Verify wiring and support components for equipment are complete and tested.
- G. Execute start-up under supervision of applicable manufacturer's representative, Contractors' personnel, and County in accordance with manufacturers' instructions.
- H. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, approve equipment or system installation prior to start-up, to supervise placing equipment or system in operation, and to train the County's staff.

1.06 DEMONSTRATION AND INSTRUCTIONS

- A. Conform to the requirements of Sections 01 64 00 - Manufacturer's Services and 01 65 00 - Facility Startup.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within (six) months.
- C. Utilize operation and maintenance manuals as the basis for instruction. Review contents of manual with County's personnel in detail to comprehensively explain the operation and maintenance.
- D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at a scheduled and agreed time, for each piece of equipment at each designated location. Time shall be acceptable to the County.
- E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- F. Required instruction time for each item of equipment and system is specified in individual sections.

1.07 TESTING, ADJUSTING, AND BALANCING

- A. County shall appoint and employ services of independent firm to perform testing, adjusting, and balancing to ensure smooth and unhindered equipment operation. Contractor shall pay for services and funds shall be within the contract price. Reports shall be submitted by independent firm to County indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.

1.08 PROJECT RECORDS DOCUMENTS

- A. The Contractor shall record any actual revisions to the Work and maintain one set of the following Project Record Documents on Site:
 - 1. Contract Drawings, Specifications, and Addenda.
 - 2. Change Orders, Field Orders, and other written notices.
 - 3. Shop drawings, Product data, and samples.
 - 4. Records of surveying and layout Work.
 - 5. Project Record Drawings.
- B. The Contractor shall record information on the Project Record Documents concurrent with construction progress and store these documents separately from the documents used for construction.
 - 1. The County will supply a set of Contract Drawings. The Contractor shall mark thereon each revision as the Work progresses in order to produce a set of as-built drawings.
 - 2. The Contractor shall note any changes made during construction by any of the Contractor's forces or those of any subcontractors.
 - 3. The Contractor shall dimension the locations of buried or concealed Work, especially piping and conduit, with reference to exposed structures.
 - 4. The Contractor shall note the installed locations of concealed service lines on the Site or within the structure by reference from the center line of the service to the structure column lines, to other main finished faces, or to other structural points that are easily identified and located in the finished Work.
 - 5. Certificates of Substantial Performance and Total Performance shall not be issued until as-built drawings are complete and submitted, and the Contractor has fully satisfied the requirements for Substantial Performance and Total Performance of the Work.
- C. For Project Record Documents and Record Shop Drawings, the Contractor shall legibly mark each item to record actual construction, including:
 - 1. Field changes of dimensions and details.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances that are concealed in construction, referenced to visible and accessible features of the Work.

4. Any Changes in the Work from the contract documents.
 5. The location of concealed mechanical services and electrical main feeders, junction boxes, and pull boxes.
- D. Upon completion of the Work, the Contractor shall prepare two DVD-ROM or USB thumb drive sets of the Record Shop Drawings and an index.
- E. The Contractor-prepared Record Shop Drawings DVD-ROM index shall identify the County's project number, project name, and Contract number and the contents of each DVD in the format listed below.
1. The index shall include the following columns of information for each Record Shop Drawing:
 - a. DVD number
 - b. Specification Section number
 - c. Specification title
 - d. Shop drawing transmittal number
 - e. Shop drawing equipment description including preselected Equipment vendor and supplier.
 2. The index shall be printed by the following two sorts:
 - a. Primary sort: Specification Section number. Secondary sort: shop drawing transmittal number.
 - b. Primary sort: DVD number. Secondary sort: Specification Section number.
 3. The index shall be generated using Microsoft Excel software. A copy of the electronic file shall be furnished to the County.
 4. The Contractor shall provide a set of Project Record Documents on DVD-ROM or USB thumb drive in an electronic format compatible with the plant DVD-ROM record standards. All drawings are to be provided electronically on DVD-ROM in both AutoCAD (latest version) and Adobe Acrobat PDF (latest version). Also provide a set of DVD-ROMs containing the software implemented on this project, including standard software and custom application software. Also provide a set of DVD-ROMs containing the various programming tools and files necessary for maintenance, editing, backing up, and restoring programmable equipment implemented on this project.

1.09 EQUIPMENT INVENTORY SPREADSHEET

- A. As part of the County's asset management program, the Contractor shall complete each field for the equipment inventory file for each piece of equipment and device provided under this Contract, as a requirement for Substantial Performance. An electronic format of the equipment inventory spreadsheet shall be provided on a DVD by the Contractor.

1.10 EQUIPMENT PREVENTIVE MAINTENANCE SPREADSHEET

- A. As part of the County's asset management program, the Contractor shall complete each field for each piece of equipment and device provided under this Contract, as a requirement for Substantial Completion. The Contractor shall transfer the manufacturer's recommended preventive maintenance tasks and frequencies into the spreadsheet. An electronic format of the equipment inventory spreadsheet shall be provided on a DVD by the Contractor.

1.11 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 them 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.

1.12 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.
- B. Deliver to location as directed by County; obtain receipt prior to final payment.
- C. Crate in containers designed for prolonged storage suitable for handling with hoisting equipment containers:
- D. Stencil on containers:
 - 1. Manufacturer/supplier name

2. Unit name
3. Spare part name
4. Manufacturer catalog number
5. Other identifying information
6. Precautionary information

1.13 FINAL COMPLETION PROCEDURES

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

1.14 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction, including, if necessary, areas disturbed by the Contractor that are outside the limits of construction.
 1. Organize the list of spaces in sequential order, starting with exterior areas first, and proceeding from the lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Include the following information at the top of each page:
 - a. Project name
 - b. Date
 - c. Name of Contractor
 - d. Page number
4. Submit list of incomplete items in the following format:
 - a. PDF electronic file. County will return annotated file.
 - b. Three paper copies. County will return two copies.

1.15 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of the County for designated portions of the Work where commencement of warranties other than the date of Substantial Completion is indicated, or when a delay in submittal of warranties might limit the County's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of the Work that are completed and occupied or used by County during the construction period, by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Contract Documents.
 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper or as directed by the County.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of installers.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the Georgia Code of Regulations maximum allowable volatile organic compound (VOC) levels.

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. General: Perform final cleaning as directed by the County.
- B. Pest Control: Comply with pest control requirements in Division 01, Section, Temporary Facilities and Controls. Prepare and submit a written report to the County.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Division 1 and meet local laws.

3.02 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determining Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration. Do not paint over "UL" or other required labels and identification, including mechanical and electrical nameplates. Remove any paint that has been applied to required labels and identification.
 - 3. Replace parts that have been subjected to operating conditions during construction that could impede operation or reduce longevity.

4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

3.03 ADJUSTING

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

END OF SECTION

SECTION 01800

MAINTENANCE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Contractor shall maintain stored and installed equipment and materials until Final Acceptance of the Work as defined by the General Requirements. Work includes, but is not limited to:
 - 1. Perform required maintenance.
 - 2. Repair and maintain protective coatings.
 - 3. Repair and replace scratched and damaged materials and equipment.
 - 4. Maintain and operate new equipment placed into service.
- B. Work, per this Section, starts on the date the equipment and materials are received and continue until the Date of Final Acceptance.
- C. Contractor shall monitor equipment storage, and subsequently, the operation and material functionality on a continual basis during the specified time period. Deterioration of materials or malfunction of equipment shall be followed by swift repair action to minimize the damage. Such repair shall include repair and technical services by an independent contractor if the County deems the Contractor's efforts are ineffective at correcting the problem.
- D. All costs for maintenance and repair of stored and installed equipment and materials, including costs from an independent contractor, during the specified time period shall be the sole responsibility of the Contractor.

END OF SECTION

SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Scope

1. This section covers the labor, equipment, and materials necessary for the work associated with the demolition or removal of pipes, manholes, catch basins, pavement, houses, and other structures within the construction easements shown on the Plans, including all necessary excavation and backfilling.
2. Where removing structural tile and brick from existing structures, the work shall include all patching and reconditioning to restore the remaining tile or brick to its existing state and to provide a proper joint for joining the existing to new construction.
3. Where concrete is cut from existing structures under this Section to permit setting or inserting pipes, flumes, equipment or appurtenances, the work shall include all re-concreting, dressing and finishing of openings to the required lines and dimensions or as necessary for the placing and fixing of inserts. This repair is to meet all structural and leakage requirements and shall use non – shrink material.
4. The Contractor shall remove from existing structures and salvage, store or dispose of as specified hereinafter, all valves and piping, mechanical equipment, plumbing, heating, electrical, and ventilating fixtures, pipes, ducts, wires, and equipment, doors and windows, floor grating and cover plates, steel stairs, pipe railing, and the like that are not to remain in service in the finished work, whether or not shown on the Drawings and/or specified herein.
5. The work specified herein and shown on the Drawings is intended to give a general idea of the scope of this work but must not be construed as covering it entirely. The Contractor shall visit the site and judge the amount of work required and the problems anticipated in the performance of the work.

B. Asbestos Abatement:

1. The Contractor shall furnish all labor, materials, facilities, equipment, services, employee training and testing, and waste transportation and disposal for the removal of asbestos-containing materials (ACM) at the site of the Work. Asbestos could possibly be encountered in demolition of houses, structures, and piping to be demolished.

2. All asbestos removal work shall be performed in accordance with the requirements established by the EPA, OSHA, Georgia Department of Transportation, NIOSH and State of Georgia EPD regulations; and any other applicable Federal, State and local regulations governing ACM abatement. Whenever there is a conflict or overlap of the above references, the most stringent provisions shall apply.
3. The Contractor, or an asbestos abatement subcontractor acceptable to the County, must be licensed in Georgia to perform asbestos abatement and meet other qualification requirements specified in this section. The Contractor shall include a program for protective equipment, breathing apparatus, work area security, and all other aspects dealing with health and safety in his Health, Safety, and Security Plan. This information may be called for elsewhere in these Specifications, however a submittal is required.

C. Related Work Specified Elsewhere:

1. Section 01210 - Measurement and Payment

1.02 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01 30 00 Submittals. In addition, the following specific information shall be provided:
 1. The Contractor shall submit to the County a schedule of demolition, detailed methods of demolition to be used for each structure, copies of authorization, and permits to demolish the structures.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The Contractor shall provide all materials and equipment in suitable and adequate quantities as required to accomplish demolition work.

PART 3 - EXECUTION

3.01 SAFETY REQUIREMENTS

- A. All work shall be performed in conformance with the laws and regulations pertaining to safety established by Federal, State, and local governments and other authorities having jurisdiction.

3.02 UTILITIES

- A. The Contractor shall be responsible for maintaining all appropriate utility services during the demolition operations.

- B. Total shutdown of the existing utilities to perform any new construction, to make the required structural or piping modifications, and/or to make or install the required service or system modifications, will not be permitted, except by written request and approval of the County.
- C. Prior to making any piping or connections or modifications to existing facilities, the Contractor shall obtain specified timing and schedule approval from the County.

3.03 EQUIPMENT TO BE SALVAGED BY THE COUNTY

- A. The following is a partial list of materials to be removed and salvaged. The County will identify other materials to be salvaged during the course of the Work. Equipment on this list will be removed by the Contractor before the demolition work begins and delivered to a site specified by the County.
 - 1. Frames, Grates, and Manhole Covers
 - 2. Fire Hydrants
 - 3. Valves
 - 4. Pumps
 - 5. Meters
 - 6. Backflow Devices

3.04 REMOVAL AND STORAGE OF EQUIPMENT FOR REUSE

- A. No structure shall be removed without the approval and consent of the County unless shown on the Plans to be removed. The Contractor shall maintain all equipment in the same condition as when it was removed. The condition of the structure shall be determined prior to removal by the County. The Contractor assumes the responsibility for assuring that the material is properly stored and maintained.

3.05 DEMOLITION

- A. The Plans define the portion of the structures to be removed. Unless otherwise shown on the Plans, the Contractor shall not make rough cuts or breaks that exceed the limits of demolition shown.
- B. All equipment, materials, and piping, except as specified hereinbefore, within the limits of the demolition shall become the property of the Contractor.

3.06 REMOVAL OF EXISTING PIPING

- A. Where existing piping is in conflict with new piping or construction, rerouting or redesign shall be as directed by the County.

3.07 REMOVAL OF ASBESTOS-CONTAINING MATERIALS

- A. The Contractor shall provide all services to perform the work as follows:
 - 1. Remove asbestos containing materials as required by applicable codes and regulations.
 - 2. Isolate each work area and erect temporary staging, containment barriers, and decontamination facilities as required.
 - 3. Remove all ACM from the work area.
 - 4. Thoroughly clean each work area and perform clearance air testing using NIOSH Method 7400.
 - 5. Remove all temporary staging, partitions, and other items installed to perform the work.
 - 6. Dispose of ACM in accordance with applicable Federal, State, and local laws and regulations.

3.08 DISPOSAL OF DEMOLITION DEBRIS

- A. The Contractor shall dispose of demolition debris in accordance with the requirements in the contract documents.

END OF SECTION

SECTION 03000

CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete, reinforcing, and related materials.
2. The Work includes:
 - a. Providing concrete consisting of Portland cement, fine and coarse aggregates, water, and approved admixtures; combined, mixed, transported, placed, finished, and cured.
 - b. Fabricating and placing reinforcing, including ties and supports.
 - c. Design, erection, and removal of formwork.
 - d. Building into the concrete all sleeves, frames, anchorage devices, inserts, and other items required to be embedded in concrete.
 - e. Providing openings in concrete as required to accommodate Work under this and other Sections.

B. Coordination:

1. Review installation procedures under other Sections and coordinate installation of items to be installed in the concrete Work.
2. Notify other contractors in advance of placing concrete to provide other contractors with sufficient time for installing items included in their contracts that are to be installed in the concrete Work.

C. Classifications of Concrete:

1. Class "A" concrete shall be steel-reinforced and includes all concrete unless otherwise shown or indicated.
2. Class "B" concrete shall be placed without forms or with simple forms, with little or no reinforcing and includes the following:
 - a. Concrete fill.
 - b. Duct banks.
 - c. Unreinforced encasements.

- d. Curbs and gutters.
- e. Sidewalks.
- f. Thrust blocks.

B. Related Sections:

- 1. Section 05053, Anchor Systems.
- 2. Section 07920, Joint Sealants.

1.02 REFERENCES

A. Standards referenced in this Section are:

- 1. ACI 224R, Control of Cracking in Concrete Structures.
- 2. ACI 301, Specifications for Structural Concrete for Buildings.
- 3. ACI 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
- 4. ACI 305R, Specification for Hot Weather Concreting.
- 5. ACI 306R, Cold Weather Concreting.
- 6. ACI 309R, Guide for Consolidation of Concrete.
- 7. ACI 318, Building Code Requirements for Structural Concrete and Commentary.
- 8. ACI 347, Guide to Formwork for Concrete.
- 9. ACI SP-66, ACI Detailing Manual.
- 10. ASTM A185/A185M, Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- 11. ASTM A615/A615M, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- 12. ASTM C31/C31M, Practice for Making and Curing Concrete Test Specimens in the Field.
- 13. ASTM C33/C33M, Specification for Concrete Aggregates.
- 14. ASTM C39/C39M, Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- 15. ASTM C94/C94M, Specification for Ready-Mixed Concrete.

16. ASTM C138/C138M, Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
17. ASTM C143/C143M, Test Method for Slump of Hydraulic-Cement Concrete.
18. ASTM C150/C150M, Specification for Portland Cement.
19. ASTM C172, Practice for Sampling Freshly Mixed Concrete.
20. ASTM C231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
21. ASTM C260, Specification for Air-Entraining Admixtures for Concrete.
22. ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
23. ASTM C494/C494M, Specification for Chemical Admixtures for Concrete.
24. ASTM C579, Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
25. ASTM C1064/C1064M, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
26. ASTM D1752, Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
27. CRD-C 572, U.S. Army Corps of Engineers Specification for Polyvinylchloride Waterstops.
28. CRSI 1MSP, Manual of Standard Practice.

1.03 QUALITY ASSURANCE

- A. Laboratory Trial Batch:
 1. Employ independent testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes.
 2. Each concrete mix design specified shall be verified by laboratory trial batch, unless indicated otherwise.
 3. Perform the following testing on each trial batch:
 - a. Aggregate gradation for fine and coarse aggregates.
 - b. Slump.

- c. Air content.
- d. Compressive strength based on three cylinders each tested at seven days and at 28 days.
- 4. Submit for each trial batch the following information:
 - a. Project identification name and number (if applicable).
 - b. Date of test report.
 - c. Complete identification of aggregate source of supply.
 - d. Tests of aggregates for compliance with the Contract Documents.
 - e. Scale weight of each aggregate.
 - f. Absorbed water in each aggregate.
 - g. Brand, type, and composition of cementitious materials.
 - h. Brand, type, and amount of each admixture.
 - i. Amounts of water used in trial mixes.
 - j. Proportions of each material per cubic yard.
 - k. Gross weight and yield per cubic yard of trial mixtures.
 - l. Measured slump.
 - m. Measured air content.
 - n. Compressive strength developed at seven days and 28 days, from not less than three test cylinders cast for each seven day and 28-day test, and for each design mix.

1.04 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Shop Drawings:
 - a. List of concrete materials and concrete mix designs proposed for use. Include results of tests performed to qualify the materials and to establish the mix designs. Do not start laboratory trial batch testing until this submittal is approved by ENGINEER.
 - b. Laboratory Trial Batch Reports: Submit laboratory test reports for concrete cylinders, materials, and mix design tests.

- c. Concrete placement drawings showing the location and type of all joints.
 - d. Drawings for fabricating, bending, and placing concrete reinforcing. Comply with ACI SP-66. For walls and masonry construction, provide elevations to a minimum scale of 1/4-inch to one foot. Show bar schedules, stirrup spacing, adhesive dowels, splice lengths, diagrams bent bars, arrangements, and assemblies, as required for fabricating and placing concrete reinforcing.
- 2. Product Data:
 - a. Manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.
- 3. Samples:
 - a. Samples: Submit samples of materials as specified and as otherwise requested by ENGINEER, including names, sources, and descriptions.
- B. Informational Submittals: Submit the following:
 - 1. Delivery Tickets: Copies of all delivery tickets for each load of concrete delivered to or mixed at the Site. Each delivery tickets shall contain the information in accordance with ASTM C94/C94M along with project identification name and number (if any), date, mix type, mix time, quantity and amount of water introduced.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Transportation, Delivery, and Handling:
 - 1. Deliver concrete reinforcing products to Site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings on approved Shop Drawings.
 - 2. Materials used for concrete shall be clean and free from foreign matter during transportation and handling, and kept separate until measured and placed into concrete mixer.
 - 3. Implement suitable measures during hauling, piling, and handling to ensure that segregation of coarse and fine aggregate particles does not occur and grading is not affected.
 - 4. Deliver grout materials from manufacturers in unopened containers that bear intact manufacturer labeling.
 - 5. Comply with Section 01610, Transportation and Handling.

B. Storage:

1. Store formwork materials above ground on framework or blocking. Cover wood for forms and other accessory materials with protective, waterproof covering. Provide for adequate air circulation or ventilation under cover.
2. Store concrete reinforcing materials to prevent damage and accumulation of dirt and excessive rust. Store on heavy wood blocking so that reinforcing does not come into contact with the ground. Space framework or blocking supports to prevent excessive deformation of stored materials.
3. Store concrete joint materials on platforms or in enclosures or covered to prevent contact with ground and exposure to weather and direct sunlight.
4. For storage of concrete materials, provide bins or platforms with hard, clean surfaces.
5. Comply with Section 01610, Transportation and Handling.

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type II.
- B. Aggregates: ASTM C33/C33M.
1. Fine Aggregate: Clean, sharp, natural sand free of loam, clay, lumps, and other deleterious substances. Dune sand, bank run sand, and manufactured sand are unacceptable.
 2. Coarse Aggregate:
 - a. Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter.
 - b. Coarse aggregate shall comply with the following:
 - 1) Crushed stone, processed from natural rock or stone.
 - 2) Washed gravel, either natural or crushed. Slag, pit gravel, and bank-run gravel are not allowed.
 - c. Coarse Aggregate Size: ASTM C33/C33M, Nos. 57 or 67, unless otherwise approved by ENGINEER.
- C. Water: Clean, potable.
- D. Admixtures:
1. Air-Entraining Admixture: ASTM C260.

2. Water-Reducing Admixture: ASTM C494/C494M, Type A.
3. Water Reducing and Set-Adjusting Admixtures: ASTM C494/C494M, Types D and E.
4. High Range Water-Reducing Admixture: ASTM C494/C494M, Type F/G.
5. Use only admixtures that have been tested and approved in the mix designs.
6. Do not use calcium chloride or admixtures containing chloride ions.

2.02 CONCRETE MIX

A. General:

1. Normal weight: 145 pounds per cubic foot.
2. Use air-entraining admixture in all concrete. Provide not less than four percent, nor more than eight percent, entrained air for concrete exposed to freezing and thawing, and provide from three to five percent entrained air for other concrete.

B. Proportioning and Design of Class "A" Concrete Mix:

1. Minimum compressive strength at 28 days: 4,500 psi.
2. Maximum water-cement ratio by weight: 0.42.
3. Minimum cement content: 564 pounds per cubic yard.

C. Proportioning and Design of Class "B" Concrete Mix:

1. Minimum compressive strength at 28 days: 3,000 psi.
2. Maximum water-cement ratio by weight: 0.50.
3. Minimum cement content: 517 pounds per cubic yard.

D. Slump Limits:

1. Proportion and design mixes to result in concrete slump at point of placement of not less than two inches and not more than four inches.
2. When using high-range water reducers, slump prior to addition of admixture shall not exceed three inches. Slump after adding admixture shall not exceed nine inches at point of placement.

E. Adjustment of Concrete Mixes:

1. Concrete mix design adjustments may be requested by CONTRACTOR when warranted by characteristics of materials, site conditions, weather, test results, or other, similar circumstances.
2. Submit for ENGINEER's approval laboratory test data for adjusted concrete mix designs, including compressive strength test results.
3. Implement adjusted mix designs only after ENGINEER's approval.
4. Adjustments to concrete mix designs shall not result in additional costs to OWNER.

2.03 FORM MATERIALS

- A. Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection. CONTRACTOR shall be responsible for designing the formwork system to resist all applied loads including pressures from fluid concrete and construction loads.
- B. Smooth Form Surfaces: Acceptable panel-type to provide continuous, straight, smooth, as-cast surfaces in accordance with ACI 301.
- C. Unexposed Concrete Surfaces: Material to suit project conditions.
- D. Provide 3/4-inch chamfer at all external corners. Chamfer is not required at re-entrant corners unless otherwise shown or indicated.
- E. Form Ties:
 1. Provide factory-fabricated, removable, or snap-off metal form ties, that prevent form deflection and prevent spalling of concrete surfaces upon removal. Materials used for tying forms are subject to approval of ENGINEER.
 2. Unless otherwise shown or indicated, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1.5 inches from outer surface of concrete. Unless otherwise shown or indicated, provide form ties that, upon removal, will leave a uniform, circular hole not larger than one-inch diameter in the concrete surface.
 3. Ties for exterior walls, below-grade walls, and walls subject to hydrostatic pressure shall be provided with waterstops.
 4. Wire ties are unacceptable.

2.04 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed bars.
- B. Welded Wire Fabric: ASTM A185/A185M.

- C. Steel Wire: ASTM A82/A82M.
- D. Provide supports for reinforcing including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing in place.
 - 1. Use wire bar-type supports complying with CRSI MSP1 recommendations, except as specified in this Section. Do not use wood, brick, or other unacceptable materials.
 - 2. For slabs on grade, use precast concrete blocks, four inches square minimum with compressive strength equal to or greater than the surrounding concrete, or supports with sand plates or horizontal runners where base materials will not support chair legs.
 - 3. For all concrete surfaces where legs of supports are in contact with forms, provide supports having either hot-dip galvanized, plastic-protected, or stainless-steel legs in accordance with CRSI MSP1.
 - 4. Provide precast concrete supports over waterproof membranes.
- E. Adhesive Dowels:
 - 1. Dowels:
 - a. Dowel reinforcing bars shall comply with ASTM A615, Grade 60.
 - 2. Adhesive:
 - a. For requirements for adhesive, refer to Section 05053, Anchor Systems.

2.05 RELATED MATERIALS

- A. Waterstops:
 - 1. PVC Waterstops:
 - a. Manufacturers: Provide products of one of the following:
 - 1) W.R. Meadows, Inc.
 - 2) Greenstreak Plastic Products Company.
 - 3) Or equal.
 - b. Waterstops shall comply with CRD-C 572. Do not use reclaimed or scrap material.
 - c. Minimum Thickness: 3/8-inch.

- d. Provide waterstops with minimum of seven ribs equally spaced at each end on each side with the first rib located at the edge. Each rib shall be minimum 1/8-inch in height.
 - e. Construction Joints: Waterstops shall be six-inch wide flat-strip type.
 - f. Expansion Joints: Waterstops shall be nine-inch-wide center bulb type.
2. Hydrophilic Waterstops:
- a. Products and Manufacturers: Provide one of the following:
 - 1) Duroseal Gasket, by BBZ USA, Inc.
 - 2) Adeka Ultraseal MC-2010M, by Asahi Denka Kogyo K.K.
 - 3) Hydrotite, by Greenstreak Plastic Products Company.
 - 4) Or equal.
 - b. Hydrophilic waterstop materials shall be bentonite-free and shall expand by minimum of 80 percent of dry volume in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast.
 - c. Waterstop material shall be composed of resins and polymers that absorb water and cause a completely reversible and repeatable increase in volume.
 - d. Waterstop material shall be dimensionally stable after repeated wet-dry cycles with no deterioration of swelling potential.
 - e. Select material in accordance with manufacturer's recommendations for type of liquid to be contained.
 - f. Minimum cross-sectional dimensions: 3/16-inch by 3/4-inch.
 - g. Location of hydrophilic waterstops shall be as shown or indicated on the Drawings, or where approved by ENGINEER.
 - h. Hydrophilic Sealant: Shall adhere firmly to concrete, metal, and PVC in dry or damp condition and be indefinitely elastic when cured.
 - 1) Products and Manufacturers: Provide one of the following:
 - a) Duroseal Paste, by BBZ USA, Inc.
 - b) Adeka Ultraseal P-201, by Asahi Denka Kogyo K.K.
 - c) Hydrotite, by Greenstreak Plastic Products Company.

d) Or equal.

B. Vapor Retarder:

1. Products and Manufacturers: Provide one of the following:
 - a. Stego Wrap 10-mil Vapor Retarder, by Stego Industries LLC.
 - b. Griffolyn 10-mil, by Reef Industries.
 - c. Moistop Ultra, by Fortifiber Industries.
 - d. Or equal.
2. Vapor retarder membrane shall comply with the following.
 - a. Water Vapor Transmission Rate, ASTM E96/E96M: 0.04 perms or lower.
 - b. Water Vapor Retarder, ASTM E1745: Meets or exceeds Class C.
 - c. Thickness of Retarder (plastic), ACI 302 1R: Not less than 10 mils.
 - d. Provide accessories by same manufacturer as vapor retarder.

C. Membrane-Forming Curing Compound: ASTM C309, Type I.

D. Epoxy Bonding Agent:

1. Two-component epoxy resin bonding agent.
2. Products and Manufacturers: Provide one of the following:
 - a. Sikadur 32, Hi-Mod LPL, by Sika Corporation.
 - b. Eucopoxy LPL, by the Euclid Chemical Company.
 - c. Or equal.

E. Epoxy-Cement Bonding Agent:

1. Three-component blended epoxy resin-cement bonding agent.
2. Products and Manufacturers: Provide one of the following:
 - a. Sika Armatec 110 EpoCem, by Sika Corporation.
 - b. Duralprep A.C., by Euclid Chemical Company.
 - c. Or equal.

F. Preformed Expansion Joint Filler:

1. Provide preformed expansion joint filler complying with ASTM D1752, Type I (sponge rubber) or Type II (cork).

G. Joint Sealant and Accessories:

1. For joint sealants and accessories used on isolation joints, control joints, and expansion joints, refer to Section 07 92 00, Joint Sealants.

2.06 GROUT

A. Non-shrink Grout:

1. Pre-packaged, non-metallic, cementitious grout requiring only the addition of water at the Site.
2. Minimum 28-day Compressive Strength: 7,000 psi.
3. Products and Manufacturers: Provide one of the following:
 - a. NS Grout by Euclid Chemical Company.
 - b. Set Grout by Master Builders, Inc.
 - c. NBEC Grout by Five Star Products, Inc.
 - d. Or equal.

B. Epoxy Grout:

1. Pre-packaged, non-shrink, non-metallic, 100 percent solids, solvent-free, moisture-insensitive, three-component epoxy grouting system.
2. Minimum Seven-day Compressive Strength: 14,000 psi, when tested in accordance with ASTM C579.
3. Products and Manufacturers: Provide one of the following:
 - a. Euco High Strength Grout, by Euclid Chemical Company.
 - b. Sikadur 42, Grout Pak, by Sika Corporation.
 - c. Five Star Epoxy Grout, by Five Star Products, Inc.
 - d. Or equal.

C. Grout Fill:

1. Grout mix shall consist of cement, fine and coarse aggregates, water, and admixtures complying with requirements specified in this Section for similar materials in concrete.
2. Proportion and mix grout fill as follows:
 - a. Minimum Cement Content: 564 pounds per cubic yard.
 - b. Maximum Water-Cement Ratio: 0.45.
 - c. Maximum Coarse Aggregate size: 1/2-inch, unless otherwise indicated.
 - d. Minimum 28-day Compressive Strength: 4,000 psi.

PART 3 – EXECUTION

3.01 INSPECTION

- A. CONTRACTOR shall examine the substrate and the conditions under which the Work will be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 FORMWORK

- A. Construct formwork in accordance with ACI 347 such that concrete members and structures are of correct size, shape, alignment, elevation, and position.
- B. Provide openings in formwork to accommodate the Work of other trades. Accurately place and securely support items required to be built into formwork.
- C. Clean and adjust forms prior to placing concrete. Apply form release agents or wet forms as required. Re-tighten forms during and after concrete placing, when required, to eliminate cement paste leaks.
- D. Removing Formwork:
 1. Comply with ACI 301 and ACI 347, except as otherwise indicated in the Contract Documents.
 2. Do not remove formwork and shoring until supported concrete members have acquired minimum of 90 percent of specified compressive strength. Results of suitable quality control tests of field-cured specimens may be submitted to ENGINEER for review as evidence that concrete has attained sufficient strength for removal of supporting formwork and shoring prior to removal times indicated in the Contract Documents.
 3. Removal time for formwork is subject to ENGINEER's acceptance.
 4. Repair form tie-holes following in accordance with ACI 301.

3.03 REINFORCING, JOINTS, AND EMBEDDED ITEMS

- A. Comply with the applicable recommendations of Laws and Regulations and standards referenced in this Section, including CRSI MSP1, for details and methods of placing and supporting reinforcing.
- B. Clean reinforcing to remove loose rust and mill scale, earth, ice, and other materials which act to reduce or destroy bond between reinforcing material and concrete.
- C. Position, support, and secure reinforcing against displacement during formwork construction and concrete placing. Locate and support reinforcing by means of metal chairs, runners, bolsters, spacers, and hangers, as required.
 - 1. Place reinforcing to obtain minimum concrete coverages as shown on the Drawings and as required in ACI 318. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcing accurately in position during concrete placing. Set with ties so that twisted ends are directed away from exposed concrete surfaces.
 - 2. Do not secure reinforcing to formwork using wire, nails or other ferrous metal. Metal supports subject to corrosion shall not be in contact with formed or exposed concrete surfaces.
- D. Provide sufficient quantity of supports of strength required to carry reinforcing. Do not place reinforcing more than two inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
- E. Splices: Provide standard reinforcing splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown or indicated for minimum lap of spliced bars.
- F. Install welded wire fabric in lengths as long as practical, lapping adjoining sections a minimum of one full mesh.
- G. Do not place concrete until reinforcing is inspected and ENGINEER indicates that conditions are acceptable for placing concrete. Concrete placed in violation of this paragraph will be rejected. Notify ENGINEER in writing at least two working days prior to proposed concrete placement.
- H. Joints:
 - 1. Provide construction, isolation, expansion, and control joints as indicated or required. Locate construction joints so as to not impair the strength and appearance of the structure. Place isolation and control joints in slabs-on-grade to stabilize differential settlement and random cracking.
 - 2. In walls, locate joints at a maximum spacing of 40 feet and approximately 12 feet from corners.

3. In foundation slabs and slabs-on-grade, locate joints at intervals of approximately 40 feet.
 4. In mats and structural slabs and beams, locate joints in compliance with ACI 224R.
 5. Locations of joints shall be in accordance with the Contract Documents and as approved by ENGINEER in the Shop Drawings.
 6. Where construction joints are indicated to be roughened, intentionally roughen surfaces of previously-placed concrete to amplitude of 1/4-inch.
- I. Installation of Embedded Items: Set and build into the Work anchorage devices and embedded items required for other Work that is attached to, or supported by, cast-in-place concrete. Use setting diagrams, templates, and instructions provided under other Sections and, when applicable, for locating and setting. Refer to Paragraph 1.1.B of this Section. Do not embed in concrete uncoated aluminum items. Where aluminum items are in contact with concrete surfaces, coat aluminum to prevent direct contact with concrete.
- J. Adhesive Dowels:
1. Adhesive dowels shall be reinforcing bar dowels set in an adhesive in hole drilled into hardened concrete. Comply with adhesive system manufacturer's installation instructions regarding hole diameter, drilling method, embedment depth required to fully develop required tensile strength, and hole cleaning and preparation instructions. Unless more-stringent standards are required by adhesive system manufacturer, comply with the following.
 2. Drill holes to adhesive system manufacturer's recommended diameter and depth to develop required tensile strength. Where indicated on the drawings, hole depths greater than required for tensile development shall be provided. Hammer-drill holes. Cored holes are not allowed.
 3. Embedment depths shall be based on concrete compressive strength of 2,000 psi when embedded in existing concrete, and 4,000 psi when embedded in new concrete.
 4. Determine location of existing reinforcing steel in vicinity of proposed holes prior to drilling. Adjust location of holes to be drilled to avoid drilling through or damaging existing reinforcing bars only when approved by ENGINEER.
 5. Before setting adhesive dowel, hole shall be free of dust and debris using method recommended by adhesive system manufacturer. Hole shall be brushed, with manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove dust and loose particles. Hole shall be dry as defined by adhesive system manufacturer.

6. Inject adhesive into hole through injection system mixing nozzle and necessary extension tubes, placed to bottom of hole. Withdraw discharge end as adhesive is placed, but keep end of tube immersed to prevent forming air pockets. Fill hole to depth that ensures that excess material is expelled from hole during dowel placement.
7. Twist dowels during insertion into partially-filled hole to guarantee full wetting of bar surface with adhesive. Insert bar slowly to avoid developing air pockets.

3.04 CONCRETE PLACING

- A. Site Mixing: Use drum-type batch machine mixer, mixing not less than 1.5 minutes for one cubic yard or smaller capacity. Increase required mixing time by minimum of 15 seconds for each additional cubic yard or fraction thereof.
- B. Ready-Mixed Concrete: Comply with ASTM C94/C94M.
- C. Concrete Placing:
 1. Place concrete in a continuous operation within planned joints or sections in accordance with ACI 304R.
 2. Do not begin placing concrete until work of other trades affecting concrete is completed.
 3. Wet concrete and subgrade surfaces to saturated surface dry condition immediately prior to placing concrete.
 4. Deposit concrete as near its final location as practical to avoid segregation due to re-handling or flowing.
 5. Avoid separation of the concrete mixture during transportation and placing. Concrete shall not free-fall for distance greater than four feet during placing.
 6. Complete concrete placing within 90 minutes of addition of water to the dry ingredients. The use of hydration control admixtures can extend this time period. Approval from the ENGINEER is required.
- D. Consolidate placed concrete in accordance with ACI 309R using mechanical vibrating equipment supplemented with hand rodding and tamping, such that concrete is worked around placing and other embedded items and into all parts of formwork. Insert and withdraw vibrators vertically at uniformly-spaced locations. Do not use vibrators to transport concrete within the formwork. Vibration of formwork or placing is not allowed.
- E. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.
 1. In hot weather comply with ACI 305R.

2. In cold weather comply with ACI 306R.

3.05 QUALITY OF CONCRETE WORK

- A. Make concrete solid, compact, smooth, and free of laitance, cracks, and cold joints.
- B. Concrete for liquid-retaining structures and concrete in contact with earth, water, or exposed directly to the elements shall be watertight.
- C. Cut out and properly replace to extent directed by ENGINEER, or repair to satisfaction of ENGINEER, surfaces that contain cracks or voids, are unduly rough, or are in defective in any way. Patches or plastering are unacceptable.
- D. Repair, removal and replacement of defective concrete directed by ENGINEER shall be at no additional cost to OWNER.

3.06 CURING

- A. Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Continue curing by using moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until formwork is removed. Provide protection, as required, to prevent damage to exposed concrete surfaces. Total curing period shall not be less than seven days. Curing methods and materials shall be compatible with scheduled finishes.

3.07 FINISHING

- A. Slab Finish:
 1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently. Use a wood float only. Check and level surface plane to a tolerance not exceeding 1/4-inch in ten feet when tested with a ten-foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float the surface to a uniform, smooth, granular texture. Slab surfaces shall receive a float finish. Provide additional trowel finishing as required in this Section.
 2. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over the surface.
 3. Consolidate concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in ten feet when tested with a ten-foot straightedge. Grind smooth surface defects that would telegraph through applied floor covering system.

4. Use trowel finish for the following:
 - a. Interior exposed slabs, unless otherwise shown or indicated.
 - b. Apply non-slip broom finish, after troweling, to exterior concrete slab and elsewhere as shown.
- B. Apply liquid sealer/densifier to exposed interior concrete floor areas when cured and dry, in accordance with manufacturer's instructions.
- C. Formed Finish:
 1. Provide smooth form concrete finish at exposed surfaces. Use largest practical form panel sizes to minimize form joints. Exposed surfaces include interior water-contacting surfaces of tanks, whether or not directly visible. All surfaces shall be considered as exposed, unless buried or covered with permanent structural or architectural material. After removing forms, patch form tie holes and defects in accordance with ACI 301. Remove fins exceeding 1/8-inch in height. Where surface will be coated or will receive further treatment, remove all fins flush with concrete surface.
 2. Provide rough form finish at all unexposed surfaces. After removing forms, patch form tie holes and defects in accordance with ACI 301. Remove fins exceeding 1/2-inch in height.

END OF SECTION

SECTION 03013

REPAIR AND REHABILITATION OF CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to repair or rehabilitate, as required, all existing concrete shown or indicated in the Contract Documents as being repaired or rehabilitated.
2. CONTRACTOR shall repair all damage to new concrete construction as specified in this Section.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate the Work that must be installed with or before repair and rehabilitation of concrete.
2. Notify other contractors in advance of repair and rehabilitation of concrete Work to provide them with sufficient time for installing and coordinating items included in their contracts that must be installed in conjunction with repair and rehabilitation of concrete Work.

C. Related Sections:

1. Section 03150, Concrete Accessories.

PART 2 – PRODUCTS

2.01 SYSTEM REQUIREMENTS

- A.** All repair and rehabilitation materials that can or will come into contact with potable water or that will be treated to become potable shall be listed in ANSI/NSF 61.

2.02 REPAIR MORTAR

- A.** Product Description: Repair mortar shall be prepackaged, cement-based product specifically formulated for repairing concrete surface defects.
- B.** Products and Manufacturers: Provide one of the following:
1. SikaTop 122 Plus, SikaTop 123 Plus, or SikaTop 126 Plus, by Sika Corporation.
 2. DuralTop Gel, DuralTop Flowable Mortar by Euclid Chemical Company.

3. Or equal.

C. Materials:

1. Provide a two-component, polymer-modified, Portland cement, fast-setting, trowel-grade mortar. Repair mortar shall be enhanced with penetrating corrosion inhibitor, and shall have the following properties:

Physical Property	Value	ASTM Standard
Minimum Compressive Strength at One Day	2,000 psi	C109
Minimum Compressive Strength at 28 Days	6,000 psi	C109
Minimum Bond Strength at 28 Days	1,800	C882*
* Modified for use with repair mortars.		

2. Where the least dimension of the placement in width or thickness exceeds four inches, extend repair mortar by adding aggregate as recommended by repair mortar manufacturer.

3. Product shall be listed in NSF/ANSI 61.

2.03 EXPANSION JOINT REPAIR SYSTEM

- A. System Description: Joint repair system shall consist of two components: an epoxy resin adhesive and hypalon sheeting.

- B. Products and Manufacturers: Provide one of the following:

1. Sikadur Combiflex, by Sika Corporation.
2. Or equal.

C. Materials:

1. Epoxy Resin Adhesive: Provide two-component epoxy resin as follows:
 - a. Component "A" shall be modified epoxy resin of epichlorohydrin bisphenol-A type containing suitable viscosity control agents and pigments. Resin shall not contain butyl glycidyl ether.
 - b. Component "B" shall be primarily a reaction product of selected amine blend with epoxy resin of epichlorohydrin bisphenol-A type containing suitable viscosity control agents, pigments, and accelerators.

2. Hypalon Sheeting:
 - a. Provide sheeting of hypalon rubber, perforated along bonding edge to provide mechanical key. Sheeting shall have ability to be vulcanized with hydrocarbon solvent for adhesion to an epoxy resin adhesive.
 - b. Provide sheeting in 12-inch width with thickness of 40 mils.
 - c. Sheeting shall be able to be lapped or seamed by heat or by anaromatic hydrosolvent strip.
 - d. Provide sheeting with removable center expansion strip.
3. Products shall be listed in NSF/ANSI 61.

2.04 REPAIR OF EXPOSED REINFORCING STEEL

- A. System Description: System for repair of exposed reinforcing steel shall consist of two components: an initial application of corrosion inhibitor and subsequent application of protective slurry mortar.
- B. Corrosion Inhibitor:
 1. Corrosion inhibitor shall penetrate the hardened concrete surface and form a protective layer on reinforcing steel.
 2. Products and Manufacturers: Provide one of the following:
 - a. Sika FerroGard 903, by Sika Corporation.
 - b. Or equal.
 3. Corrosion inhibitor shall:
 - a. Not change the substrate's color, appearance, or texture.
 - b. Penetrate independently of orientation (horizontal, vertical, overhead) at rate up to 1/10 to 4/5 inches per day, depending on density of concrete, measured using secondary neutron mass spectroscopy.
 - c. Form on reinforcing steel a protective layer of high integrity of at least 100 angstroms thickness, measured using x-ray photon spectroscopy and secondary ion mass spectroscopy.
 - d. Demonstrate reduction in corrosion currents after treatment as determined using cracked beam corrosion tests of concrete, as adapted from ASTM G109.

- e. Be capable of reducing active corrosion rates by at least 65 percent. Reduction shall be demonstrated by project references and an independent corrosion engineer using linear polarization resistance.
 - f. Penetrate up to three inches in 28 days, measured using secondary neutron mass spectroscopy.
 - g. Product shall be listed in NSF/ANSI 61.
- C. Protective Slurry Mortar:
 - 1. Material shall be two-component, polymer-modified, cementitious waterproofing and protective slurry mortar. Provide two coats at coverage of 50 square feet per gallon per coat.
 - 2. Products and Manufacturers: Provide one of the following:
 - a. Sikatop Seal 107, by Sika Corporation.
 - b. Or equal.
 - 3. Product shall be listed in NSF/ANSI 61.

2.05 CRACK INJECTION MATERIALS

- A. Structural Crack Repair System:
 - 1. Epoxy for injection shall be low-viscosity, high-modulus moisture insensitive type.
 - 2. Products and Manufacturers: Provide one of the following:
 - a. Sikadur 35, Hi-Mod L.V. and Sikadur 31, Hi-Mod Gel, by Sika Corporation.
 - b. Eucopoxy Injection Resin, by Euclid Chemical Company.
 - c. Or equal.
 - 3. Product shall be listed in NSF/ANSI 61.
- B. Non-structural Crack Repair System:
 - 1. Hydrophobic Polyurethane Chemical Grout:
 - a. Provide hydrophobic polyurethane that forms a flexible gasket.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) SikaFix HH LV, by Sika Chemical Company.

- 2) Hydro Active Flex SLV, by De Neef Construction Chemicals, Inc.
 - 3) Or equal.
 - c. Shrinkage limit shall not exceed 4.0 percent in accordance with ASTM D1042.
 - d. Minimum elongation of 250 percent in accordance with ASTM D3574.
 - e. Minimum tensile strength of 150 psi in accordance with ASTM D3574.
 - f. Product shall be listed in NSF/ANSI 61.
2. Hydrophilic Acrylate-Ester Resin:
- a. Hydrophilic crack repair system shall be acrylate-ester resin that forms a flexible gasket and increase in volume by at least 50 percent when in contact with water.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Duroseal Multigel 850, manufactured by BBZ USA, Inc.
 - 2) Or equal.
 - c. Product shall be listed in NSF/ANSI 61.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which the repair Work is to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation:
 - 1. Initial Surface Preparation: Remove by chipping, abrasive blasting, or hydro blasting all laitance, foreign material, and unsound concrete from entire area to be repaired. Further roughen surface as specified in this Section. Where non-shrink grout or repair mortar is used, perform additional surface preparation, if any, recommended by product manufacturer.

2. Wetting Procedure: Where repair concrete, shotcrete, or cement grout is used, and bonding agent is not required, or where repair mortar or non-shrink grout manufacturer recommends wet or saturated surface, perform the following:
 - a. Continuously apply water for at least four hours to surface being repaired. Where large surface areas are to be repaired, use fog-spray nozzles, mounted on stands, in sufficient number so that entire surface to be repaired is contacted by fog spray cloud.
 - b. Prevent concrete from drying until after repair is completed. Re-wet surfaces not yet repaired using water sprays at least a daily; should more than four days elapse without re-wetting surfaces not yet repaired, repeat the original saturating procedure.
 - c. Remove standing water in areas to be repaired before placing repair material. Provide means to remove excess water from structure.
3. Preparation for Epoxy Bonding Agent: Where repair material manufacturer recommends use of epoxy-bonding agent, conform to recommendations of both repair material manufacturer and bonding agent manufacturer.

3.03 INSTALLATION, GENERAL

- A. Care shall be taken to fully consolidate repair material, completely filling all portions of space to be filled.
- B. Bring surface being repaired into alignment with adjacent surfaces, providing uniform, even surface. Surface repaired shall match adjacent existing surfaces in texture and shall receive coatings or surface treatments, if any, provided for the existing surface adjacent to repaired surface.
- C. Curing:
 1. Curing of repair mortar and non-shrink grout shall be in accordance with manufacturer's recommendations, except that minimum cure period shall be three days.

3.04 REPAIR OF SURFACE DEFECTS

- A. Surface defects are depressions in a concrete surface that do not extend all the way through the concrete. Surface defects can result from removal of an embedded item, removal of an intersecting concrete member, physical damage, or unrepaired rock pockets created during original placement. For spalls that result from corroded reinforcing steel or other embedment refer to Article 3.7 of this Section.
- B. Preparation: Perform the following in addition to requirements of Article 3.2 of this Section:

1. Remove by chipping all loose, damaged concrete to sound material.
 2. Where existing reinforcing is exposed, remove concrete to minimum of one-inch around exposed bars. If existing bars are cut through, cracked, or cross-sectional area is reduced by more than 25 percent from original, immediately notify ENGINEER.
 3. Score-cut perimeter of area to be repaired to minimum depth of 1/2-inch and maximum depth that will not cut existing reinforcing steel. Chip out existing concrete to the score line so that minimum thickness of repair mortar will be 1/2-inch.
- C. Repair Material:
1. Completely fill the surface defect with specified repair material, in accordance with material manufacturer's instructions and the Contract Documents.
 2. Perform, with repair mortar, repairs of surface defects in concrete normally in contact with water or soil, and interior surfaces of structures that contain water.
 3. Repair of other surface defects may be by applying repair mortar, repair concrete, shotcrete, or cement grout, as appropriate.

3.06 REPAIR OF LINED HOLES

- A. This Article applies to openings with embedded material over all or a portion of inside surface of hole. Where indicated on the Drawings, remove embedded materials and repair the hole in accordance with Article 3.5 of this Section, as modified in this Article 3.6.
- B. Where embedded material is allowed to remain, remove embedded material to at least two inches into the hole, as measured from the plane surface of concrete wall or slab, as applicable. Embedded material left in place shall be roughened or abraded for proper bonding to repair material. Completely remove substances that interfere with proper bonding.
- C. Completely remove embedded items not securely and permanently anchored into concrete.
- D. Completely remove embedded items larger than 12 inches in their smallest dimension. In lieu of removing the embedded item, where reinforcing is required as shown or indicated in the Contract Documents, weld reinforcing to embedded item to remain, provided embedded item to remain is composed of metal to which reinforcing steel can be welded.

3.07 REPAIR OF DETERIORATED CONCRETE

- A. This Article pertains to deteriorated concrete which has been damaged due to corrosion of reinforcing steel, physical damage due to abrasion, or damage due

to chemical attack. Use repair mortar, as specified in this Article, for repairing deteriorated concrete. Where repaired surface will be subsequently covered with plastic liner material, coordinate finishing with requirements for installing plastic liner material.

- B. Surface Preparation: In addition to requirements of Article 3.2 of this Section, perform the following surface preparation:
1. Remove loose, broken, softened, and acid-contaminated concrete by abrasive blasting and chipping to sound, uncontaminated concrete.
 2. Upon completion of removal of deteriorated concrete, notify ENGINEER in writing. Allow two weeks for ENGINEER to evaluate the surface, perform testing for acid contamination if required, determine if additional concrete shall be removed, and to develop special repair details (if any) required. Should ENGINEER determine that additional concrete be removed to reach sound, uncontaminated concrete, allow another two-week period for further evaluation and testing following the additional removal.
 3. Surface preparation shall conform to recommendations of repair mortar manufacturer.
 4. Repair and rehabilitate isolated areas of exposed reinforcing bars in accordance with Article 3.4 of this Section. If extensive areas of reinforcing steel are uncovered after removal of deteriorated concrete, ENGINEER will determine the repair methods required.
- C. Repair Mortar Placing:
1. Conform to manufacturer's recommended procedures for mixing and placing repair mortar.
 2. After initial mixing of repair mortar, addition of water is not allowed.
 3. Minimum Thickness:
 - a. Install repair mortar to not less than minimum thickness recommended by manufacturer, and not less than 1/2-inch.
 - b. Where removal of deteriorated concrete results in repair thickness of less than minimum required thickness to return to original concrete surface in isolated areas totaling less than ten percent of total repair surface area, remove additional concrete to obtain at least the required minimum thickness.
 - c. Where surface area with repair thickness less than minimum required thickness exceeds ten percent of total repair area, notify ENGINEER.

- d. Provide repair mortar so that minimum cover over existing reinforcing steel is two inches. Do not place repair mortar creating locally raised areas.
 - e. Where transitioning to or from wall surfaces not requiring repair, do not feather-out repair mortar at transition. Instead, form the transition by saw cutting a score line to not less than minimum required repair mortar depth and chip out concrete to the saw cut line. Do not cut or otherwise damage reinforcing steel.
 - 4. Place repair mortar to an even, uniform plane to restore concrete member to its original surface. Out-of-plane tolerance shall be such that the gap between 12-inch-long straight edge and repair mortar surface does not exceed 1/8-inch, and gap between a four-foot-long straight edge and repair mortar surface shall not exceed 1/4-inch. Tolerances specified in this paragraph apply to straight edges placed in any orientation at any location.
- D. Finishing:
- 1. Provide smooth, steel trowel finish to repair mortar.
 - 2. When completed, there shall be no sharp edges. Provide exterior corners, such as at penetrations, one-inch radius. Interior corners shall be square, except corners to receive plastic lining which shall be made with two-inch fillet in repair mortar.

3.08 REPAIR OF EXPANSION JOINTS

- A. Surface Preparation: Remove the following from surfaces to be repaired: laitance, foreign material, and unsound concrete. Remove by chipping, abrasive blasting, or hydro blasting. Additional surface preparation, if required, shall be as recommended by expansion joint repair system manufacturer.
- B. Installation: Installation shall be as recommended by expansion joint repair system manufacturer.

3.09 REPAIR OF EXPOSED REINFORCING

- A. Remove, by abrasive blasting or hydro blasting, all corrosion, foreign materials, and unsound concrete from area to be repaired.
- B. Surface shall be visually dry before applying corrosion inhibitor. Liberally apply corrosion inhibitor to achieve coverage of 100 square feet per gallon in two or more coats, by allowing corrosion inhibitor to soak into substrate. Time between coats shall be the longer of: one hour, or as recommended by corrosion inhibitor manufacturer. Apply using rollers, brushes, or hand-pressure spray equipment.
- C. After applying final coat of corrosion inhibitor, minimum cure time of 24 hours is required.

- D. Provide high-pressure wash to surfaces to be repaired to remove filmy residue from corrosion inhibitor.
- E. For mortar coating, conform to Paragraphs 3.7.C, 3.7.D, 3.7.E of this Section.

3.10 CRACK INJECTION

- A. Examine areas under which injection Work will be installed and locate cracks that require injection. Identify and inject cracks greater than 0.010-inch wide in structures that retain or contain water, wastewater, or similar liquid.
- B. Install injection material in accordance with crack injection manufacturer's requirements.
- C. After injecting and curing, verify that injected material penetrated the crack adequately and that there is no visible leakage through the crack. After injecting, if crack continues to leak, re-inject crack at no additional cost to OWNER until structure is watertight.
- D. If proper penetration of crack cannot be achieved, submit to ENGINEER a proposed alternate approach for modifying the specified injection procedure to properly seal the crack. In new concrete and in concrete cracked as a result of CONTRACTOR's operations, perform modifications to crack injection procedure and fully repair the crack without additional cost to OWNER or extension of the Contract Times.

3.11 SITE QUALITY CONTROL

- A. OWNER will employ and pay for services of testing laboratory for Site quality control testing. ENGINEER will direct the number of tests and specimens required, including providing necessary materials for making and facility for storing test specimens. CONTRACTOR shall make standard compression test specimens as specified in this Section under the observation of ENGINEER. CONTRACTOR shall provide:
 - 1. Necessary assistance required by ENGINEER.
 - 2. All labor, material, and equipment required, including rods, molds, thermometer, curing in heated storage box, and all other incidentals required, subject to approval by ENGINEER.
 - 3. All necessary storage, curing, and transportation required for testing.
 - 4. CONTRACTOR will be charged for cost of additional testing and investigation, if any, for Work performed that is not in accordance with the Contract Documents or is otherwise defective.
- B. **Site Tests of Cement-based Grouts and Repair Mortar:**
 - 1. Obtain compression test specimens during construction from first placement of each type of mortar or grout, and at intervals thereafter as

selected by ENGINEER, to verify compliance with the Contract Documents. Specimens will be made by ENGINEER or ENGINEER's representative.

2. Compression tests and fabrication of specimens for repair mortar and non-shrink grout will be performed in accordance with ASTM C109. Set of three specimens will be made for each test. Tests will be made at seven days, 28 days, and additional time periods as deemed appropriate by ENGINEER.
3. Material, already placed, failing to conform to the Contract Documents, is defective.

END OF SECTION

SECTION 03110

CONCRETE FORMING

PART 1 - GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete forming. The Work also includes:
 - a. Designing forming systems in accordance with requirements of ACI 347 and the Contract Documents.
 - b. Providing forming to accommodate the Work under this and other Sections and building into forming items such as sleeves, anchorage devices, inserts, pipe embedment, reinforcing, and all other items to be embedded in concrete for which placement is not specifically provided under other Sections.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before concrete forming Work.

C. Related Sections:

1. Section 03150, Concrete Accessories.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. ACI 117, Specifications for Tolerances for Concrete Construction and Materials and Commentary.
2. ACI 301, Specifications for Structural Concrete.
3. ACI 347, Guide to Formwork for Concrete.
4. ASTM C805/C805M, Test Method for Rebound Number of Hardened Concrete.
5. ASTM C1074, Practice for Estimating Concrete Strength by the Maturity Method.
6. NIST PS 1, Structural Plywood.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Professional Engineer:

- a. CONTRACTOR or formwork Supplier shall retain a registered professional engineer legally qualified to practice in same state as the Site. Professional engineer shall have at least five years' experience designing formwork and falsework of the type required.
- b. Responsibilities include:
 - 1) Reviewing formwork and falsework performance and design criteria stated in the Contract Documents.
 - 2) Preparing written requests for clarifications or interpretations of performance or design criteria for submittal to ENGINEER by CONTRACTOR.
 - 3) Preparing or supervising preparation of design calculations verifying compliance of formwork and falsework with requirements of the Contract Documents.
 - 4) Signing and sealing all calculations.
 - 5) Certifying that:
 - a) Design of formwork and falsework was performed in accordance with performance and design criteria stated in the Contract Documents, and
 - b) Design conforms to all Laws and Regulations, and to prevailing standards of practice.

- B. Mock-Ups for Concrete Finishes:** Provide forming for mock-ups as required for finish work shown and specified for the Work. Place embedded materials in mock-up. Obtain ENGINEER'S acceptance of each mock-up prior to starting forming for the Work. Do not remove mock-up(s) until directed by ENGINEER.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:

1. Samples:

- a. Plywood form material used for smooth form finish, four inches square minimum.
- b. Form liner section sufficiently large to show two full repeating patterns, at least 12 inches square.

- c. Controlled permeability forming liner material, eight inches square, minimum.
 - d. Form Liner Sample Panel:
 - 1) Sample shall show texture and surface pattern, required backing, form tie treatment, and treatment at liner panel joints. Use form material to be used in the Work.
 - 2) Minimum Size: Three feet by four feet.
- B. Informational Submittals: Submit the following:
 - 1. Shop Drawings: When requested by ENGINEER, submit Shop Drawings showing and indicating general construction of individual forms, including:
 - a. Jointing.
 - b. Special formed joints or reveals.
 - c. Location, pattern, and details of form tie placement, removal, and repair procedures.
 - d. Location and details for temporary openings.
 - e. Void-form layout drawings and details of installation.
 - f. Other items that would visually affect the finished concrete.
 - 2. Design of Temporary Measures: Design of formwork and falsework is CONTRACTOR's responsibility. Submit the following:
 - a. Falsework layout drawings with the seal and signature of CONTRACTOR's or Supplier's professional engineer. Layout drawings shall show bracing details, waler arrangements, location of shores, joint forming details, and details at connections to previously placed concrete. ENGINEER's review will be for general conformance to the requirements of the Contract Documents and ACI 347, as indicated for delegated design in the General Conditions.
 - b. Design calculations for formwork and falsework, when requested by ENGINEER.
 - c. Certification letter from CONTRACTOR's or Supplier's professional engineer stating that in-place falsework was inspected and complies with the intent of the falsework design.
 - 3. Product Data: Manufacturer's data for proprietary materials, including form coatings, manufactured form systems, ties and accessories.

4. Manufacturer's Instructions: Installation instructions for proprietary materials, including form coatings, manufactured form systems, ties and accessories.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage:
 1. Upon delivery to the Site, place materials in area protected from weather.
 2. Store materials in accordance with manufacturer's recommendations.
 3. Store materials above ground on framework or blocking. Cover wood for forms and other accessory materials with protective, waterproof covering. Provide for adequate air circulation or ventilation under cover.
- B. Handle materials in accordance with the manufacturers' recommendations. Do not damage materials during handling.

PART 2 – PRODUCTS

2.01 SYSTEM PERFORMANCE

- A. Design Criteria:
 1. Design, erect, support, brace and maintain forming in accordance with ACI 347 so that forming safely supports vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by forming system or in-place construction that has attained adequate strength for the purpose. Construct forming so that concrete members and structures are of correct size, shape, alignment, elevation, and position.
 2. Design forms and falsework to include values of live load, dead load, weight of moving equipment operated on forming, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
 3. Provide shores and struts with positive means of adjustment capable of taking up forming settlement during concrete placing operations, using wedges or jacks, or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.
 4. Support form facing materials by structural members spaced sufficiently close to prevent beyond tolerance deflection, in accordance with ACI 117. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances. For long-span members without intermediate supports, provide camber in forming as required for anticipated deflections resulting from weight and pressure of fresh concrete and construction loads.

5. Design and construct forming to be readily removable without impact, shock or damage to concrete surfaces and adjacent materials.
6. Provide forming sufficiently tight to prevent leakage of cement paste during concrete placing. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.
7. Omit side forms of footings and place concrete directly against excavation only when requested by CONTRACTOR in writing and accepted by ENGINEER in writing. When omission of forms is accepted, provide additional concrete required beyond minimum design profiles and dimensions of footings as shown or indicated on the Drawings. No additional compensation will be paid to CONTRACTOR for additional concrete required.

2.02 FORM MATERIALS

A. Forms for Smooth Finish Concrete:

1. Unless otherwise shown or indicated in the Contract Documents, construct forming for smooth concrete surfaces with plywood, metal, metal-framed plywood-faced, or other panel type materials acceptable to ENGINEER, to provide continuous, straight, smooth as-cast surfaces with no wood grain or other surface texture imparted by forming. Provide in largest practical sizes to minimize number of joints and to conform to joint system shown or specified in the Contract Documents. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

B. Forms for Standard Finish Concrete:

1. Form concrete surfaces designated to have standard formed finish with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least two edges and one side.

C. Forms for Architecturally Finished Concrete:

1. Form finish concrete surfaces with units of face design, size, arrangement, and configuration as shown or as required to comply with approved Project job mock-up. Provide solid backing and form supports to ensure stability of form liners.
2. Form Material: Overlaid plywood in accordance with NIST PS 1. Provide B-B high density overlaid concrete form, Class I.
3. Form Liners: Rigid PVC or fiberglass in pattern shown or indicated.
4. Form Reuse: To be determined by ENGINEER at time of installation.
5. Rustication Joints: Rigid PVC in profile shown or indicated.

6. Panel Joints: Conceal joints behind rustication joints, unless approved by ENGINEER in writing.

D. Pan Forms:

1. Provide new forms for concrete pan-type construction complete with covers and end closures to form true, clean, smooth concrete surface. Provide units that facilitate easy removal without damaging placed concrete. Block adjoining pan units as required to avoid lateral deflection of forming during concrete placing and vibration. Provide standard or tapered ends.
2. Exposed-to-View Forms: Form joints are acceptable only in one-way joists at end caps and tapered end forms. Offset at form joints shall not exceed 1/8- inch.
3. Factory-fabricate pan form units to required sizes and shapes, using one of the following materials:
 - a. Steel: Minimum of 16-gage, free of dents, irregularities, sag, and rust. Use only new pan forms and reuse only once, if in satisfactory condition and accepted by ENGINEER.
 - b. Glass-Fiber Reinforced Plastic: Molded under pressure with matched dies, 0.11-inch minimum wall thickness.
 - c. Asphalt-impregnated Corrugated Material: Treated for moisture resistance with factory-applied polyethylene coating, and with top- and side-cover joints taped where concrete is exposed.

F. Form Ties:

1. Provide factory-fabricated metal form ties, designed to prevent form deflection, and to prevent spalling of concrete surfaces upon removal.
2. Unless otherwise shown or indicated in the Contract Documents, provide ties so that portion of tie remaining within concrete after removal of exterior parts of tie is at least 1.5 inches from the outer concrete surface. Unless otherwise shown or indicated in the Contract Documents, provide form ties that will leave a hole no larger than one-inch diameter in concrete surface.
3. Ties shall have waterstops on all exterior, below-grade walls, and walls subject to hydrostatic pressure.
4. Ties shall leave a uniform, circular hole when forms are removed.
5. Do not use removable ties unless accepted by ENGINEER. Removable ties are not allowed on exterior below-grade walls or walls subject to hydrostatic pressure. If removable ties are accepted, CONTRACTOR shall submit hole repair details for ENGINEER approval.

6. Wire ties are not allowed.
 7. Do not use reinforcing bars shown by the Drawings as part of the form tie system unless approved by ENGINEER.
 8. Provide stainless steel form ties for areas with architectural finish. When used, tiebreak back point shall be at least one inch from outer concrete surface.
- G. Form Coatings:
1. Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compounds. For concrete surfaces that will be in contact with potable water or water that will be treated to become potable, form coating shall be a mineral oil base coating.
- H. Controlled Permeability Formwork (CPF) Liner:
1. Provide surface densification for wall surfaces, where shown or indicated in the Contract Documents, through use of CPF liner material that wicks water and trapped air away from the form surface.
 2. Product and Manufacturer: Provide one of the following CPF liner systems:
 - a. Zemdren MD manufactured by DuPont
 - b. Or equal.
 3. CPF liner shall consist of a filter layer constructed of 100% polypropylene fibers, thermally bonded, which is laminated to a plastic net that ensures drainage and provides stiffness to the liner. Material shall have the following properties:
 - a. Non-compressible under concrete pressure.
 - b. Controlled pore size to permit drainage of excess water and air while retaining cement particles, mean pore size less than 35 microns.
 - c. Retains within its structure minimum of 0.5 liters of water per square meter of material.
 - d. Liner shall not leave filaments on the concrete surface.
 4. CPF liner shall improve characteristics performance of concrete as follows:

- a. Surface Hardness: In tests performed in accordance with ASTM C805/C805M, mean rebound number calculated for CPF liner face shall exceed that of control face (cast using standard formwork without CPF liner and same concrete mix and placement procedures) by minimum of five rebound units.
 - b. Surface shall have uniform texture and be free of minor surface defects due to trapped air.
- 5. Staples used for fastening the liner shall be stainless steel.
- I. Void-Forms:
 - 1. Void (carton) forms shall be corrugated fiberboard used for creating a void space beneath grade beams and slabs on grade.
 - 2. Manufacturer: Provide void-forms by one of the following:
 - a. Savway Carton Forms
 - b. Sheplers
 - c. SureVoid Products
 - d. Or equal
 - 3. Void-forms shall have moisture-resistant treated paper faces, be laminated with waterproof adhesive, and be bio-degradable. Void-forms shall have interior fabrication of uniform braced cellular configuration and shall be capable of sustaining minimum working load of 1,000 psf for minimum of ten days after concrete placement.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine substrate and conditions under which the Work will be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 FORM CONSTRUCTION

- A. Construct forms in accordance with ACI 347; to the exact sizes, shapes, lines, and dimensions shown; as required to obtain accurate alignment, location, and grades; to tolerances specified; and to obtain level and plumb work in finish structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes. Finish shall be in accordance with approved mock-up or sample panel, when specified.

B. Allowable Tolerances:

1. Construct forming to provide completed concrete surfaces complying with tolerances specified in ACI 117, ACI 301, and ACI 347.
 - a. Architectural finish forming, and where shown or indicated on the Drawings, shall be Class A surface, 1/8-inch offset.
 - b. Other surfaces exposed to view shall be Class B surface, 1/4-inch offset.
 - c. Other surfaces shall be Class C surface, 1/2-inch offset.
2. Tolerances apply to form offsets and to irregularities within the formed surface when measured with a straightedge over a five-foot distance.

C. Install forming and accessories for facilities in accordance with manufacturer's instructions, Laws and Regulations, and the Contract Documents.

D. Fabricate forms for easy removal without damaging concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.

E. Provide temporary openings where interior area of forming is inaccessible for cleanout, for inspection before concrete placement, and for placing concrete. Brace temporary closures and set tightly to forms to prevent loss of cement paste. Locate temporary openings on forms in locations as inconspicuous as possible, consistent with requirements of the Work. Form intersecting planes of openings to provide true, clean-cut corners, with edge grain of plywood not exposed as form for concrete.

F. Falsework:

1. Erect falsework and support, brace, and maintain falsework to safely support vertical, lateral, and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct falsework so that adjustments can be made for take-up and settlement.
2. Provide wedges, jacks or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce finished Work of required dimensions.

G. Forms for Smooth Finish Concrete:

1. Do not use metal cover plates for patching holes or defects in forms.

2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
3. Use extra studs, walers, and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material that will produce bow.
4. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
5. Form molding shapes, recesses, rustication joints and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

H. Corner Treatment:

1. Form exposed corners of beams, walls, foundations, bases and columns to produce smooth, solid, unbroken lines, except as otherwise shown or indicated in the Contract Documents. Chamfer exposed corners.
2. Form chamfers with 3/4-inch by 3/4-inch strips, unless otherwise shown or indicated in the Contract Documents, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Use rigid PVC chamfers for architecturally formed concrete. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
3. Reentrant or internal and unexposed corners may be formed either square or chamfered.

I. Joints:

1. For joint treatment, comply with Section 03 15 00, Concrete Accessories. Locate joints as shown and specified.

J. Openings and Built-In Work:

1. Provide openings in concrete forming shown or required under other Sections. Refer to Paragraph 1.1.B of this Section for coordination requirements.
2. Accurately place and securely support items to be built into forms.

K. Sealing Forming:

1. Forming joints shall be tight-fitting or otherwise sealed to prevent loss of cement paste.
2. Provide forming resting against concrete surfaces with compressible gasket material between the concrete and edge of form, to fill irregularities and create tight seal.

L. Cleaning and Tightening:

1. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before concrete is placed. Retighten forms immediately after placing concrete, as required to eliminate cement paste leaks.

3.03 FORM COATINGS

- A. Coat form contact surfaces with non-staining form-coating compound before installing reinforcing materials. Do not allow excess form coating material to accumulate in forms or come into contact with surfaces that will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.
- B. Coat steel forms with non-staining, rust-preventative form oil, or otherwise protect against rusting. Do not use rust-stained steel forming.
- C. For concrete surfaces that will be in contact with potable water or water that will be treated to become potable, form coating shall be mineral-oil base coating.
- D. Do not use form coatings on form surfaces covered with CPF liner material.

3.04 INSTALLATION OF EMBEDDED ITEMS

- A. Set and build into forming anchorage devices and other embedded items, shown, specified, or required under other Sections. Refer to Paragraph 1.1.B of this Section for coordination requirements. Use necessary setting drawings, diagrams, instructions, and directions.
- B. Edge Forms and Screeds Strips for Slabs:
 1. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units to support screeds.

3.05 CONTROLLED PERMEABILITY FORMING LINER

- A. Where shown or indicated in the Contract Documents, install controlled permeability forming (CPF) liner material in accordance with manufacturer's instructions so that liner entirely and continuously covers forming surface.
- B. Do not use form release agent on forms with CPF liner. Remove residual traces of release agent on previously used forms prior to placing liner.
- C. Joints and seams in CPF liner shall be taped with materials recommended by liner manufacturer. Attach CPF liner to form surface at intermediate spacing to prevent buckles and ripples in liner material when warmed by fresh concrete placement. Spacing of attachments shall not exceed two feet.
- D. Form panel edges, except the bottom, shall be taped around corner with materials recommended by liner manufacturer. Edges of penetrations through

form, including form tie holes, shall be taped or otherwise sealed. Leave open the liner at bottom edge of forms to facilitate drainage.

- E. CPF liner can be reused one time without removing liner from forms. Prior to reuse, wash the liner material and remove all concrete and other foreign material.

3.06 VOID-FORMS

- A. Install void-forms where shown or indicated in the Contract Documents, to the thickness indicated, in accordance with manufacturer's recommendations.
- B. Where void-form is shown or indicated in the Contract Documents, place void-form to grades and elevations shown over an even, well-compacted subgrade to form continuous void space under entire extent of slab, mat, or grade beam.
- C. For structural slab applications, place 1/8-inch thick masonite or plywood sheet over void-form. Place void-forms in largest pieces practical and secure in place.
- D. Properly surround and void around upper portion of drilled piers at intersection of slab, grade beam or pier cap using premanufactured, non-field cut sealed void-form with curved, radial, vertical edge adjacent to drilled pier.
- E. Void-forms shall remain dry and undamaged prior to concrete placement. Replace damaged pieces prior to placing concrete. Seal all joints and exposed ends to prevent concrete leakage into void space.

3.07 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Before placing concrete, check ties, tie cones, tie waterstops, embedded items, form coatings, forming stability, alignment, and tolerances. Make corrections and adjustments to ensure forming complies with intent of the forming design, proper stability of forming systems, and accurate size and location of concrete members.
 - 2. During concrete placing, check forming and related supports to ensure that forms are not displaced and that completed Work will be within specified tolerances.
 - 3. If forms are unsatisfactory in any way, either before or during concrete placing, stop or postpone placing of concrete until defects are corrected as required by CONTRACTOR's or Supplier's professional engineer and accepted by ENGINEER.

3.08 REMOVAL OF FORMS

- A. Determination of time between placing concrete and removing forms is CONTRACTOR's responsibility. Requirements specified in this Section are minimum times and requirements intended to ensure that concrete will support its own weight, and do not consider additional effects of the construction. Additional

effects of the construction shall be accounted for by CONTRACTOR when determining time for removing forming. Time for removing of forms is subject to ENGINEER's acceptance.

- B. Comply with requirements of ACI 301 and ACI 347, except as indicated in the Contract Documents.
- C. Removal of Forms for Walls, Columns, Sides of Beams and Girders, and Slab and Foundation Edges:
 - 1. Comply with requirements of Table 03 10 00-A of this Section:

TABLE 03 10 00-A REMOVAL OF FORMS					
Component	Average Daily Ambient Air Temperature (deg F)				Min. Concrete Compressive Strength for Form Removal
	Over 70 F	60 F to 70 F	50 F to 60 F	Below 50 F	750 PSI
Walls	One day	Two days	Three Days	See Paragraph	1000 PSI
Columns	Two days	Three days	Four days		500 PSI
Slab and foundation edges	One day	One day	Two days		500 PSI

- 2. When average daily ambient air temperature is below 50 degrees F, do not remove forms until concrete attains minimum compressive strength indicated in Table 03 10 00-A for form removal, and comply with Paragraph 3.8.C.3.b of this Section.
- 3. Concrete Strength Requirements for Form Removal:
 - a. For other than beams and elevated slabs, do not remove forms until concrete attains minimum concrete compressive strength indicated in Table 03 10 00-A for form removal.
 - b. For beams and elevated slabs, do not remove supporting forms or shoring until concrete attains minimum of 90 percent of its specified compressive strength.
- D. Alternative Criteria for Removing Forms for Walls, Columns, Sides of Beams and Girders, and Slab and Foundation Edges: CONTRACTOR has the option of submitting an alternative removal of forms table, together with supporting data, for ENGINEER's acceptance. Supporting data shall include representative field data for each different placement ambient temperature condition and minimum of three tests per temperature condition to ensure that accurate correlation between concrete strength and placement temperature is obtained.
- E. Determination of In-place Concrete Strength:

1. Determine compressive strength of in-place concrete by compression test specimens cured at the Site under the same conditions of temperature and moisture as the concrete member under consideration.
 2. Alternately, determine compressive strength of in-place concrete by maturity factor procedure in accordance with ASTM C1074 and approved by ENGINEER. Location of embedded thermistors or thermocouples shall be as approved by ENGINEER.
- F. When high-early strength concrete is used, time for removing the forms will be developed at the Site from the age/strength relationships established for the materials and proportions used by tests in accordance with ACI 301.
- G. Leave form facing material in place for minimum of four days after concrete placement, unless otherwise approved by ENGINEER.

3.09 PERMANENT SHORES

- A. Provide permanent shores in accordance with ACI 347.
- B. Reshores are not allowed.

3.10 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in the construction. Do not use split, frayed, delaminated, or otherwise damaged form facing material. Apply form coating compound material to concrete contact surfaces as specified for forming.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces. Form surfaces are subject to ENGINEER's approval.

END OF SECTION

SECTION 03150
CONCRETE ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Scope:
 - 1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete accessories.
- B. Related Sections:
 - 1. Section 07920, Joint Sealants.

1.02 REFERENCES

- A. Standards referenced in this Section are:
 - 1. ACI 301, Standard Specifications for Structural Concrete.
 - 2. ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - 3. CRD-C572, U.S. Army Corps of Engineers Specifications for Polyvinyl-Chloride Waterstop.

1.03 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Shop Drawings:
 - a. Layout of construction and expansion joint locations. Submit and obtain approval prior to submitting concrete reinforcement Shop Drawings.
 - b. For construction and expansion joints that require waterstops, submit layout of locations showing waterstop details. Indicate waterstop type, waterstop joint conditions, and details on how joint conditions will be handled.
 - c. Detail for joining PVC to steel waterstops.
 - d. Layout of all control joint locations.

2. Samples:
 - a. Submit Sample, at least six inches long each, of each type of waterstop proposed for use.
 - b. Submit Sample of foam rubber and cork expansion joint fillers.
 - c. Submit Sample of each type of prefabricated PVC waterstop joint.
- B. Informational Submittals: Submit the following:
 1. Manufacturer's Instructions: Manufacturer's specifications and installation instructions for all materials required.

PART 2 – PRODUCTS

2.01 WATERSTOPS

- A. Polyvinyl Chloride (PVC):
 1. Material Requirements:
 - a. Waterstops shall be extruded from elastomeric PVC compound containing plasticizers, resins, stabilizers, and other materials necessary to meet requirements of the Contract Documents and requirements of CRD-C572. Do not use reclaimed or scrap material.
 - b. Tensile strength of finished waterstop: 1,400 psi, minimum.
 - c. Ultimate elongation of finished waterstop: 280 percent, minimum.
 - d. Minimum thickness shall be 3/8-inch over entire width of waterstop.
 - e. Provide waterstops with minimum of seven ribs equally spaced at each end on each side. First rib shall be at the edge. Ribs shall be a minimum of 1/8-inch in height.
 - f. Provide waterstops with hog rings or factory-installed grommets anchored to exterior ribs to facilitate tying waterstop in position.
 2. Split waterstops are not allowed.
 3. Construction Joints: Waterstops shall be flatstrip ribbed type, six-inch minimum width, unless otherwise shown or indicated in the Contract Documents.
 4. Expansion Joints: Waterstops shall be centerbulb ribbed type, nine-inch minimum width, unless otherwise shown or indicated in the Contract Documents. Centerbulb shall have minimum outside diameter of 7/8-inch.

5. Product and Manufacturer: Provide one of the following:
 - a. W.R. Meadows, Inc.
 - b. Durajoint Concrete Accessories.
 - c. Greenstreak Plastic Products Company.
 - d. Paul Murphy Plastics Company.
 - e. Vinylex Corporation.
 - f. Or equal.
- B. Hypalon:
 1. Provide hypalon waterstops as shown or indicated in the Contract Documents, 40-mil thick.
 2. Waterstop shall be an integral part of manufacturer's joint sealing system and shall be in accordance with manufacturer's published recommendations.
 3. Product and Manufacturer: Provide one of the following:
 - a. Sikadur Combiflex, as manufactured by Sika Corporation.
 - b. Or equal.
- C. Hydrophilic Waterstop Materials:
 1. General Material Properties:
 - a. Bentonite-free, and expandable by minimum of 80 percent of dry volume in presence of water to form watertight joint seal without damaging concrete in which material is cast. Provide only where shown or indicated in the Contract Documents.
 - b. Material shall be composed of resins and polymers that absorb water and cause an increase in volume in completely reversible and repeatable process. Waterstop material shall be dimensionally stable after repeated wet-dry cycles with no deterioration of swelling potential.
 - c. Select materials that are recommended by manufacturer for type of liquid to be contained.
 2. Hydrophilic Rubber Waterstop:
 - a. Minimum cross-sectional dimensions shall be 3/16-inch by 3/4-inch.

- b. Product and Manufacturer: Provide one of the following:
 - 1) Duroseal Gasket, by BBZ USA, Inc.
 - 2) Adeka Ultraseal MC-2010M, by Asahi Denka Kogyo K.K.
 - 3) Hydrotite, by Greenstreak Plastic Products Company.
 - 4) Or equal.
 - 3. Hydrophilic Sealant:
 - a. Hydrophilic sealant shall adhere firmly to concrete, metal, and PVC in dry or damp condition. When cured sealant shall be elastic indefinitely.
 - b. Product and Manufacturer: Provide one of the following:
 - 1) Duroseal Paste, by BBZ USA, Inc.
 - 2) Adeka Ultraseal P-201, by Asahi Denka Kogyo K.K.
 - 3) Hydrotite, by Greenstreak Plastic Products Company.
 - 4) SikaSwell S, by Sika Corporation.
 - 5) Or equal.
- D. Injection Hose Waterstop System:
- 1. Injection Hose Waterstop:
 - a. Injection hose shall consist of PVC or neoprene central core of sufficient strength to resist weight of minimum of 25 vertical feet of fresh concrete placed upon it. Provide injection openings closely spaced in minimum of three locations equally spaced around perimeter of hose. Seal openings with strips of closed cell foam of consistency to act as one-way valves preventing entrance of cement paste while allowing free flow of injection material, pumped through hose, into the concrete joint surface.
 - b. Injection hose system shall be appropriate for injection of hydrophilic injection resin. Hose shall allow for vacuuming operations and repeated use. Construction of hose shall permit free discharge of specified injected grout into concrete without backwash, for entire length of hose.
 - c. Injection hose system shall be complete with hold-down clips, connection tubes, fittings, and injection connections designed to be mounted flush with concrete surface and sealed to allow future

injections. All system components shall be provided by same manufacturer.

d. Product and Manufacturer: Provide one of the following:

- 1) Fuko Injection System, by BBZ USA, Inc.
- 2) SikaSwell Hose, by Sika Corporation.
- 3) Or equal.

2. Hydrophilic Injection Resin:

a. Hydrophilic injection resin shall be acrylate-ester based. Viscosity shall be less than 50 centipoises (cps). Resin shall be water soluble in its uncured state, solvent-free, and non-water reactive. In cured state, resin shall form solid, hydrophilic, flexible material resistant to permanent water pressure, and shall not attack bitumen, joint sealants, and concrete.

b. Product and Manufacturer: Provide one of the following:

- 1) Duroseal Inject 1K/2K, by BBZ USA, Inc.
- 2) Sika Injection 29, by Sika Corporation.
- 3) Or equal.

2.02 PREFORMED EXPANSION JOINT FILLER

A. Provide preformed expansion joint filler complying with ASTM D1752, Type I (sponge rubber) or Type II (cork).

2.03 CONCRETE CONSTRUCTION JOINT ROUGHENER

A. Provide water-soluble non-flammable, surface-retardant roughener.

B. Product and Manufacturer: Provide one of the following for the types of joints specified:

1. Rugasol-S, by Sika Corporation for horizontal joints only.
2. Concrete Surface Retarder-Formula S, by Euclid Chemical Company, for horizontal joints only.
3. Concrete Surface Retarder-Formula F, by Euclid Chemical Company, for vertical joints only.
4. TK-6100 Concrete Form Surface Retarder, by TK Products.
5. Or equal.

2.04 EPOXY BONDING AGENT

- A. Provide a two-component epoxy-resin bonding agent.
- B. Product and Manufacturer: Provide one of the following:
 - 1. Sikadur 32 Hi-Mod LPL, by Sika Corporation.
 - 2. Eucopoxy LPL, by the Euclid Chemical Company.
 - 3. Resi-Bond J-58, by Dayton Superior.
 - 4. Or equal.

2.05 EPOXY-CEMENT BONDING AGENT

- A. Provide three component epoxy resin-cement blended formulated as bonding agent.
- B. Product and Manufacturer: Provide one of the following:
 - 1. Sika Armatec 110 EpoCem, as manufactured by Sika Corporation.
 - 2. Duralprep A.C., as manufactured by the Euclid Chemical Company.
 - 3. Emaco P24, as manufactured by MBT/ChemRex.
 - 4. Or equal.

2.06 JOINT SEALANT AND ACCESSORIES

- A. For joint sealants and accessories used on isolation joints, control joints, and expansion joints, refer to Section 07 92 00, Joint Sealants.

2.07 CONCRETE BOND BREAKERS

- A. Provide asphalt-saturated rag felt building paper, not less in weight than commercially known as 15 pound felt building paper, which weighs 15 pounds per 100 square feet.
- B. Chemical Bond Breaker:
 - 1. Provide medium solids resin solution chemical concrete bond breaker complying with ASTM C309, Type I, Class B.

2.08 NEOPRENE BEARING PADS

- A. Product and Manufacturer: Provide one of the following:
 - 1. 65 Durometer, Sheet Neoprene No. 1200, as manufactured by Williams Products Company.

2. Or equal.

2.09 RUBBER BONDING AGENT

- A. Product and Manufacturer: Provide one of the following:
 1. Scotch-Grip 1300 Rubber Adhesive, as manufactured by 3M Company.
 2. Or equal.

PART 3 – EXECUTION

3.01 INSPECTION

- A. CONTRACTOR and installing Subcontractor, if any, shall examine substrate and conditions under which the Work is to be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 CONSTRUCTION JOINTS

- A. Comply with requirements of ACI 301 and the Contract Documents.
- B. Locate and install construction joints as shown or indicated on the Drawings. Where not shown or indicated, locate joints to not impair strength of the structure; position joints at points of minimum shear. Location of joints shall be approved by ENGINEER. In addition to joints shown or indicated on the Drawings, locate construction joints as follows:
 1. In foundation mats, locate joints at spacing of approximately 40 feet. Joints shall be located within middle third of element span, unless otherwise shown or indicated on the Drawings. Element span shall be considered distance between piles or, as determined by ENGINEER, distance between bearing elements, such as columns, exterior walls and interior walls. Place concrete in strip pattern, unless otherwise shown or indicated on the Drawings.
 2. In walls, locate joints at a maximum spacing of 40 feet. Locate joints away from wall intersections a minimum of one-quarter of the clear span distance between wall intersections measured horizontally.
 3. In structural slabs and beams, joints shall be located within middle third of element span and shall be located in compliance with ACI 301, unless otherwise shown or indicated on the Drawings.
 4. In slabs on grade, locate joints at spacing of approximately 40 feet. Place concrete in strip pattern, unless otherwise shown or indicated on the Drawings.

C. Horizontal Joints:

1. Roughen concrete at interface of construction joints by abrasive blasting, hydroblasting, or using surface retardants and water jets to expose aggregate and remove accumulated concrete on projecting rebar immediately subsequent to form stripping, unless otherwise approved by ENGINEER. Immediately before placing fresh concrete, thoroughly clean existing contact surface using stiff brush or other tools and stream of pressurized water. Surface shall be clean and wet, and free from pools of water at time of placing fresh concrete.
2. Remove laitance, waste mortar, and other substances that may prevent complete adhesion. Where joint roughening was performed more than seven days prior to concrete placing or where dirt or other bond reducing contaminants are on surface, perform additional light abrasive blasting or hydroblasting to remove laitance and all bond-reducing materials just prior to concrete placement.
3. Provide over contact surface of concrete a six-inch layer of Construction Joint Grout as specified in this specification. Place fresh concrete before grout has attained its initial set. Placement of grout may be omitted if concrete mix has slump increased to at least six inches by addition of high range water reducer.

D. Vertical Joints:

1. Apply roughener to the form in thin, even film by brush, spray, or roller in accordance with manufacturer's instructions. After roughener is dry, concrete may be placed.
2. When concrete has been placed, remove joint surface forms as early as necessary to allow for removal of surface retarded concrete. Forms covering member surfaces shall remain in place as required under Section 03 11 00, Concrete Forming. Wash loosened material off with high-pressure water spray to obtain roughened surface subject to approval by ENGINEER. Alternately, surface shall be roughened by abrasive blasting or hydroblasting to expose aggregate. Outer one-inch of each side of joint face shall be masked and protected from blasting to avoid damaging member surface.

E. Satisfactory Surface:

1. Roughen concrete surface so that amplitude between high and low point on any 2-inch square is at least 1/4 inch.
2. Remove all laitance, waste mortar or other substance, which may prevent complete adhesion.
3. Expose clean coarse aggregate.
4. Do not undercut edges of coarse aggregate particles.

5. After roughening, wash and rinse with potable water.
6. Continue rinsing as long as there is any trace of cloudiness of the rinse water.
7. Where the rinsing occurs more than 2 days prior to placing the next lift or where the work in the area subsequent to the cleaning causes dirt or debris to be deposited on the surface, the surface shall be rinsed again as the last operation prior to placing the next lift.

3.03 EXPANSION JOINTS

- A. Comply with requirements of ACI 301 and this Section.
- B. Locate and install expansion joints as shown and indicated in the Contract Documents. Install joint filler in accordance with manufacturer's instructions. Install sealants as specified in this Section.

3.04 CONTROL JOINTS

- A. Provide control joints in non-water bearing slabs on grade as shown or indicated on the Drawings. Where control joints are not shown or indicated on the Drawings, space control joints at 24 to 36 times thickness of slab in both directions. Locate control joints only at places approved by ENGINEER.
- B. A groove, with depth of at least 25 percent of the member thickness, shall be tooled, formed, or saw-cut in concrete. Groove shall be filled with joint sealant material in accordance with Section 07920, Joint Sealants.
- C. Where control joint is formed by saw cutting, make sawcut in presence of ENGINEER immediately after concrete has set sufficiently to support the saw and be cut without damage to concrete. Keep concrete continually moist during cutting. Joints shall be approximately 1/8-inch wide.
- D. Control joints may be formed with tool or by inserting joint forming strip. After concrete has achieved design strength, remove upper portion of joint forming strip and fill void with sealant.

3.05 ISOLATION JOINTS

- A. Provide isolation joint where sidewalk or other slab on grade abuts a concrete structure and slab on grade is not shown doveled into that structure. Form isolation joint by 1/2-inch joint filler with upper 1/2-inch of joint filled with sealant.

3.06 WATERSTOPS

- A. General:
 1. Comply with ACI 301 and this Section. Make joints in accordance with manufacturer's instructions.

2. Provide PVC waterstops, except where otherwise shown or indicated on the Drawings.
3. Provide waterstops in all joints where concrete construction is below grade or intended to retain liquid. Install waterstop to the higher of: at least 12 inches above grade, or 12 inches above overflow liquid level in tanks.
4. Waterstops shall be fully continuous for extent of joint and with waterstops in intersecting joints. Maintain waterstop continuity at transitions between waterstops in joints at different levels and orientations.
5. In vertical joints in walls that are free at the top, waterstops shall extend no closer than six inches from top of wall.
6. In placing concrete around horizontal waterstops, with waterstop flat face in horizontal plane, work the concrete under waterstops by hand to avoid forming air and rock pockets.

B. Polyvinyl Chloride Waterstop:

1. Waterstops shall be positively held from displacement during concrete placing. Tie waterstops to reinforcement or other rigid supports at maximum spacing of 18 inches so that waterstop is securely and rigidly supported in proper position during concrete placing. Continuously inspect waterstops during concrete placing to ensure proper positioning.
2. Perform splicing in waterstops by heat sealing adjacent waterstop sections in accordance with manufacturer's printed recommendations. The following is required:
 - a. Material shall not be damaged by heat sealing.
 - b. Splices shall have tensile strength of not less than 60 percent of unspliced material's tensile strength.
 - c. Maintain the continuity of waterstop ribs and of its tubular center axis.
3. Only butt-type joints of ends of two identical waterstop sections shall be made while material is in forms.
4. Prefabricated PVC Waterstop Joint:
 - a. Joints with waterstops involving more than two ends to be jointed together, and joints that involve an angle cut, alignment change, or joining of two dissimilar waterstop sections, shall be prefabricated by CONTRACTOR or manufacturer prior to placing in the forms.

- b. Prefabricated joints shall have minimum of 2.0 feet of waterstop material beyond joint in each direction.
 - c. Install prefabricated joint assembly in the forms and butt-weld each two-foot end to a straight-run portion of waterstop in place in the forms.
 - 5. Where centerbulb waterstop intersects and is jointed with non-centerbulb waterstop, seal end of centerbulb using additional PVC material as required.
 - 6. Symmetrical halves of waterstops shall be equally divided between concrete placements at joints and centered within joint width, unless shown or indicated otherwise in the Contract Documents. Place centerbulb waterstops in expansion joints so that centerbulb is centered on joint filler material.
 - 7. When waterstop is installed in the forms or embedded in first concrete placement and waterstop remains exposed to atmosphere for more than four days, implement suitable precautions to shade and protect exposed waterstop from direct rays of sun during entire exposure, until exposed portion of waterstop is embedded in concrete.
 - 8. Protect waterstop placed in joints intended for future concrete placement from direct rays of the sun by temporary means until permanent cover is installed, so that waterstop is not exposed to direct rays of the sun for more than four days total.
- C. Hypalon Waterstop:
- 1. Provide hypalon waterstop where shown or indicated on the Drawings.
 - 2. Install in accordance with manufacturer's recommendations.
- D. Hydrophilic Rubber Waterstop and Sealant:
- 1. Where a hydrophilic rubber waterstop or sealant is required in accordance with the Contract Documents, or where approved by ENGINEER, install waterstop or sealant in accordance with manufacturer's instructions and recommendations; except, as modified in the Contract Documents.
 - 2. When requested by ENGINEER, provide manufacturer's technical assistance at the Site.
 - 3. Locate waterstop or sealant as near as possible to center of joint. Waterstop or sealant shall be continuous around entire joint. Minimum distance from edge of waterstop to face of the member shall be three inches.

4. Where hydrophilic rubber waterstop is used in combination with PVC waterstop, hydrophilic rubber waterstop shall overlap PVC waterstop for minimum of six inches. Fill contact surface between hydrophilic rubber waterstop and PVC waterstop with hydrophilic sealant.
5. Where wet curing methods are used, apply hydrophilic rubber waterstop and sealant after curing water is removed and just prior to closing up of the forms for concrete placement. Protect hydrophilic rubber waterstop and sealant from direct rays of sun and from becoming wet prior to concrete placement. If material becomes wet and expands, allow material to dry until material has returned to original cross sectional dimensions before placing concrete.
6. Install hydrophilic rubber waterstop in bed of hydrophilic sealant, before skinning and curing begins, so that irregularities in concrete surface are completely filled and waterstop is bonded to sealant. After sealant has cured, install concrete nails, with washers of a diameter equal to waterstop width, to secure waterstop to concrete at maximum spacing of 1.5 feet.
7. Prior to installing hydrophilic sealant, wire brush or sandblast the concrete surface to remove laitance and other materials that may interfere with bonding. Metal and PVC surfaces to receive sealant shall be cleaned of paint and any material that may interfere with bond. When sealant alone is shown or indicated in the Contract Documents, place sealant placed in built-up bead which has a triangular cross section with each side of triangle at least 3/4-inch long, unless otherwise indicated in the Contract Documents. Do not place concrete until sealant has cured as recommended by sealant manufacturer.

E. Injection Hose Waterstop:

1. Provide injection hose waterstop where shown or indicated on the Drawings.
2. Install injection hose in maximum lengths recommended by manufacturer, but not greater than 40 feet.
3. Clean concrete surface of all debris prior to installing injection hose. Install injection hose on two-inch wide strip of unroughened concrete at center of member width in direct contact with concrete. Clamp hose into position with anchor clips set into concrete spaced no more than 10 inches on centers.
4. Where injection hose is used in combination with PVC waterstop, hose shall overlap PVC waterstop for minimum of six inches and shall be less than two inches away from PVC waterstop.
5. Provide each end of injection hose with solid injector hoses mounted to formwork using a fitting. Provide fitting with cover that seals hose from cement paste and serves as a removable and reinstallable cover for

future reinjections. Mount fittings on dry side of member, unless shown otherwise on the Drawings.

6. Hose system shall not be injected until authorization is given by ENGINEER. When authorized, hose system shall be injected with hydrophilic resin in conformance with manufacturer's recommendations. Injection shall be by an applicator authorized by injection system manufacturer.
7. Injection system Supplier shall provide necessary supervision to satisfy ENGINEER that application conforms strictly to manufacturer's recommendations.
8. Prior to resin injection, flush hose system with water. At end of injection operation, clean the hose system in accordance with manufacturer's recommendations to facilitate future injections. Plug and cover injection and vent ends of system, leaving system ready for future reinjections.

3.07 BONDING AGENT

- A. Use epoxy bonding agent for bonding of fresh concrete to concrete that has been in place for at least 60 days, and for bonding to existing concrete.
- B. Use epoxy-cement bonding agent for the following:
 1. Bonding toppings and concrete fill to concrete that has been in place for at least 60 days, and for bonding to existing concrete.
 2. For locations where bonding agent is required and concrete cannot be placed within open time period of epoxy bonding agent.
 3. Bonding of horizontal construction joints where joints are required in accordance with the Drawings or approved by ENGINEER for foundation mats that are five feet thick or greater.
- C. Use cement-water slurry as bonding agent for toppings and concrete fill to new concrete. Cement water slurry shall be worked into surface with stiff bristle broom and place the concrete before cement-water slurry dries.
- D. Handle and store bonding agent in accordance with manufacturer's printed instructions and safety precautions.
- E. Mix bonding agent in accordance with manufacturer's instructions.
- F. Before placing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with bonding agent not less than 1/16-inch thick. Place fresh concrete while bonding agent is still tacky (within its open time), without removing in-place bonding agent coat, and as directed by manufacturer.

3.08 BEARING PAD INSTALLATION

- A. Neoprene Bearing Pad: Install with water insensitive adhesive in accordance with manufacturer's instructions.

END OF SECTION

SECTION 04000

MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide labor, materials, equipment, and incidentals as shown, specified and required for masonry Work, including:
 - a. Providing openings in unit masonry construction to accommodate the Work under this and other Specification Sections, and building into unit masonry construction all items such as sleeves, anchorage devices, inserts and other items to be embedded in unit masonry construction for which placement is not specifically provided under other Specification Sections.
2. Extent of each type of unit masonry is shown.
3. Types of products and features required include:
 - a. Concrete unit masonry.
 - b. Masonry mortar and grout.
 - c. Masonry accessories.
 - d. Unit masonry meeting requirements of LEED Credits MR 4.1, 4.2., 5.1, and 5.2.
 - e. Unit masonry meeting requirements of Special Inspections.
 - f. Construction Waste Management, meeting the requirements of LEED Credits MR 2.1 and 2.2.
 - g. Construction Waste Management.

B. Coordination:

1. Review installation procedures under other Specification Sections and coordinate the items that must be installed with unit masonry construction Work.
2. Unit masonry construction done without built-in flashings and other built-in Work shall be removed and rebuilt at no additional cost to OWNER, even if discovered after apparent completion of unit masonry construction.
3. Coordinate Work under other Specification Sections to avoid delay of masonry construction.

C. Related Sections:

1. Section 05503, Miscellaneous Metal Fabrications.
2. Section 07920, Joint Sealants.
3. Section 09910, Painting.

1.02 REFERENCES

A. Referenced Standards: Standards referenced in this Section are:

1. ACI 530, Building Code Requirements for Masonry Structures.
2. ACI 530.1, Specification for Masonry Structures.
3. ASTM A36, Standard Specification for Carbon Structural Steel.
4. ASTM A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
5. ASTM A615, Standard Specification for Deformed and Plain Carbon - Bars for Concrete Reinforcement.
6. ASTM A1008, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
7. ASTM A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Low-Alloy with Improved Formability.
8. ASTM C5, Standard Specification for Quicklime for Structural Purposes.
9. ASTM C33, Standard Specification for Concrete Aggregates.
10. ASTM C67, Standard Test Method for Sampling and Testing Brick and Structural Clay Tile.
11. ASTM C90, Standard Specification for Hollow Load-Bearing Concrete Masonry Units.
12. ASTM C91, Standard Specification for Masonry Cement.
13. ASTM C129, Standard Specification for Non-loadbearing Concrete Masonry Units
14. ASTM C136, Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates.

15. ASTM C140, Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
16. ASTM C144, Standard Specification for Aggregate for Masonry Mortar.
17. ASTM C150, Standard Specification for Portland Cement.
18. ASTM C207, Standard Specification for Hydrated Lime for Masonry Purposes.
19. ASTM C270, Standard Specification for Mortar for Unit Masonry.
20. ASTM C331, Standard Specification for Lightweight Aggregates for Concrete Masonry Units.
21. ASTM C387, Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
22. ASTM C404, Standard Specification for Aggregates for Masonry Grouts.
23. ASTM C426, Standard Test Method for Linear Drying Shrinkage of Concrete Block.
24. ASTM C780, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
25. ASTM C1019, Standard Test Method for Sampling and Testing Grout.
26. ASTM C1093, Practice for Accreditation of Testing Agencies for Unit Masonry.
27. ASTM C1314, Standard Test Method for Compressive Strength of Masonry Prisms.
28. ASTM D2240, Standard Test Method for Rubber Property-Durometer Hardness.
29. ASTM D2287, Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
30. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
31. ASTM E119, Standard Test Method for Fire Tests of Building Construction and Materials.
32. BIA, Technical Bulletin 1A, Construction and Protection Recommendations for Cold Weather Masonry Construction.
33. NCMA, Guide Specifications and Technical Bulletins.

- 34. UL, Design No. U 901, Bearing Wall Rating – 4 HR.; Non-bearing Wall Rating –4 HR.
- 35. UL, Design No. U 902, Bearing Wall Rating – 4 HR., Alternative Detail.
- 36. UL, Design No. U 904, Bearing Wall Rating – 3 HR.; Non-bearing Wall Rating –3 HR.
- 37. UL, Design No. U 905, Bearing Wall Rating – 2 HR.; Non-bearing Wall Rating –2 HR.
- 38. UL, Design No. U 906, Bearing Wall Rating – 2 HR.; Nonbearing Wall Rating – 2 HR.
- 39. UL, Design No. U 907, Nonbearing Wall Rating – 3 or 4 HR.
- 40. UL, Design No. U 909, Nonbearing Wall Rating – 3 or 4 HR.
- 41. UL, Design No. U 910, Bearing Wall Rating – 4 HR.; Non-bearing Wall Rating – 4 HR.
- 42. UL, Design No. U 912, Bearing Wall Rating – 3 HR.; Non-bearing Wall Rating 3 HR.
- 43. UL, Design No. U 913, Bearing Wall Rating – 2 HR.; Nonbearing Wall Rating – 2 HR.
- 44. UL, Design No. U 914, Bearing Wall Rating – 3 HR.; Nonbearing Wall Rating – 3 HR.
- 45. UL 901, Specification for Quicklime for Structural Purposes.

1.03 QUALITY ASSURANCE

A. Qualifications:

- 1. Installer: Hire a single installer regularly engaged in preformed unit masonry installation and with successful and documented experience in erecting unit masonry of scope and type of Work required; and employs only tradesmen with specific skill and successful experience in this type of Work. Submit name and qualifications to ENGINEER with the following information for at least three successful, completed projects:
 - a. Names and telephone numbers of owners, architects or engineers responsible for project.
 - b. Approximate contract cost of unit masonry for which installer was responsible.
 - c. Amount (square feet) of unit masonry installed.

2. Laboratory Qualifications:
 - a. Testing Laboratory: In accordance with ASTM C1093.
- B. Component Supply and Compatibility:
 1. Obtain each type of concrete masonry unit from one Supplier, cured by one process and of uniform texture and color, or in an established uniform blend thereof.
 2. Do not change source or brands of mortar products during the Project.
 3. Where question of compliance to requirements of this Section arise, mortar properties Specification will take precedence over mortar proportion Specification.
 4. Do not change proportions established for mortar accepted under property Specifications, and do not use products with different physical characteristics in mortar used in the Work, unless compliance with requirements of property Specifications is re-established by submitting acceptable data to ENGINEER.
 5. Do not combine two air-entraining materials in mortar.
- C. Regulatory Requirements: Where fire-resistance classification is shown or scheduled for unit masonry construction (four-hour, three-hour, and similar designations), comply with applicable requirements for products and installation established by UL tests referenced in this Section and authorities having jurisdiction.
- D. Job Mock-up:
 1. Prior to installing unit masonry and after ENGINEER's approval of Samples, erect job mock-ups using products, pattern bond, and joint tooling shown or specified. Build mock-up at the Site, at a location approved by the ENGINEER, of full required wall thickness. Mock-up shall be approximately 4.0 feet by 3.33 feet unless another size or location is shown as job mock-up. Provide special features as directed, including finished opening 16 inches by 16 inches, finished end, and masonry control joint. Indicate proposed range of color, texture and workmanship to be expected in completed Work. Obtain ENGINEER's approval of visual qualities of mock-up before starting unit masonry construction. Retain and protect mock-up during construction as a standard for judging unit masonry Work. Do not alter, move, or destroy mock-up until receiving written permission by ENGINEER.
 2. Build as many mock-up panels as required to obtain ENGINEER's approval.
 3. Perform unit masonry construction tests per ACI 530.1. Provide to ENGINEER acceptable test results before starting masonry construction.

4. Masonry construction that does not meet standards approved on mock-up panel shall be removed and rebuilt to conform to the Contract Documents. Provide mock-up panel for the following:
 - a. Typical complete exterior wall including cavity wall flashing, anchors, and masonry wall ties and all other components of complete exterior wall system.
 - b. Typical complete interior partition of concrete unit masonry where both sides will remain visually exposed in finished Work.

F. Masonry Pre-installation Conference:

1. Prior to starting unit masonry construction Work, schedule and hold masonry pre-installation conference at the Site, to review foreseeable methods and procedures related to unit masonry Work including:
 - a. Project requirements per the Contract Documents.
 - b. Structural concept.
 - c. Sequence of masonry construction.
 - d. Special masonry details.
 - e. Required submittals.
 - f. Standard of workmanship.
 - g. Prism tests or mortar, grout sample and unit masonry tests results.
 - h. Quality control requirements.
 - i. Job organization and availability of products, tradesmen, equipment, and facilities needed to conform to Progress Schedule.
 - j. Masonry control and expansion joint location and materials.
 - k. Modular planning requirements.
 - l. Weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
 - m. Required special inspection, testing, and certifying procedures.
 - n. Compliance with building codes and other Laws and Regulations.
 - o. Construction Waste Management Plan requirements.
2. Attendance is mandatory for the following:

- a. CONTRACTOR's Site superintendent.
 - b. Masonry Subcontractor's Site superintendent.
 - c. Masonry Subcontractor's foreman.
 - d. Authorized representative of unit masonry Suppliers.
 - e. ENGINEER.
 - f. Special Inspection Coordinator.
3. If additional information must be developed to adequately cover agenda items, reconvene conference as soon as possible.
 4. CONTRACTOR shall record discussions of conference and decisions and agreements (or disagreements) and provide copy of record to each conference attendee.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Submit the following:
 - a. Complete layout of all masonry walls showing modular planning and all special shapes to be used in the Work. Show details for each condition encountered in the Work. Provide plan and elevation views drawn at a scale of 1/4-inch equal to 1.0 foot, and details drawn at a scale of 1.5-inch equal to 1.0 foot. Show all items included in unit masonry construction.
 - b. Shop Drawings showing location, extent and accurate configuration and profile of all items shown, specified, and required by this and other Specification Sections included in unit masonry construction.
 - c. Shop Drawing for fabrication, bending, and placement of reinforcing bars. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabricating and placing reinforcing for unit masonry Work.
 - d. Job Mock-up: Shop Drawings showing location, extent, and accurate configuration of all items to be built into the mock-up. Provide elevations drawn at scale of 1.5 inch equal to 1.0 foot.
2. Product Data: Submit the following:
 - a. Copies of manufacturer's specifications and test data for each type of concrete masonry unit specified, including certification that concrete masonry unit complies with Contract Documents. Include

instructions for handling, storage, installation and protection of each type of concrete masonry unit.

3. Samples: Submit the following:
 - a. Color Sample board, for each type of unit masonry specified, showing standard and custom colors.
 - b. Each type of unit masonry specified in colors selected by ENGINEER. Select each type of unit masonry to show range of color and texture that can be expected in the Work.
 - c. ENGINEER's review will be for color and texture only.

B. Informational Submittals:

1. Source Quality Control Submittals: Submit the following:
 - a. Pre-construction laboratory test results, in accordance with ASTM C140.
2. Test and Evaluation Reports
 - a. Preconstruction testing results as specified in Paragraph 3.1.B of this Section.
3. Sustainable Design Submittals: Submit the following:
 - a. For LEED certification, comply with referenced requirements.
4. Qualification Statements:
 - a. Testing laboratory.
 - b. Installer.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling of Products:

1. Comply with Section 01610, Transportation and Handling.

B. Storage of Materials:

1. Comply with 01610, Transportation and Handling.
2. Maintain temperatures under cover so that masonry products are above 20 degrees F during installation.

1.06 JOB CONDITIONS

- A. Temporary Facilities: Provide supplemental heat sources and equipment as required should CONTRACTOR desire to continue unit masonry Work in cold weather. Pay for fuel for supplemental heat.
- B. Environmental Requirements:
 - 1. Do not perform unit masonry Work when air temperature is below 28 degrees F on a rising temperature, or below 36 degrees F on falling temperatures without providing temporary, heated enclosures, or without providing temporary heating or other precautions to prevent freezing.
 - 2. Do not use frozen products, and do not build upon frozen unit masonry Work.
 - 3. Remove and replace all unit masonry Work damaged by cold.
- C. Protection:
 - 1. Protect unit masonry Work against freezing for at least 48 hours after being placed.
 - a. For Mean Daily Air Temperatures of 40 degrees F to 32 degrees F: Protect unit masonry construction from precipitation for 48 hours after installation.
 - b. For Mean Daily Air Temperatures of 32 degrees F to 25 degrees F: Completely cover unit masonry construction for 48 hours after installation.
 - c. For Mean Daily Temperatures of 25 degrees F to 20 degrees F: Completely cover unit masonry construction with insulating blankets for 48 hours after installation of the masonry.
 - d. For Mean Daily Air Temperatures of 20 degrees F and Below: Maintain unit masonry construction above 32 degrees F for 48 hours by enclosure and supplementary heating.
 - 2. When Work is not in progress, protect partially completed unit masonry construction against rapid heat loss and from water entering the masonry by covering the top of walls with a strong, waterproof, non-staining membrane. Extend the membrane at least two feet down both sides of wall and secure in place using wall cover clamps spaced at intervals of four feet and at each end, and at joints in membrane.
- D. Cold Weather Unit Masonry Construction:
 - 1. Mortar used in unit masonry construction when mean daily temperature is below 40 degrees F shall be Portland cement-lime-sand mortar using high early strength Portland cement.

2. Clay or shale unit masonry with suctions in excess of 20 grams of water per 30 square inches per minute shall be sprinkled with heated water just prior to installation. Provide water temperature above 70 degrees F when temperature of masonry units is above 32 degrees F. Water temperature shall be above 120 degrees F when temperature of masonry units is below 32 degrees F.
 3. For Air Temperatures of 40 degrees F to 32 degrees F: Heat sand or mixing water to a minimum of 70 degrees F and maximum of 160 degrees F.
 4. For Air Temperatures of 32 degrees F to 25 degrees F: Heat sand and mixing water to a minimum of 70 degrees F and maximum of 160 degrees F.
 5. For Air Temperatures of 25 degrees F to 20 degrees F: Heat sand and mixing water to a minimum of 70 degrees F and maximum of 160 degrees F. Provide heat on both sides of the wall under construction. Employ wind breaks when wind is in excess of 15 mph.
 6. For Air Temperatures of 20 degrees F and Below: Heat sand and mixing water to minimum of 70 degrees F and maximum of 160 degrees F. Provide enclosure and auxiliary heat to maintain air temperature above 32 degrees F in the work area. Temperature of masonry units when laid shall not be less than 20 degrees F.
- E. Hot Weather Unit Masonry Work: Protect unit masonry Work by methods acceptable to ENGINEER from direct exposure to wind and sun when surrounding air temperature is 99 degrees F in the shade with relative humidity less than 50 percent.

PART 2 - PRODUCTS

2.01 MORTAR MATERIALS

- A. Portland Cement: Provide the following for Portland cement-lime mortars:
1. ASTM C150, Type I.
 2. Use ASTM C150, Type III high-early strength, for laying masonry when air temperature is less than 50 degrees F.
 3. Provide non-staining Portland cement of natural color.
- B. Masonry Cement: Provide the following for masonry cement mortars:
1. ASTM C91 Type S, proportioned to comply with ASTM C270.
 2. Maximum Air Content, ASTM C91: 19 percent.
 3. Non-staining.

- C. Hydrated Lime: ASTM C207 Type S, or lime putty ASTM C5.
- D. Sand Aggregates:
 - 1. ASTM C144, except for joints less than ¼-inch, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 2. White Mortar Aggregates: Provide natural white sand or ground white stone for Portland cement-lime mortars.
 - 3. Colored Mortar Aggregates: Provide ground marble, granite, or other sound stone as required to match the sample approved by ENGINEER for Portland cement-lime mortars.
 - 4. Fine Aggregate for Grout: Sand, ASTM C404, Size No. 1.
 - 5. Course Aggregate for Grout: ASTM C404, Size No. 8 or Size No. 89.
- F. Ready-mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified for mortar materials, combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C270 and C387.
- G. Water: Free from injurious amounts of oils, acids, alkalis, or organic matter, and clean, fresh, and potable.

2.02 MORTAR MIXES

- A. General:
 - 1. Anti-freeze Admixture or Agents: Not allowed.
 - 2. Calcium Chloride: Not allowed.
- B. Mortar for Unit Masonry: Comply with ASTM C270, Table 2, except limit materials to those specified in this Section, do not substitute ASTM C91 masonry cement for ASTM C150 Portland cement without an submittal approval by ENGINEER, and limit cement to lime ratio by volume as specified in 04 05 11 Masonry Mortaring and Grouting.
- C. Grout:
 - 1. Fine Grout:
 - a. Provide the following proportions by volume:
 - 1) Portland Cement: One part.
 - 2) Hydrated Lime or Lime Putty: Zero to 1/10 part.

- 3) Aggregate Ratio (Measured in a Damp Loose Condition): Sand shall be not less than 2.25 times and not more than three times sum of volumes of cement and lime.
 - b. Mix grout to have a slump of ten inches plus or minus one-inch at placement.
2. Coarse Grout:
 - a. Provide the following proportions by volume:
 - 1) Portland Cement: One part.
 - 2) Hydrated Lime or Lime Putty: Zero to 1/10 part.
 - 3) Fine Aggregate Ratio (Measured in a Damp Loose Condition): Sand shall be not less than 2.25 times and not more than three times sum of volumes of cement and lime.
 - 4) Coarse Aggregate Ratio: Not less than one and not more than two times sum of volumes of cement and lime.
 - b. Mix grout to have slump of ten inches plus or minus one-inch, at placement.

2.03 CONCRETE MASONRY UNITS

- A. General: Concrete masonry units shall comply with requirements below.
- B. Hollow and Solid Load-bearing Concrete Masonry Units: ASTM C90, with minimum of 15 percent coal fly ash and 50 percent recycle aggregate as part of concrete mix.
- C. Hollow Non-load-bearing Concrete Masonry Units: ASTM C129 with minimum of 15 percent coal fly ash and 50 percent recycle aggregate as part of the concrete mix.
- D. Weight:
 1. Provide normal weight units using concrete aggregates complying with ASTM C33 producing dry net weight of not less than 125 pounds per cubic foot.
- E. Size: Manufacturer's standard units with nominal face dimensions of 16 inches long by eight inches high by nominal width dimension shown on Drawings (15-5/8-inches by 7-5/8-inches actual).
- F. Special Shapes: Provide the following:

1. Lintels, bond beams, reinforcing units, and flush-end reinforcing units, interior and exterior corner shapes, solid jambs, sash block, coves, pre-molded control joint blocks, headers, and other special conditions.
 2. Bullnose units for outside vertical corners including doors, windows, louvers and other openings, unless specifically shown by note indicating that this feature is not required.
 3. End blocks at all locations where masonry walls abut concrete, or steel columns to facilitate installation of compressible filler, backer rod and sealant or fire-rated fire stop sealant systems, if required.
- G. Provide concrete masonry units meeting requirements of LEED for Credits MR4.1, 4.2., 5.1, and 5.2.

2.04 HOLLOW LOAD-BEARING UNITS.

- A. Miscellaneous Masonry Accessories: Provide the following, where shown:
1. Reinforcing Bars:
 - a. Deformed carbon steel, ASTM A615, Grade 60 for bars No. 3 to No. 18 except as otherwise shown.
 2. Rebar Positioners: Provide the following:
 - a. Nine-gage reinforcing bar positioners that accommodate both horizontal and vertical reinforcing steel.
 - b. Fabricate units as required for the Work.
 - c. Products and Manufacturers: Provide products of one of the following:
 - 1) #RB Series and #RB-Twin Series Rebar Positioners by Hohmann & Barnard, Inc
 - 2) Rebar Positioners by Heckmann Building Products.
 - 3) Or equal.
 3. Masonry Control Joint Components: Provide the following:
 - a. Pre-molded Control Joint Strips: Provide complete selection of solid extruded rubber and PVC strips with a Shore A durometer hardness of 80 to 90 complying with ASTM D2240 and D2287, designed to fit standard sash block and maintain lateral stability in masonry wall. Size and configuration shall be as shown.
 - 1) Products and Manufacturers: Provide products of one of the following:

- a) #RS-12- Control Joints by Hohmann & Barnard, Inc.
 - b) #352-13Control Joints by Heckmann Building Products.
 - c) Or equal.
- 4. Expansion Joint Components:
 - a. As per 07 95 13 Expansion Joint Cover Assemblies
- 5. Cavity Drainage Material:
 - a. Manufactured of high-density polyethylene or nylon strands woven into a 90 percent open mesh
 - 1) Products and Manufacturers: Provide precuts of one of the following:
 - a) Mortar net by Hohmann and Barnard, Inc.
 - b) MortarNet by Heckmann Building Products.
 - c) Or equal.

2.08 SOURCE QUALITY CONTROL

- A. Allowable Tolerances: For concrete masonry units provide the following:
 - 1. Face Dimension: Total variation in finished and installed face dimensions of units shall not exceed 1/16-inch between largest and smallest units in each lot of units of each size.
 - 2. Distortion: Distortion of plane and edges of face of individual units, as installed, from corresponding plane surface and edges of prefaced concrete masonry unit, shall not exceed 1/16-inch.
 - 3. Top and Bottom Surfaces: Ground to provide finish height of 7-5/8 inches plus or minus 1/16-inch.

PART 3 - EXECUTION

3.01 INSPECTION

- A. CONTRACTOR and installer shall examine areas and conditions under which unit masonry construction Work will be installed, and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Preconstruction Testing: Testing agency shall perform tests prior to installation of unit masonry. Special inspections testing procedures are specified in the referenced standards and the Contract Documents.

1. Mortar Test: For each mix required, per ASTM C780.
2. Grout Test: For each mix required, per ASTM C1019 and ACI 530.1.
3. Prism Test: For each type of construction required, per ASTM C 1314 and ACI 530.1.
4. Compressive strength of completed concrete unit masonry walls shall not be less than 1,500 psi as determined by methods specified in ACI 530.1.

3.02 PREPARATION

A. Measurement of Mortar Materials:

1. Cement and Hydrated Lime: Batched by the bag.
2. Sand: Batched by volume in suitably calibrated containers, provided proper allowance is made for bulking and consolidation and for weight per cubic foot, of contained moisture.
3. Proportion of Volumetric Mixtures: One 94-pound sack of Portland cement and one 50-pound sack of hydrated lime constitute nominal one cubic foot.
4. Shovel measurement: Not allowed.

B. Mortar Mixing:

1. Type of Mixer: Machine mix in approved mixer in which quantity of water is accurately and uniformly controlled.
2. While mixer is in operation add approximately three-quarters of required water, half the sand, all the cement, then add remainder of sand.
3. Allow batch to mix briefly then add water in small quantities until satisfactory workability is obtained.
4. Mix for at least five minutes after all materials have been added.
5. Hydrated Lime for Mortar Requiring Lime Content: Use dry-mix method. Turn over materials for each batch together until even color of mixed, dry materials indicates that cementitious material has been thoroughly distributed throughout mass, then add water to obtain required plasticity.
6. Lime putty, if approved for use, shall be prepared in accordance with ASTM C5.
7. Mixer drum shall be completely emptied before recharging next batch.
8. Re-tempering of mortar is not allowed.

C. Wetting of Masonry Units:

1. Face Brick: Wet brick having ASTM C67 absorption rates in excess of 30 grams per 30 square inches per minute, so that rate of absorption when laid does not exceed this amount.
 - a. Determine absorption by placing 20 drops of water using a medicine dropper inside one-inch diameter circle on typical units. If water is absorbed within 90 seconds, wet brick before laying.
2. Use wetting methods that ensure that each masonry unit is nearly saturated but surface-dry when laid.
3. Concrete Masonry Units: Except for absorbent units specified to be wetted, lay masonry units dry. Do not wet concrete masonry units.

- D. Cleaning Reinforcement: Before being placed, remove loose rust, mill scale, earth, ice, and other coatings except galvanizing from reinforcement. Do not use reinforcing bars with kinks or bends not shown on Drawings or approved Shop Drawings, or bars with reduced cross-section.

3.03 INSTALLATION, GENERAL

- A. Thickness: Build walls, floors and other unit masonry construction work to thickness shown. Build single-wythe walls to actual thickness of masonry units using units of nominal thickness shown or specified.
- B. Build chases and recesses as shown or required by others. Provide at least eight inches of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.
- C. Leave openings for equipment, piping, ducts, and other items to be installed subsequent to start of masonry Work. After installing said items, complete unit masonry Work to match Work immediately adjacent to openings.
- D. Cut masonry units using wet cutting, motor driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining Work neatly. Use full size units without cutting wherever possible.
- E. Match Existing Masonry: Match coursing, pattern bond, color, texture and size of new unit masonry with adjacent, existing masonry.

3.04 LAYING MASONRY WALLS

A. General:

1. Mortar Types: Unless otherwise indicated, use mortar as specified and as follows:
 - a. For Work, use mortar as per 04 05 11 Masonry Mortaring and Grouting.

- b. Use coarse grout fill for structural requirements and for grouting reinforcing steel in unit masonry construction Work.
 - c. Do not use mortar that has begun to set or if more than 30 minutes have elapsed since initial mixing. Re-temper mortar during the 30-minute period only as required to restore workability.
 - 2. Lay out walls in advance for accurate spacing of surface pattern bond with uniform joint widths and to properly locate openings, masonry control joints, returns, and offsets. Avoid using less than half-size units at corners, jambs, and where possible at other locations.
 - 3. Layup walls plumb and true to comply with specified tolerances, with courses level, accurately spaced, and coordinated with other Work.
 - 4. Pattern Bond Unit Masonry:
 - a. Lay all unit masonry Work visible in the finished Work in running bond with vertical joints in each course centered on units in courses above and below. Avoid using less than full-size units.
 - b. Bond and interlock each course of each wythe at corners.
 - c. Do not use units with less than eight-inch horizontal face dimensions at corners or jambs.
 - d. Interlock alternate courses at corners.
 - 5. Color of Concrete Unit Masonry:
 - a. Lay all concrete unit masonry of natural color.
- B. Construction Tolerances:
 - 1. Variation from Plumb: For lines and surfaces of columns, walls and arises, do not exceed 1/4-inch in 10 feet, or 3/8-inch in a story height (20 feet maximum), nor two-inch in 40 feet or more. Except for external corners, expansion joints and other conspicuous lines, do not exceed 1/4-inch in any story or 20 feet maximum, nor two-inch in 40 feet or more.
 - 2. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4-inch in any bay or 20 feet maximum, nor 3/4-inch in 40 feet or more.
 - 3. Variation of Linear Building Line: For position shown and related portion of columns, walls and partitions, do not exceed two-inch in any bay or 20 feet maximum, nor 3/4-inch in 40 feet or more.
 - 4. Variation in Cross-sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4-inch nor plus two-inch.

C. Mortar Bedding and Jointing:

1. Lay solid masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.
2. Lay hollow masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.
 - a. Maintain joint widths shown, except for minor variations required to maintain pattern bond alignment. Lay walls with 3/8-inch joints.
3. Cut joints flush for masonry walls that are to be concealed or to be covered by other materials, except paint, unless otherwise shown.
4. Tool exposed joints, when mortar is "thumbprint" hard, slightly concave. Rake out mortar in preparation for application of calking or sealants where required.
5. Concave-tool exterior joints below grade.
6. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

D. Stopping and Resuming Work: Rake back half-unit masonry length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly, if required, and remove loose masonry units and mortar prior to laying new masonry.

E. Built-in Work:

1. As the Work progresses, build in items shown, specified or required by others. Fill cores in one block width solidly with masonry around built-in items.
2. Where built-in items are to be embedded in cores of hollow masonry units, place layer of cavity fill mesh in joint below and rod mortar or grout into core.

F. Horizontal Joint Reinforcing:

1. Provide continuous horizontal joint reinforcing as specified. Fully embed longitudinal side rods in mortar for their entire length with minimum cover of 5/8-inch on exterior side of walls and 1/2-inch at other locations. Lap reinforcement minimum of six inches at ends of units. Do not bridge masonry control joints with reinforcing.

2. Reinforce all masonry walls with continuous horizontal joint reinforcing unless specifically noted or specified to be omitted.
3. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units in accordance with manufacturer's written instructions.
4. Space continuous horizontal reinforcing as follows:
 - a. Space reinforcing as specified in original contract documents.
5. Reinforce masonry openings greater than 12 inches wide, with horizontal joint reinforcing placed in two horizontal joints approximately eight inches apart, immediately above lintel and immediately below sill. Extend reinforcing minimum of 2.0 feet beyond jambs of opening.
6. In addition to wall reinforcing, provide additional reinforcing at openings as required to comply with the Contract Documents.

G. Structural Bonding of Multi-wythe Masonry:

1. Use continuous reinforcing embedded in horizontal mortar joints for bond tie between wythes as specified in this Section.
2. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.
 - a. For horizontally reinforced masonry, provide continuity at corners with prefabricated "L" units as specified in this Section, in addition to masonry bonding.
3. Intersecting and Abutting Walls: Unless vertical expansion or masonry control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes and space as follows:
 - a. Provide masonry bond in alternate courses.
 - b. Provide individual metal ties at not more than 2.0 feet on centers vertically, unless shown at closer spacing.
 - c. Provide continuity with horizontal joint reinforcing using prefabricated "T" and "L" units.

H. Non-Load Bearing Interior Partitions and Non-Load Bearing Interior Cavity Wall Wythe:

1. Build full height of story to underside of structure above, unless otherwise shown.
2. Tie non load bearing partitions and non-load bearing interior wythe of cavity walls at top and sides with masonry anchors at terminations. Build

in end blocks as shown and specified to facilitate placing compressible filler. Insert compressible filler in all horizontal and vertical joints where non load bearing masonry and non-load bearing interior wythe of cavity walls terminate. Insert filler 3/4inches from both faces of masonry. Use filler four times as thick as the widest part of joint. Thickness of filler shall be minimum of 1.5 times the compressed thickness. Compress filler to less than thickness of joint and insert. At splices, overlap strips by three inches and compress ends to form tight joint. Finish with backer rod and sealant.

- I. Structural Reinforced Unit Masonry Construction:
 - 1. Comply with the requirements of ACI 530.1 and applicable codes.
- J. Grouting Structural Reinforced Unit Masonry Construction:
 - 1. Comply with requirements of ACI 530.1 and applicable codes.
- K. Anchoring Masonry Work:
 - 1. Provide anchoring devices of type specified. If not shown or specified, provide standard type for facing and back up involved in compliance with requirements of Laws and Regulations.
 - 2. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:
 - a. Provide an open space not less than 1/2-inch or more than one-inch in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar and other rigid materials.
 - b. Space anchors as shown, but not more than 2.0 feet on center vertically and 3.0 feet on center horizontally.
 - c. Provide end blocks where masonry abuts structural support to facilitate installation of compressible filler, fire saving insulation, backer rod, and sealant.
 - 3. Anchor single wythe masonry veneer to backing with metal ties as follows:
 - a. Anchor veneer to structural members with metal anchors embedded in masonry joints and attached to structure. Provide anchors with flexible tie section, unless otherwise shown.
 - b. Space anchors as shown, but not more than 2.0 feet on center vertically and 3.0 feet on center horizontally.
- L. Masonry Control and Expansion Joints:
 - 1. Provide vertical control and expansion joints in masonry where shown. Build in related items as unit masonry Work progresses. Rake out mortar in preparation for application of compressible filler, calking and sealants.
 - 2. Masonry Control and Expansion Joints Items: Build in sash block and pre-molded control joint strips as the Work progresses.
- M. Lintels and Bond Beams:

1. Provide masonry lintels and bond beams where openings of 16 inches or more are shown. Provide formed in place masonry lintels and bond beams. Temporarily support formed-in-place lintels and bond beams.
 - a. Unless otherwise shown, provide one horizontal number six deformed reinforcing bar for each 4 inches of wall thickness.
 - b. For hollow masonry unit walls, use specially formed "U"-shaped lintel and bond beam units with reinforcing bars placed as shown, filled with coarse grout as specified.
2. Provide minimum bearing at each jamb of eight inches for all openings.
3. On concrete unit masonry walls where pattern bond remains visually exposed, increase minimum bearing of masonry lintels to maintain joint pattern of wall and install to be indistinguishable from surrounding masonry.

3.05 REPAIR, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During tooling of joints, enlarge voids or holes, except weep holes, and completely fill with mortar. Point up all joints at corners, openings and adjacent Work to provide neat, uniform appearance, properly prepared for application of sealant compounds.
- C. Cleaning Exposed, Unglazed Masonry Surfaces:
 1. Final Cleaning: After mortar is thoroughly set and cured, clean sample wall area of approximately 20 square feet as described below. Obtain ENGINEER's acceptance of sample cleaning before proceeding to clean remainder of masonry Work.
 - a. Dry-clean to remove large particles of mortar using wood paddles and scrappers. Use chisel or wire brush if required.
 - b. Presoak wall by saturating with water and flush off loose mortar and dirt.
 - c. Comply with requirements and recommendations for "Cleaning Clay Products Masonry" of Technical Notes on Brick and Tile Construction by Brick Industry Association for type of masonry and conditions involved in the Work.
 - d. Apply cleaners per manufacturer's instructions.
 - e. Protect other Work from cleaning solutions and cleaning operations.

2. Do not use acid cleaning agent, abrasive tools or powders, or metal cleaning tools or wire brushes, unless specifically recommended in writing by manufacturer.
- D. Protection:
1. Protect unit masonry construction Work from deterioration, discoloration or damage during subsequent construction operations.

3.06 FIELD QUALITY CONTROL

- A. CONTRACTOR shall hire independent testing laboratory acceptable to ENGINEER to take samples and conduct tests to evaluate air entrainment, water retention, and compliance of products with Contract Documents, and to determine compressive strength of mortar and grout. Conduct tests in accordance with ASTM C91. Provide tests results to ENGINEER prior to commencement of Work.
- B. After initial test, ENGINEER will require maximum of five additional tests to be conducted at his discretion.
- C. Test and inspect all non-load-bearing concrete unit masonry during construction, meeting requirements of Level 2 Quality Assurance as defined by ACI 530.1.
- D. Test and inspect all load-bearing concrete unit masonry during construction, meeting the requirements of Level 3 Quality Assurance as defined by ACI 530.1.
- E. Masonry walls that do not meet requirements of Special Inspections shall be repaired in manner acceptable to ENGINEER at no expense to OWNER.

END OF SECTION

SECTION 04012

MASONRY RESTORATION AND CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall furnish all labor, equipment and incidentals required to provide masonry and limestone restoration and cleaning Work as shown and specified.
2. The extent of the masonry and limestone restoration and cleaning Work is shown on the Drawings

B. Coordination:

1. Review installation, restoration and demolition procedures under other Sections and Contracts and coordinate them with the Work specified herein.

1.02 QUALITY ASSURANCE

A. Installer Qualifications: Masonry and limestone cleaning Work shall be performed by a firm with experience in masonry and limestone restoration Work similar in scope to the Work required in this Contract. The CONTRACTOR shall employ only personnel skilled in this type of Work.

B. Codes: Comply with applicable requirements of governing authorities.

C. Job Mock-Up: Prior to start of the masonry and limestone cleaning Work conduct the following procedures on a 4-foot by 6-foot corner of an existing building as selected by the ENGINEER.

1. Cleaning: Prepare area showing materials and methods to be employed.
2. Tuckpointing: Show routing and repointing methods including mortar, type of joint, and workmanship.
3. Repair: Show materials and workmanship.
4. Retain mock-up Work during construction as a standard for judging completed Work. Completed Work which in the opinion of the ENGINEER does not meet the standards of workmanship or quality set on the mock-up and sample areas, shall be redone at no additional cost to the OWNER by any means the ENGINEER may direct.

D. Design Criteria:

1. It is the intention of these Specifications to restore existing damaged masonry and lintels in a manner which will match the surrounding color, texture, coursing and joint tooling of existing undamaged masonry. The CONTRACTOR shall provide appropriate methods as determined by the ENGINEER to achieve this result.

E. Source Quality Control: Obtain all materials from one manufacturer, for each type of material required.

F. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. U.S. Department of the Interior, "Standards for Rehabilitation".

1.03 SUBMITTALS

A. Samples: Submit for approval the following:

1. Cured samples of each type of grout and mortar showing color to match existing, which can be expected in the finished Work.
2. Samples will be reviewed by the ENGINEER for color and texture only. Compliance with other requirements is the exclusive responsibility of the CONTRACTOR.

B. Shop Drawings: Submit for approval the following:

1. Copies of the manufacturer's specifications and test data for masonry and limestone restoration and cleaning materials required, including certification that materials comply with the specified requirements. Include instructions for handling, storage, installation and protection of materials.

C. Test Reports: Submit copies of certified laboratory test data showing existing mortar constituents and ratios.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver materials, in their original containers, plainly marked with identification of materials and manufacturers.

B. Storage of Materials:

1. Protect liquid admixtures from freezing.

1.05 JOB CONDITIONS

- A. Environmental Requirements: Do not place any masonry or limestone when air temperature is 40 F and falling. Masonry and limestone may be placed when air temperature is 32 F and rising. In either case, it may not be placed if temperature is expected to drop below 32 F during next 72 hours unless adequate protection is provided as specified in 1.5.B.3.b below.
- B. Protection:
1. Protect partially completed masonry and limestone restoration Work against weather, when Work is not in progress, by covering top of walls with strong, waterproof, non-staining membrane. Extend membrane at least 2 feet down both sides of walls and hold securely in place.
 2. Do not apply concentrated loads for at least seven days after completing masonry Work.
 3. Cold Weather Protection:
 - a. When surrounding air temperature is 48 F to 40 F protect masonry construction from rain or snow for a minimum of 48 hours by covering with non-staining weathertight membrane.
 - b. When surrounding air temperature is 40 F and below maintains masonry construction temperature above 40 F for a minimum of 48 hours by enclosure and supplementary heat, electric heating blankets, infrared lamps, or other methods acceptable to the ENGINEER.
 - c. Comply with governing codes and review the "Construction and Protection Recommendations for Cold Weather Masonry Construction" of the Technical Notes on Brick and Tile Construction by the Brick Institute of America. Comply with recommendations except where superseded by this Section.
 - d. Frozen Materials: Do not use frozen materials or materials mixed or coated with ice or frost.
 - e. Frozen Work: Do not build on frozen Work. Remove and replace masonry Work damaged by frost or freezing as directed by the ENGINEER.
 4. Hot Weather Protection: Protect masonry construction, by methods acceptable to ENGINEER, from direct exposure to wind and sun when the surrounding air temperature is 99 F in the shade with relative humidity less than 50 percent.
 5. Protect mortar and grout materials from deterioration by moisture and temperature. Store containers tightly closed and away from open flames.

C. Scheduling:

1. Do not proceed with the masonry and limestone restoration and cleaning Work until all accessory items are installed or available for use.
2. Do not deliver limestone unit masonry to the job site until the Work has progressed sufficiently for immediate installation of the limestone units.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Mortar for Unit Masonry: Match existing.
- B. Limestone Masonry: Match existing.
- C. Ties and Reinforcing: Reuse existing ties and reinforcing where possible.
- D. Masonry Repair and Tuckpointing Mortar:
 1. General: Masonry repair mortar shall be used on all areas on the exterior facades of existing buildings requiring localized repairs as directed by the ENGINEER.
 2. Provide mortar for face brick and accessories to match original mortar in color texture, strength, hardness, density and porosity.
 3. Determine existing mortar constituents and ratios by analysis or other data acceptable to the ENGINEER. Review laboratory evaluations and other data with ENGINEER before proceeding with the Work.
 4. Match color of existing mortar by use of aggregates matching original aggregate color where possible. Use inorganic coloring pigments if satisfactory color match cannot be attained with natural materials.
 5. If laboratory or other data indicated that the original mortar is primarily lime and sand use the following mix:
 - a. 1 bag hydrated lime, 1/4 bag portland cement and 3-cubic feet of sand.
 6. If laboratory or other data indicates that the original mortar contains Portland cement and in areas of severe exposure such as parapets use the following:
 - a. 1 bag hydrated lime, 1 bag Portland cement and 5 to 6 - 1/2 cubic feet of sand.
 7. No expansive (non-shrink) type mortar shall be approved by the ENGINEER.

- E. Shims: Stainless steel, lead or plastic only.
- F. Cleaners:
 - 1. General: Final cleaning techniques shall be discussed with the ENGINEER prior to use.
 - 2. The basic technique employed shall be pressure washing and cleaning with a chemical additive specially prepared for the type of masonry.
 - 3. Submit complete description of cleaning technique to be employed to the ENGINEER prior to use giving pressure wash specifications, chemical selection and manufacturer's recommendations.

2.02 MORTAR MIXES

- A. General:
 - 1. Anti-Freeze Admixtures or Agents: Not permitted
 - 2. Calcium Chloride: Not permitted.
- B. Tuckpointing Mortar: Add only enough water to dry mix ingredients to produce a damp, workable mix. Keep mortar in dampened condition for 1 to 2 hours, and then add sufficient water to bring it to proper consistency.

PART 3 - EXECUTION

3.01 INSPECTION

- A. The CONTRACTOR and his installers shall examine areas and conditions under which the Work is to be performed and advise the ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.

3.02 PREPARATION

- A. Wetting of Masonry Units:
 - 1. Use wetting methods which ensure that each masonry unit is nearly saturated but surface dry when laid.

3.03 FINAL CLEANING

- A. Allow mortar to fully harden for approximately 30 days after completion of Work, then thoroughly clean exposed masonry surfaces of excess mortar and foreign matter using stiff nylon or bristle brushes and clean water under normal pressure.
- B. Use of metal scrapers or brushes will not be permitted.

3.04 PROTECTION

- A. Protect the masonry and precast restoration and cleaning Work from deterioration, discoloration or damage during subsequent construction operations.

END OF SECTION

SECTION 04050

UNIT MASONRY CONSTRUCTION

PART 1 - GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install all unit masonry construction. The Work also includes:
 - a. Providing openings in unit masonry construction to accommodate the Work under this and other Sections and building into unit masonry construction all items such as sleeves, anchorage devices, inserts, and other items to be embedded in unit masonry construction for which placement is not specifically included under other Sections.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items to be installed with or before unit masonry construction Work.
2. Remove and rebuild unit masonry construction advanced without built-in flashings and other built-in items at no additional cost to OWNER, even after unit masonry construction has been completed.

C. Related Sections:

1. Section 04 01 21, Masonry Restoration and Cleaning.
2. Section 04 05 11, Masonry Mortaring and Grouting.
3. Section 04 05 19, Masonry Anchorage and Reinforcing.
4. Section 05 50 13, Miscellaneous Metal Fabrications.
5. Section 07 92 00, Joint Sealants.
6. Section 09 91 00, Painting.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. ACI 530, Building Code Requirements for Masonry Structures.
2. ACI 530.1, Specification for Masonry Structures.

3. ASTM C140, Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
4. ASTM C387, Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
5. ASTM C780, Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unity Masonry.
6. ASTM C1093, Practice for Accreditation of Testing Agencies for Unit Masonry.
7. ASTM C1314, Test Method for Compressive Strength of Masonry Prisms.
8. NCMA, TEK Manual for Concrete Masonry Design and Construction.
9. UL, Design No. U 901, Bearing Wall Rating – 4 HR.; Non-bearing Wall Rating – 4 HR.
10. UL, Design No. U 902, Bearing Wall Rating – 4 HR., Alternative Detail.
11. UL, Design No. U 904, Bearing Wall Rating – 3 HR.; Non-bearing Wall Rating – 3 HR.
12. UL, Design No. U 905, Bearing Wall Rating – 2 HR.; Non-bearing Wall Rating – 2 HR.
13. UL, Design No. U 906, Bearing Wall Rating – 2 HR.; Non-bearing Wall Rating – 2 HR.
14. UL, Design No. U 907, Nonbearing Wall Rating – 3 or 4 HR.
15. UL, Design No. U 909, Nonbearing Wall Rating – 3 or 4 HR.
16. UL, Design No. U 910, Bearing Wall Rating – 4 HR.; Non-bearing Wall Rating – 4 HR.
17. UL, Design No. U 912, Bearing Wall Rating – 3 HR.; Non-bearing Wall Rating – 3 HR.
18. UL, Design No. U 913, Bearing Wall Rating – 2 HR.; Non-bearing Wall Rating – 2 HR.
19. UL, Design No. U 914, Bearing Wall Rating – 3 HR.; Non-bearing Wall Rating – 3 HR.

1.03 TERMINOLOGY

- A. The following words or terms are not defined but, when used in this Section, have the following meaning:

1. Masonry control joint" is a joint in interior and exterior masonry walls that allows expansion and contraction to occur independently without damage to the masonry.
2. Masonry expansion joint" is a control joint in interior and exterior masonry walls, located at the separation between adjoining parts of a concrete or steel structure that is provided to allow movements transferred to the masonry to occur independently without damage to the masonry.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Installer:

- a. Engage a single installer regularly engaged in preformed unit masonry installation and with successful and documented experience in erecting unit masonry of the scope and type of Work required; and who employs only tradesmen with specific skill and successful experience in the type of Work required. Submit name and qualifications with the following information for a minimum of three successful projects:
 - 1) Names and telephone numbers of owners, architects, or engineers responsible for projects.
 - 2) Approximate contract cost of unit masonry.
 - 3) Quantity (area) of unit masonry installed.

B. Component Supply and Compatibility:

1. Obtain each type of concrete masonry units from one manufacturer, cured by one process and of uniform texture and color or in an established uniform blend thereof.
2. Use a single source and brand of mortar materials throughout the Work.

C. Regulatory Requirements:

D. Job Mock-up:

1. Prior to installing unit masonry and after ENGINEER's approval of Samples, erect job mock-ups using materials, pattern bond, and joint tooling shown or specified. Build mock-up at the Site, at location acceptable by ENGINEER, of full required wall thickness. Mock-up shall be approximately four feet by 3.33 feet unless another size or location is shown or indicated for the job mock-up. Provide special features as directed, including finished opening 16 inches by 16 inches, finished end, and masonry control joint. Indicate proposed range of color, texture, and workmanship to be expected in the completed Work. Obtain

ENGINEER's approval of visual qualities of mock-up before starting unit masonry construction. Retain and protect mock-up during construction as a standard for judging unit masonry Work. Do not alter, move, or destroy mock-up until given permission by ENGINEER.

2. Build as many mock-up panels as required to obtain ENGINEER's approval.
3. Masonry construction that does not comply with standards approved on mock-up panel shall be removed and rebuilt to conform to the Contract Documents. Provide mock-up panel for the following:
 - a. Typical complete exterior walls, including metal cavity wall flashing, anchors and masonry wall ties, and other components of complete exterior wall system.
 - b. Typical complete interior partition of concrete unit masonry where both sides will remain visually exposed upon completion of the Work.
 - c. Typical interior glazed structural tile partition using all shapes and accessories shown on the approved Shop Drawings and other submittals.
 - d. Typical interior partition of concrete unit masonry using all shapes and accessories shown or indicated on the approved Shop Drawings and other submittals.

E. Pre-Construction Masonry Conference:

1. Prior to installing unit masonry construction, CONTRACTOR and CONTRACTOR's installer shall attend pre-construction masonry conference at the Site. Review foreseeable methods and procedures related to unit masonry construction including, but not limited to, the following:
 - a. Requirements of the Contract Documents.
 - b. Structural concept.
 - c. Sequence of masonry construction.
 - d. Special masonry details.
 - e. Required submittals, including LEED submittal requirements.
 - f. Standard of workmanship.
 - g. Prism and grout sampling, and unit masonry test results.
 - h. Quality control requirements.

- i. Project organization and availability of materials, tradesmen, equipment, and facilities required to avoid delays.
 - j. Masonry control and expansion joint locations and materials.
 - k. Modular planning requirements.
 - l. Weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
 - m. Required inspection, testing, and certifying procedures.
 - n. Requirements for complying with building codes.
 - o. Construction waste management plan requirements, if any.
2. Attendance at the conference is mandatory for the following:
- a. CONTRACTOR, including Site superintendent and LEED coordinator.
 - b. Masonry Subcontractor's superintendent and foreman.
 - c. Authorized representative of face brick and concrete unit masonry Suppliers.
 - d. ENGINEER
 - e. Resident Project Representative, if any.
 - f. Coordinating Special Inspector.
3. If additional information is required to adequately cover items on agenda, reconvene conference as soon as possible.
4. CONTRACTOR shall record discussions of conference and decisions and agreements (or disagreements) and furnish a copy of the record to each person and entity attending.

1.05 SUBMITTALS

- A. Action Submittals: Submit the following:
- 1. Shop Drawings:
 - a. Complete layout of all masonry walls showing modular planning and all special shapes to be used in the Work. Show all details for each condition encountered in the Work. Submit plan and elevation views drawn at scale of 1/4-inch equal to one foot, and details drawn at scale of 1.5-inch equal to one foot. Show all items included in the unit masonry construction.

- b. Masonry control joint locations and details.
 - c. Drawings showing location, extent, and accurate configuration and profile of all items required by the Contract Documents, in this and other Sections, for unit masonry construction. Provide elevations drawn at scale of 1/4-inch equal to one foot, and details drawn at scale of 1.5-inch equal to one foot.
 - d. Drawings for fabricating, bending, and placing of reinforcing bars. Submit bar schedules, diagrams of bent bars, stirrup spacing, lateral ties, and other arrangements and assemblies required for fabricating and placing of reinforcing for unit masonry construction.
 - e. Job Mock-Up: Shop Drawings showing location, extent, and accurate configuration of items to be built-in to mock-ups. Provide elevations drawn at scale of 1.5-inch equal to one foot.
 - 2. Samples:
 - a. Mock-ups.
- B. Informational Submittals: Submit the following:
 - 1. Field Quality Control Submittals:
 - a. Pre-installation test results in accordance with ASTM C140 and ASTM C1314, and the field quality control Article of this Section.
 - b. Post-installation quality control submittals in accordance with the field quality control Article of this Section.
 - 3. Qualifications Statements:
 - a. Installer.
 - b. Testing laboratory.

1.06 DELIVERY, STORAGE AND HANDLING

- A. General:
 - 1. Comply with:
 - a. Section 01610, Transportation and Handling
 - b. Section 01610, Transportation and Handling
 - 2. Storage: Maintain temperatures in shelter so that masonry materials are above 20 degrees F when installed.

1.07 SITE CONDITIONS

A. Environmental Requirements:

1. General:

- a. Temporary Facilities and Temporary Utilities: Provide supplemental heat sources and energy as required for unit masonry construction in cold weather.
- b. Do not perform unit masonry construction when air temperature is below 28 degrees F for rising temperature, or below 36 degrees F for falling temperatures, without providing temporary enclosures and heat, or without heating materials or other measures necessary to prevent freezing as specified.
- c. Do not use frozen materials and do not build on frozen unit masonry construction.
- d. Remove and replace all unit masonry construction damaged by cold temperatures and freezing.

2. Protection:

- a. Cold Weather Protection: Protect unit masonry construction against freezing for at least 48 hours after placement, as follows:
 - 1) When anticipated minimum temperature will be between 40 degrees F and 25 degrees F, cover newly constructed masonry with weather-resistive membrane for 48 hours after installation.
 - 2) When anticipated minimum temperature will be between 25 degrees F and 20 degrees F, completely cover newly constructed masonry with weather-resistive insulating blankets, or equal protection, for 48 hours after installation.
 - 3) When anticipated minimum temperature will be below 20 degrees F, maintain newly constructed masonry at temperature above 32 degrees F for at least 48 hours after installation by using heated enclosures, electric heating blankets, infrared lamps, or other acceptable methods of supplementary heating.
- b. Hot Weather Protection: When mean daily temperature exceeds 100 degrees F, or exceeds 90 degrees F with wind velocity greater than eight miles per hour, fog-spray newly constructed masonry until damp at least three times per day until masonry is 72 hours old.
- c. When Work is not in progress, protect partially-completed unit masonry construction against rapid heat loss and from water

entering the masonry by covering top of walls with strong, waterproof, non-staining membrane. Extend membrane at least two feet down both sides of wall and secure in place using wall cover clamps spaced at intervals of four feet and at each end, and at joints in the membrane.

- d. Do not apply floor or roof loading for at least 72 hours after completing masonry columns or walls.
- e. Do not apply concentrated loads for at least 168 hours after completing masonry columns or walls.

3. Cold Weather Unit Masonry Construction:

- a. When mean daily temperature is below 40 degrees F, mortar used in unit masonry construction shall be Portland cement-lime-sand mortar using high-early strength Portland cement. Use mortar within 1.5 hours of initial mixing. Use grout within 1.5 hours of initial mixing.
- b. Clay or shale unit masonry with suctions in excess of 20 grams of water per 30 square inches per minute shall be sprinkled with heated water just prior to installation. Provide water temperature above 70 degrees F when temperature of masonry units is above 32 degrees F. Water temperature shall be above 120 degrees F when temperature of masonry units is below 32 degrees F.
- c. For Air Temperatures of 40 degrees F to 32 degrees F: Water and aggregates used in mortar and grout shall not be heated above 140 degrees F. Heat mortar sand or mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F at time of mixing. Heat water and aggregates for grout when water or aggregate temperature is below 32 degrees F.
- d. For Air Temperatures of 32 degrees F to 25 degrees F: Comply with Paragraph 1.7.A.3.c of this Section and the following: Maintain mortar temperature above freezing until used in masonry. Heat aggregates and mixing water for grout to produce grout temperature between 70 degrees F and 120 degrees F at time of mixing. Maintain grout temperature above 70 degrees F at time of grout placement.
- e. For Air Temperatures of 25 degrees F to 20 degrees F: Comply with Paragraphs 1.7.A.3.c and 1.7.A.3.d of this Section and the following: Heat masonry surfaces under construction to 40 degrees F. Provide temporary wind breaks or enclosures when wind velocity exceeds 15 miles per hour. Prior to grouting, heat the masonry to minimum of 40 degrees F.
- f. For Air Temperatures of 20 degrees F and below: Comply with Paragraphs 1.7.A.3.c, 1.7.A.3.d, and 1.7.A.3.e of this Section and

the following: Provide temporary enclosures and auxiliary heat to maintain air temperature within temporary enclosure above 32 degrees F. Temperature of masonry units when laid shall not be less than 20 degrees F.

4. Hot Weather Unit Masonry Construction: Using methods acceptable to ENGINEER, protect unit masonry construction from direct exposure to wind and sun when ambient air temperature is 99 degrees F in shade with relative humidity less than 50 percent.
 - a. When ambient temperature exceeds 100 degrees F, or exceeds 90 degrees F with wind velocity greater than eight miles per hour, maintain temperature of mortar and grout below 120 degrees F. Flush mixers, mortar transport containers, and mortarboards with cool water before they come into contact with mortar ingredients or mortar. Maintain mortar consistency by re-tempering with cool water. Use mortar within two hours of initial mixing. Use grout within 1.5 hours of initial mixing. Maintain sand piles in damp, loose condition.
 - b. When ambient temperature exceeds 115 degrees F, or exceeds 105 degrees F with wind velocity greater than eight miles per hour, comply with Paragraph 1.7.A.4.a of this Section and the following: Use cool mixing water for mortar and grout. Use of ice will be allowed in mixing water prior to use; ice is not allowed in the mixing water when added to other mortar or grout materials. Shade materials and mixing equipment from exposure to direct sunlight.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Material requirements for masonry materials are in the following:
 1. Section 04 05 11, Masonry Mortaring and Grouting.
 2. Section 04 05 19, Masonry Anchorage and Reinforcing.
 3. Section 04 22 00, Concrete Unit Masonry.
- B. Mortar, General:
 1. Where question of compliance with or interpretation of requirements of this Section arises, mortar properties Specification will take precedence over mortar proportion Specifications.
 2. Make no change in proportions established for mortar approved under property Specifications, and do not use materials with different physical characteristics in mortar unless compliance with requirements of property Specifications is re-established by Shop Drawing or submittal data.

3. Do not combine two air-entraining materials in mortar.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which unit masonry construction will be installed, and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Wetting of Masonry Units:
 1. Use wetting methods that ensure that each masonry unit is nearly saturated, but surface-dry when laid.
 2. Concrete Masonry Units: Except for absorbent units specified to be wetted, lay masonry units dry. Do not wet concrete masonry units.
- B. Cleaning of Reinforcing: Before placing, remove loose rust, mill scale, earth, ice, and other contamination from reinforcing materials. Do not use reinforcing bars with kinks or bends not shown or approved Shop Drawings, or bars with reduced cross-section due to rusting or other causes.

3.03 INSTALLATION, GENERAL

- A. Thickness: Build walls, floors, and other unit masonry construction to thickness shown or indicated. Build single wythe walls to actual thickness of masonry units using units of nominal thickness shown or indicated.
- B. Build chases and recesses as shown or required by others, as specified. Provide not less than eight inches of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.
- C. Leave openings for equipment, piping, ducts, and other items to be installed subsequent to starting unit masonry construction. After installation of said items, complete unit masonry construction to match the Work immediately adjacent to openings.
- D. Cut masonry units using motor-driven wet cutting saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining Work neatly. Use full-size units without cutting where possible. Provide special unit masonry shapes for transitions and intersections. Do not attempt to field-cut special shapes from regular unit masonry shapes, and do not use other options for special unit masonry shapes.
- E. Build interior masonry walls visible from both sides in the finished Work using two wythes of masonry. Masonry shall be continuous over entire plane of wall, including walls that continue behind fixtures, equipment, furniture, lockers, and similar items

- F. Matching Existing Masonry: Match with existing masonry the coursing, pattern bond, color, and texture of new unit masonry construction

3.04 LAYING MASONRY WALLS

A. General:

1. Mortar Types: Unless otherwise shown or indicated, use mortar specified in Section 0405 11, Masonry Mortaring and Grouting, as follows:
 - a. Use Type M mortar for exterior load-bearing walls.
 - b. Use Type S mortar for other exterior walls and interior load-bearing walls.
 - c. Use Type N mortar for interior, non-load-bearing walls.
 - d. Use epoxy pointing mortar for glazed structural tile.
 - e. Use mortar type specified in Section 04 05 11 Masonry Mortaring and Grouting, for tuck pointing mortar.
 - f. Use grout fill for structural requirements and for grouting reinforcing steel in unit masonry construction.
 - g. Do not use mortar that has begun to set or if more than thirty minutes have elapsed since initial mixing. Re-temper mortar during the thirty-minute period only as required to restore workability.
2. Lay out walls in advance for accurate spacing of surface pattern bond with uniform joint widths and to properly locate openings, masonry control joints, returns, and offsets. Avoid using less than half-size units at corners, jambs, and where possible at other locations.
3. Lay-up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced, and coordinated with other work.
4. Color and Texture:
 - a. Lay concrete unit masonry using mortar of natural color.

B. Construction Tolerances:

1. Variation from Plumb: For lines and surfaces of columns, walls and arises, do not exceed 1/4-inch in ten feet, or 3/8-inch in a story height (20 feet), maximum, nor 1/2-inch in 40 feet or more. Except for external corners, expansion joints and other conspicuous lines, do not exceed 1/4-inch in any story or 20 feet maximum, nor 1/2-inch in 40 feet or more.

2. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4-inch in any bay or 20 feet maximum, nor 3/4-inch in 40 feet or more.
3. Variation of Linear Building Line: For position shown and related portion of columns, walls and partitions, do not exceed 1/2-inch in any bay or 20 feet maximum, nor 3/4-inch in 40 feet or more.
4. Variation in Cross Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4-inch nor plus 1/2-inch.

C. Mortar Bedding and Jointing:

1. Lay solid masonry units and glazed structural tile with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.
2. Lay vertical cell glazed structural tile units with divided head joints.
3. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course of piers, columns, and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.
4. Maintain joint widths shown, except for minor variations required to maintain pattern bond alignment. If not shown, lay unit masonry to provide the following joint widths:
 - a. Concrete Unit Masonry: 3/8-inch.
 - b. Prefaced Concrete Unit Masonry: 1/4-inch.
 - c. Concrete Unit Masonry Patches: Match existing adjacent joint width.
 - d. Match width, texture and color of existing joints.
5. Cut joints flush for masonry walls to be concealed or to be covered by other materials, except paint, unless otherwise shown.
6. Tool exposed joints slightly concave, when mortar is "thumbprint hard", unless otherwise required to match existing joint treatment. Rake out mortar 1/2-inch deep in preparation for application of calking or sealants and for epoxy pointing mortar for glazed structural tile where required.
7. Concave-tool exterior joints below grade.
8. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units that have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

D. Collar Joints:

1. Fill vertical space between wythes solidly with mortar by parging the in-place wythe and shoving units into the parging, for the following unit masonry construction:
 - a. Exterior multi-wythe walls, except cavity walls, and interior multi-wythe walls and partitions.
 - b. Load-bearing interior walls and partitions where metal ties or horizontal reinforcing are specified for structural bonding.
 - c. Non-load-bearing interior walls or partitions where metal ties or horizontal reinforcing are specified for structural bonding and full thickness of wall or partition is required to comply with code requirements for thickness to height ratio.

E. Stopping and Resuming Work: Rake back one-unit masonry length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly, if required, and remove loose masonry units and mortar prior to laying new masonry.

F. Built-in Work:

1. As the Work progresses, build-in the items shown, specified or required in the Contract Documents. Fill cores in one-block width solidly with mortar around built-in items.
2. Do not fill space between hollow metal frames and masonry solidly with mortar.
3. Where built-in items are to be embedded in cores of hollow masonry units, place layer of cavity fill mesh in the joint below and rod mortar or grout into core.
4. Where required by Laws or Regulations, or to comply with thickness-to-height ratio, or to provide required fire resistance, fill all cells of unit masonry construction solid with grout.

H. Non-Load-Bearing Interior Partitions and Non-Load-Bearing Interior Cavity Wall Wythe:

1. Build full height of story to underside of structure above, unless otherwise shown or indicated.
2. Tie non-load-bearing partitions and non-load-bearing interior wythe of cavity walls at top and sides with masonry anchors at terminations. Build in end blocks as shown and specified to facilitate placing compressible filler. Insert compressible filler, specified in Section 04 05 19, Masonry Anchorage and Reinforcing, in all horizontal and vertical joints where non-load-bearing masonry and non-load-bearing interior wythe of cavity walls

terminate. Insert filler 3/4-inch from both faces of masonry. Use filler four times as thick as widest part of joint. Thickness of filler shall be a minimum of 1.5 times the compressed thickness. Compress filler to less than thickness of joint and insert. At splices, overlap strips by three inches and compress ends to form tight joint. Finish with backer rod and sealant.

J. Horizontal Joint Reinforcing:

1. Provide continuous horizontal joint reinforcing as shown and specified. Refer to Section 04090, Masonry Accessories, for reinforcing units required. Fully embed longitudinal side rods in mortar for entire length of rods with minimum cover of 5/8-inch on exterior side of walls and 1/2-inch at other locations. Lap reinforcing minimum of six inches at ends of units. Do not bridge masonry control joints and building expansion joints with reinforcing.
2. Reinforce walls with continuous horizontal joint reinforcing unless specifically indicated as being omitted.
3. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend units in accordance with manufacturer's written instructions for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
4. Space continuous horizontal reinforcing as follows:
 - a. For multi-wythe walls, solid or cavity, that are structurally bonded by masonry headers or individual wire ties, space horizontal reinforcing as shown on original Contract Drawings.
 - b. For multi-wythe walls, solid or cavity, where continuous horizontal reinforcing also acts as structural bond or tie between wythes, space reinforcing as required by Laws and Regulations and as shown on original Contract Drawings.
 - c. For single-wythe walls, space reinforcing as shown on original Contract Drawings.
 - d. For parapets, space reinforcing as shown on original Contract Drawings.
5. Reinforce masonry openings greater than 12 inches wide, with horizontal joint reinforcing placed in two horizontal joints approximately eight inches apart, immediately above lintel and immediately below sill. Extend reinforcing a minimum of two feet beyond jambs of opening.
5. In addition to wall reinforcing, provide additional reinforcing at openings as required to comply with the above.

K. Structural Reinforced Unit Masonry Construction:

1. Comply with ACI 530, ACI 530.1 and Laws and Regulations for structural reinforced unit masonry construction.
2. Shape and dimension reinforcement as shown and required by applicable ACI standards and Laws and Regulations.
3. Position reinforcing accurately at spacing shown on approved Shop Drawings. Support and secure vertical bars against displacement using rebar positioners.
4. Where vertical bars are shown in close proximity, provide clear distance between bars of not less than the greater of the nominal bar diameter or one-inch.
5. For columns, piers, and pilasters, provide clear distance between vertical bars as shown, but not less than the greater of 1.5 times nominal bar diameter or 1.5 inches. Provide lateral ties.
6. Provide lapped splices with reinforcing steel placed in contact and wire tied. Provide minimum lap required by Laws and Regulations, unless requirements that are more stringent are shown or indicated. Do not splice reinforcing at points other than shown or as approved on Shop Drawings.
7. Provide substantial and tight formwork and shores as required for temporary support of reinforced masonry elements. Design, erect, support, brace, and maintain formwork.
8. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar grout. Brace, tie, and support as required for maintaining position and shape during construction and curing of reinforced masonry.
9. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other temporary loads that may be placed on them during construction.
10. Allow not less than the following duration to elapse after completing a member before removing shores or forms, provided suitable curing conditions have been obtained during the curing period:
 - a. Girders and Beams: Ten days.
 - b. Slabs: Seven days.
 - c. Reinforced Masonry Soffits: Seven days.

L. Grouting Structural Reinforced Unit Masonry Construction:

1. Limit extent of masonry construction to sections that do not exceed the maximum pour requirements specified. Provide temporary dams or barriers to control horizontal flow of grout at ends of wall sections. Build dams to full height of grout pour. If masonry units are used, do not bond into permanent masonry wythes. Remove temporary dams after completing grout pour.
2. Use fine grout for filling spaces less than four inches in both horizontal directions. Use coarse grout for filling spaces four inches or larger in both horizontal directions.
3. For spaces 10 inches and larger, use concrete fill.
4. Low-Lift Grouting:
 - a. Use low-lift grouting techniques using fine grout mix for the following:
 - 1) Two-wythe walls with grout space of two inches or less in width.
 - 2) Multi-wythe walls.
 - 3) Columns, piers and pilasters where masonry units are shown in core areas enclosed by masonry units.
 - 4) Grout spaces less than 2-inches in width at intervals not to exceed two feet in lifts of six to eight inches.
 - 5) At CONTRACTOR's option, low-lift-grouting technique may be used for structural reinforced unit masonry construction with grout spaces wider than two inches, except use coarse grout mix and place in lifts not to exceed eight inches in height.
 - b. Construct low-lift structural reinforced unit masonry construction by placing reinforcing, laying masonry units and pouring grout as the Work progresses.
 - c. Place vertical reinforcing bars and supports prior to laying of masonry units. Extend above elevation of maximum pour height as required to allow for splicing. Horizontal reinforcing bars may be placed progressively with laying of masonry units.
 - d. Limit grout pours as required to prevent displacing masonry by grout pressure (blowout), but do not exceed 12-inch pour height.
 - e. Lay masonry units prior to each grout pour, but do not construct more than 12 inches above maximum grout pour height in one

exterior wythe and four inches above in other exterior wythe.
Provide metal wall ties, if required, to prevent blowouts.

- f. Pour grout using container with spout and consolidate immediately by rodding or puddling; do not use trowels. Place grout continuously; do not interrupt pouring of grout for more than one hour. If poured in lifts, place from center-to-center of masonry courses. Terminate pour 1.5 inches below top of highest course in pour.

5. High-Lift Grouting:

- a. High-lift grouting technique may be used for the following structural reinforced unit masonry construction:
 - 1) Two-wythe walls with grout spaces of 2.5 inches or greater width.
 - 2) Columns, piers, or pilasters when no unit masonry fill is shown to be placed in reinforced grout space.
- b. Place reinforcing and support in proper position, prior to laying of masonry units, except if shown to be placed in mortar joints, place as masonry units are laid. Place horizontal bars in grout spaces on same side of vertical bars.
- c. Construct high-lift structural reinforced unit masonry construction by laying masonry to full height and width prior to placing of grout. Provide cleanout holes in first course of masonry, and use high-pressure water jet stream to remove excess mortar from grout spaces, reinforcing bars and top surface of structural members, which support wall. Clean grout spaces daily during construction of masonry.
- d. Walls: Omit every other masonry unit in first course of one wythe to provide cleanout holes. Tie wythes together with metal ties as shown or required by Laws and Regulations, but provide not less than nine-gage wire ties spaced not less than two feet on centers horizontally and 16 inches on centers vertically for running pattern bond or 12 inches on centers vertically for stack bond.
- e. Columns, Piers, and Pilasters: Omit every other masonry unit around perimeter of member to provide cleanout holes. Provide reinforcing bands placed in bed joints as the structural reinforced unit masonry construction progresses. Provide bands of the size and vertical spacing shown, or as required by Laws and Regulations, but not less than nine-gage wire spaced 12 inches on centers vertically.

- f. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dirt, dust, mortar droppings, loose pieces of masonry, and other foreign materials from grout spaces. Clean reinforcing and adjust to proper positioning. Clean top surface of structural members supporting masonry to ensure bond. After cleaning and inspection, close cleanout holes with matching masonry units and brace closures to resist grout pressures.
 - g. Place grout after entire height of masonry to be grouted has attained sufficient strength to resist grout pressure, but not less than three days curing time. Install shores and bracing, if required, before starting grouting operations.
 - h. Place grout by pumping into grout spaces, unless alternate methods are acceptable to ENGINEER.
 - i. Use coarse grout mix. Rod or vibrate each grout lift during placing and again after excess moisture has been absorbed, but before plasticity is lost. Do not penetrate or damage grout placed in previous lifts or pours.
 - j. Limit grout pours to sections that can be completed in one working day with not more than one-hour interruption of pouring operation. Limit pours to not exceed capacity of masonry to resist displacement or loss of mortar bond due to grout pressures.
 - 1) Do not exceed 12 feet pour height.
 - 2) Do not exceed 25 feet horizontal pour dimension.
 - k. Where pour height exceeds four feet place grout in series of lifts not exceeding four feet in height. Place each lift as continuous pouring operation. Allow at least 30 minutes and not more than 60 minutes between lifts of each pour.
 - l. When more than one pour is required to complete a section of masonry, extend reinforcing beyond masonry as required for splicing. Pour grout to within 1.5 inches of top course of first pour. After grouted masonry is cured, remove temporary dams, lay masonry units, and place reinforcing for second pour section before grouting.
- M. Anchoring Masonry Work:
- 1. If not shown or indicated, provide standard type for facing and back-up involved in compliance with Laws and Regulations.
 - 2. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:

- a. Provide an open space not less than a 1/2-inch or more than one-inch in width between masonry and structural members, unless otherwise shown. Keep open space free of mortar and other rigid materials.
 - b. Anchor masonry to cast-in-place concrete and structural steel members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections.
 - c. Anchor masonry to cast-in-place concrete and structural steel members using continuous wire ties embedded in mortar and snap-locked into seismic clips and with triangular ties fitted with flexible dovetails for anchorage to cast-in-place concrete in accordance with Section 04 05 19, Masonry Anchorage and Reinforcing.
 - d. Space anchors as shown on 100 % Submittal Drawings.,
 - e. Provide end blocks where masonry abuts structural support to facilitate installation of compressible filler, fire-safing insulation, backer rod, and sealant.
- 3. Anchor single-wythe masonry veneer to backing with metal ties as follows:
 - a. Anchor veneer to structural members with metal anchors embedded in masonry joints and attached to structure. Provide anchors with flexible tie section, unless otherwise shown.
 - b. Anchor veneer to concrete back-up with dovetail anchors and to structural steel back-up with slotted anchors.
 - c. Anchor veneer to concrete and structural steel members using continuous wire ties embedded in mortar and snap-locked into seismic clips with triangular ties, fitted with flexible dovetails for anchorage to cast-in-place concrete, snap-locked to seismic clip and attached to structural supports in accordance with Section 04 05 19, Masonry Anchorage and Reinforcing.
 - d. Space anchors as shown, but not more than two feet on centers vertically and three feet on centers horizontally.
- N. Masonry Control and Expansion Joints:
 - 1. Provide vertical expansion and control joints in masonry where shown. Build in related items as unit masonry construction progresses. Rake out mortar in preparation for application of calking and sealants, in accordance with Section 07920, Joint Sealants.
 - 2. Provide masonry control and expansion joints items specified under Section 04051, Masonry Anchorage.

- a. Build-in compressible fillers as specified. Install in accordance with manufacturer's written instructions.
 - b. Build-in factory-pre-molded control joint strips into masonry. Build-in sash block and pre-molded control joint strips as the Work progresses.
 - c. Provide end blocks where masonry partitions abut structure to facilitate installation of compressible filler, fire-safing insulation, backer rod, and sealant.
 - d. Build-in prefabricated control and expansion joint assemblies, into masonry. Install in accordance with manufacturer's written instructions.
4. Concrete Unit Masonry Control Joint Spacing: Locate masonry control joints as recommended by NCMA TEK Manual for Concrete Masonry Design and Construction.
5. Masonry Expansion Joint Spacing: Locate masonry expansion joints at structural expansion joints.
6. Masonry Control and Expansion Joint Spacing: Provide masonry control and expansion joints as shown.
7. Provide masonry lintels and bond beams as indicated on 100 % submittal Drawings. Provide formed-in-place masonry lintels and bond beams. Temporarily support formed-in-place lintels and bond beams.
 - a. Unless otherwise shown or indicated, provide one horizontal No. 4 deformed reinforcing bar for each four inches of wall thickness.
 - b. For hollow masonry unit walls, use specially formed U-shaped lintel and bond beam units with reinforcing bars placed as shown, filled with grout as specified in Section 04051, Masonry Mortaring and Grouting.
8. Provide minimum bearing at each jamb, of four inches for openings less than six feet wide, and eight inches for wider openings.
9. On concrete and clay unit masonry walls where pattern bond remains visually exposed, increase minimum bearing of masonry lintels to maintain joint pattern of wall and install to be indistinguishable from surrounding masonry.

3.05 REPAIR, POINTING, AND CLEANING

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

- B. Pointing: During tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints at corners, openings, and adjacent Work to provide a neat, uniform appearance, properly prepared for application of sealant compounds.
- C. Cleaning Glazed Masonry Work:
 - 1. After laying glazed masonry units, wipe off excess mortar with clean, soft, damp cloth.
 - 2. Clean glazed surfaces with clean water and soap powder and rinse with clear water, as recommended by unit masonry manufacturer.
 - 3. Do not use acid cleaning agent, abrasive tools, or powders, or metal cleaning tools or wire brushes, unless specifically recommended in writing by manufacturer.
- D. Cleaning Exposed, Unglazed Masonry Surfaces:
 - 1. Wipe off excess mortar as the Work progresses. Dry-brush at end of each day's work.
 - 2. Final Cleaning: After mortar is thoroughly set and cured, clean sample wall area of approximately 20 square feet as described below. Obtain ENGINEER's acceptance of sample cleaning before proceeding to clean remainder of masonry Work.
 - a. Dry clean to remove large particles of mortar using wood paddles and scrappers. Use chisel or wire brush if required.
 - b. Presoak wall by saturating with water and flush off loose mortar and dirt.
 - c. Scrub down wall with stiff fiber brush and solution of half-cup of sodium hexameta phosphate and half-cup of household detergent dissolved in one gallon of water.
 - d. Rinse walls, using clean, pressurized water, to neutralize cleaning solution and remove loose material.
 - e. Acid cleaning of masonry is unacceptable.
- G. Protection:
 - 1. Protect the unit masonry construction from deterioration, discoloration, and damage during subsequent construction operations. At areas where items are installed that project from the finish plane of masonry walls, such as concrete curbs, precast concrete sills, and the like, immediately upon completion of the projecting portion of the Work, provide a minimum 3/4-inch-thick plywood cover, cut to fit, to prevent damage from

operations continuing above the work. Refer to Section 06105,
Miscellaneous Rough Carpentry.

3.06 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Pre-construction Testing:
 - a. Engage independent testing laboratory to obtain samples and conduct the following tests prior to the start of installation of unit masonry construction:
 - 1) Mortar Test: For each mix required: ASTM C780.
 - 2) Grout Test: For each mix required: ASTM C1019 and ACI 530.1.
 - 3) Prism Test: For each type of construction required: ASTM C1314 and ACI 530.1.
 - 4) Compressive strength of completed concrete unit masonry walls shall be at least 1,500 psi as determined by methods in ACI 530.1.
 - b. Obtain ENGINEER's acceptance of tests results prior to commencing installation of materials.
 - c. After initial test, ENGINEER will require performance of up to five additional tests ENGINEER's discretion.
2. During and After Installation:
 - a. Test and inspect unit masonry during construction in accordance with quality assurance program defined in ACI 530, ACI 530.1 and Laws and Regulations in effect at the Site, including building code
3. Repair masonry walls that do not comply with requirements of the special inspections in a manner acceptable to ENGINEER.

END OF SECTION

SECTION 04051

MASONRY MORTARING AND GROUTING

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install masonry mortaring and grouting for unit masonry architectural precast concrete construction.
2. This Section includes masonry mortaring and grouting for masonry architectural precast concrete
 - a. Section 04012, Masonry Restoration and Cleaning.
 - b. Section 04220, Concrete Unit Masonry.
3. Types of materials required under this Section include:
 - a. Portland cement-lime mortars.
 - b. Fire-resistant mortars.
 - c. Ready-mixed mortar
 - d. Fine grout.
 - e. Coarse grout.
 - f. Grout fill around reinforcement in masonry lintels and bond beams.
 - g. Epoxy pointing mortar.
 - h. Tuck pointing mortar
 - i. Mortar waterproofing admixtures, inorganic pigments, and other miscellaneous mortar components and additives.

B. Related Sections:

1. Section 04012, Masonry Restoration and Cleaning.
2. Section 04050, Unit Masonry Construction.
3. Section 04220, Concrete Unit Masonry.

1.02 REFERENCES

- A. Referenced Standards: Standards referenced in this Section are:
1. ANSI/UL 263, Fire Resistance Ratings.
 - a. BXUV U901, Bearing Wall Rating – 4 HR.; Nonbearing Wall Rating – 4 HR.
 - b. BXUV U902, Bearing Wall Rating – 4 HR., Alternative Detail.
 - c. BXUV U904, Bearing Wall Rating – 3 HR.; Nonbearing Wall Rating – 3 HR.
 - d. BXUV U905, Bearing Wall Rating – 2 HR.; Nonbearing Wall Rating – 2 HR.
 - e. BXUV U906, Bearing Wall Rating – 2 HR.; Nonbearing Wall Rating – 2 HR.
 - f. BXUV U907, Nonbearing Wall Rating – 3 or 4 HR.
 - g. BXUV U909, Nonbearing Wall Rating – 3 or 4 HR.
 - h. BXUV U910, Bearing Wall Rating – 4 HR.; Nonbearing Wall Rating – 4 HR.
 - i. BXUV U912, Bearing Wall Rating – 3 HR.; Nonbearing Wall Rating – 3 HR.
 - j. BXUV U913, Bearing Wall Rating – 2 HR.; Nonbearing Wall Rating – 2 HR.
 - k. BXUV U914, Bearing Wall Rating – 3 HR.; Nonbearing Wall Rating – 3 HR.
 2. ASTM C5, Specification for Quicklime for Structural Purposes.
 3. ASTM C144, Specification for Aggregate for Masonry Mortar.
 4. ASTM C150/C150M, Specification for Portland Cement.
 5. ASTM C207, Specification for Hydrated Lime for Masonry Purposes.
 6. ASTM C270, Specification for Mortar for Unit Masonry.
 7. ASTM C387/C387M, Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
 8. ASTM C404, Specification for Aggregates for Masonry Grout.

9. ASTM C1019, Test Method for Sampling and Testing Grout.

1.03 QUALITY ASSURANCE

- A. Component Supply and Compatibility:
 - 1. Do not change source or brands of mortar materials during the Project.
- B. Regulatory Requirements:
 - 1. Where fire-resistance classification is shown or indicated for unit masonry construction (four-hour, three-hour, and similar designations), proportion mortar and masonry grouts to comply with requirements established by fire rating designations of ANSI/UL 263 indicated in this Section, Laws and Regulations, and requirements of authorities having jurisdiction.
- C. Job Mockup: Refer to Section 04050, Unit Masonry Construction.

1.04 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Shop Drawings:
 - a. Schedule of locations where each mortar type will be used in the Work.
 - b. Grout mix design and material certification.
 - 2. Product Data:
 - a. Manufacturer's specifications and instructions for each manufactured material or product.
 - b. Compression test results of grout mix, for identical mix previously prepared and tested, in accordance with ASTM C1019, at maximum aggregate allowed. If no previously-prepared mix is identical, perform tests on the job mix design in accordance with ASTM C1019 and submit to ENGINEER.
 - c. Product data and specifications for integral waterproofing admixture.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Portland Cement: Provide the following for Portland cement-lime mortars:
 - 1. ASTM C150/C150M:
 - a. Use Type I when installation temperature is 50 degrees F or higher.

- b. Use Type III, high-early strength, when installation temperature is lower than 50 degrees F.
 - 2. Products and Manufacturers: Provide one of the following:
 - a. Type I and Type III Portland Cement, by Essroc Italcementi Group.
 - b. Type I and Type III Portland Cement, by Lehigh Portland Cement Company.
 - c. White Portland Cement Type I and Type III, by Federal White Cement Ltd.
 - d. White Portland Cement Type I and Type III, by Lehigh Portland Cement Company.
 - e. Or equal.
 - 3. Provide non-staining Portland cement of natural color or of color required to be compatible with required mortar pigment color selected by ENGINEER.
- B. Hydrated Lime: ASTM C207, Type S, or lime putty ASTM C5.
- C. Sand Aggregates:
 - 1. Mortar Aggregates: ASTM C144, except for joints less than 1/4-inch use aggregate graded with 100 percent passing the No. 16 sieve.
 - 2. White Mortar Aggregates: Provide natural white sand or ground white stone for Portland cement-lime mortars.
 - 3. Fine Aggregate for Grout: ASTM C404, Size No. 1.
 - 4. Coarse Aggregate for Grout: ASTM C404, Size No. 8 or Size No. 89.
- E. Ready-mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in Article 2.1 of this Section, combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C270 and ASTM C387/C387M.
- F. Water: Free of injurious amounts of oils, acids, alkalis, and organic matter, and clean, fresh, and potable.
- G. Water-repellent Admixture for Exterior Masonry Mortar:
 - 1. Provide cross-linked acrylic polymer integral waterproofing system.
 - 2. Products and Manufacturers: Provide one of the following:

- a. DRY-BLOCK Mortar Admixture, by Grace Construction Products Division, W. R. Grace & Company.
 - b. Eucon Blocktite Mortar Admixture, by Euclid Chemical Company.
 - c. Or equal.
3. Proportion: In accordance with manufacturer's instructions.

2.02 MORTAR MIXES

A. General:

1. Material Performance:
 - a. Masonry Strength: Refer to Section 04050, Unit Masonry Construction.
 - b. If questions of compliance with the Contract Documents arise, Specifications for mortar properties shall take precedence over Specification for mortar proportions.
2. Do not change proportions established for mortar approved, and do not use materials with different physical characteristics in mortar used in the Work, unless compliance with the Contract Documents for mortar properties is re-established via submittals approved by ENGINEER.
3. Do not combine in mortar different air-entraining materials.
4. Anti-freeze Admixture or Agents: Not allowed.
5. Calcium Chloride: Not allowed.

B. Fire-Resistant Mortar:

1. Reference Standard: ANSI/UL BXUV U901 through BXUV U914.
2. Proportion: Use one-part Portland cement, three parts clean sand, and 15 percent hydrated lime (by cement volume).

C. Mortar for All Other Unit Masonry: Comply with ASTM C270, Table 2, except limit materials to those specified in this Section. Limit cement-to-lime ratio by volume as follows:

2. Type S:
 - a. Provide the following proportions by volume:
 - 1) Portland Cement: One part.
 - 2) Hydrated Lime or Lime Putty: Over 1/4 to 1/2, maximum.

- 3) Aggregate Ratio (measured in damp loose condition): Not less than 2-1/4 and not more than three times sum of volumes of cementitious materials.

a. Properties:

- 4) Average Compressive Strength, ASTM C270: 1,800 psi.
- 5) Minimum Water Retention, ASTM C270: 75 percent.

3. Type N:

a. Provide the following proportions by volume:

- 1) Portland Cement: One part.
- 2) Hydrated Lime or Lime Putty: Over 1/2 to 1-1/4, maximum.
- 3) Aggregate Ratio (measured in damp loose condition): Not less than 2-1/4 and not more than three times sum of volumes of cementitious materials.

b. Properties:

- 1) Average Compressive Strength, ASTM C270: 750 psi.
- 2) Minimum Water Retention, ASTM C270: 75 percent.
- 3) Maximum Air Content, ASTM C270: 12 percent.

D. Grout:

1. Fine Grout:

a. Provide the following proportions by volume:

- 1) Portland Cement: One part.
- 2) Hydrated Lime or Lime Putty: Zero to 1/10 part.
- 3) Aggregate Ratio (measured in a damp loose condition): Sand; not less than 2-1/4 and not more than three times sum of volumes of cementitious materials.

b. Mix grout to have slump of ten inches plus or minus one inch at time of placement.

2. Coarse Grout:

a. Provide the following proportions by volume:

- 1) Portland Cement: One part.
 - 2) Hydrated Lime or Lime Putty: Zero to 1/10 part.
 - 3) Fine Aggregate Ratio (measured in a damp loose condition): Sand; not less than 2-1/4 and not more than three times sum of volumes of cementitious materials.
 - 4) Coarse Aggregate Ratio: Not less than one and not more than two times the sum of volumes of cementitious materials.
- b. Mix grout to have slump of ten inches plus or minus one inch at time of placement.
- E. Grout Fill Around Reinforcement in Masonry Lintels: Portland cement, sand, gravel and water, to be proportioned as required to provide 28-day minimum compressive strength of 2,000 psi.
- F. Water-repellent Admixture: Add to mix in accordance with manufacturer's written instructions.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine conditions under which the Work will be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Measurement of Materials:
1. Cement and Hydrated Lime: Batched by the bag.
 2. Sand: Batched by volume in suitably calibrated containers. Make allowance for bulking and consolidation, and for weight per cubic foot of contained moisture.
 3. Proportion of Volumetric Mixtures: One 94-pound sack of Portland cement and one 50-pound sack of hydrated lime constitute nominal one cubic foot.
 4. Shovel measurement: Unacceptable.
- B. Mortar Mixing:
1. Type of Mixer: Machine mix in appropriate mixer in which quantity of water is accurately and uniformly controlled.

2. While mixer is operating, add approximately three-quarters of required water, half the sand, all the cement, and then add remainder of sand.
3. Allow batch to mix briefly and then add balance of water in small quantities until satisfactory workability is obtained.
4. Mix for not less than five minutes after all materials have been added.
5. Hydrated Lime for Mortar Requiring Lime Content: Use dry-mix method. Turn materials over together for each batch until even color of mixed, dry materials indicates that cementitious material has been thoroughly distributed throughout the mass, and then add water to obtain required plasticity.
6. Prepare lime putty, if approved for use, in accordance with ASTM C5.
7. Waterproofing Admixture: Add to mortar mix for all exterior masonry in accordance with manufacturer's instructions.
8. Mixer drum shall be completely emptied before recharging the next batch.
9. Limit batch size to avoid re-tempering. Re-tempering of mortar is not allowed.

3.03 INSTALLATION AND MORTAR AND GROUT TYPE LOCATION

- A. For mortar and grout type, location, and installation requirements, refer to:
 1. Section 04012, Masonry Restoration and Cleaning.
 2. Section 04050, Unit Masonry Construction.

3.04 FIELD QUALITY CONTROL

- A. Site Tests:
 1. Refer to Section 04050, Unit Masonry Construction, for load-bearing masonry wall strength tests.

END OF SECTION

SECTION 04052

MASONRY ANCHORAGE AND REINFORCING

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install masonry anchorages and reinforcing.
2. Section specifies masonry anchorages and reinforcing for Work specified in:
 - a. Section 04050, Unit Masonry Construction.
 - b. Section 04012, Masonry Restoration and Cleaning.
3. Types of products required include:
 - a. Continuous horizontal wire reinforcing and ties.
 - b. Individual wire ties.
 - c. Anchoring and positioning devices.
 - d. Miscellaneous masonry accessories, reinforcing bars, compressible filler, and pre-molded control joint strips.

B. Coordination:

1. Provide masonry anchorages and reinforcing of sizes, dimensions and configurations coordinated with unit masonry construction system component sizes, dimensions and configurations.
2. Where continuous horizontal cavity wall reinforcement is required for restraining cavity wall insulation, coordinate dimensions with specified thickness of cavity wall insulation for proper clearances. Refer to Section 07210, Building Insulation.

C. Related Sections:

1. Section 04012, Masonry Restoration and Cleaning.
2. Section 04050, Unit Masonry Construction.
3. Section 05120, Structural Steel Framing.
4. Section 07920, Joint Sealants.

5. Section 09910, Painting.

1.02 REFERENCES

- A. Reference Standards: Standards referenced in this Section are:
1. ACI 315, Details and Detailing of Concrete Reinforcement.
 2. ASTM A36/A36M, Specification for Carbon Structural Steel.
 3. ASTM A82/A82M, Specification for Steel Wire, Plain, for Concrete Reinforcement.
 4. ASTM A153/A153M, Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
 5. ASTM A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 6. ASTM A240/A240M, Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 7. ASTM A580/A580M, Specification for Stainless Steel Wire.
 8. ASTM A615/A615M, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 9. ASTM A663/A663M, Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
 10. ASTM A1008/A1008M, Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 11. ASTM A1011/A1011M, Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
 12. ASTM D2240, Test Method for Rubber Property – Durometer Hardness.
 13. ASTM D2287, Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
 14. UL U901, Bearing Wall Rating – 4 HR.; Nonbearing Wall Rating – 4 HR (ANSI/UL 263).
 15. UL U902, Bearing Wall Rating – 4 HR., Alternative Detail (ANSI/UL 263).
 16. UL U904, Bearing Wall Rating – 3 HR.; Nonbearing Wall Rating – 3 HR (ANSI/UL 263).

17. UL U905, Bearing Wall Rating – 2 HR.; Nonbearing Wall Rating – 2 HR (ANSI/UL 263).
18. UL U906, Bearing Wall Rating – 2 HR.; Nonbearing Wall Rating – 2 HR (ANSI/UL 263).
19. UL U907, Nonbearing Wall Rating – 3 or 4 HR (ANSI/UL 263).
20. UL U909, Nonbearing Wall Rating – 3 or 4 HR (ANSI/UL 263).
21. UL U910, Bearing Wall Rating – 4 HR.; Nonbearing Wall Rating – 4 HR (ANSI/UL 263).
22. UL U912, Bearing Wall Rating – 3 HR.; Nonbearing Wall Rating – 3 HR (ANSI/UL 263).
23. UL U913, Bearing Wall Rating – 2 HR.; Nonbearing Wall Rating – 2 HR (ANSI/UL 263).
24. UL U914, Bearing Wall Rating – 3 HR.; Nonbearing Wall Rating – 3 HR (ANSI/UL 263).

1.03 QUALITY ASSURANCE

A. Component Supply and Compatibility:

1. Provide all metal sheet, wire, plate and bar stock masonry anchorages and reinforcing from same manufacturer.
2. Miscellaneous masonry accessory items other than metal sheet, wire, plate and bar stock shall each be obtained from a single, manufacturer, which may be different from the manufacturer of other products specified in this Section.

B. Regulatory Requirements:

1. Where fire-resistance classification (four-hour, three-hour, and similar designations) is shown or indicated for unit masonry construction, provide masonry anchorages and reinforcing complying with requirements established by UL tests referenced in this Section (UL U901 through UL U914, as applicable), Laws and Regulations, and requirements of authorities having jurisdiction.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Submit drawings and material schedules showing all dimensions and sizes of masonry anchorages and reinforcing coordinated with

unit masonry Work and other Work in which masonry anchorages and reinforcing will be embedded, be supported from, or restrained.

- b. Submit schedule indicating type, location, and spacing of each masonry accessory in unit masonry construction and that type, location, and spacing are in compliance with code requirements.

2. Product Data:

- a. Manufacturer's product literature and specifications for each masonry accessory required. Include data substantiating that materials comply with the Contract Documents.

3. Samples:

- a. One unit or one modular length of each item specified.

B. Informational Submittals: Submit the following:

1. Manufacturer's Instructions:

- a. Manufacturer's instructions for handling, storing, and installing for each masonry accessory required.

1.05 DELIVERY, STORAGE AND HANDLING

A. Comply with:

- 1. Applicable requirements of standards referenced in this Section.
- 2. Section 01610, Transportation and Handling
- 3. Section 01610, Transportation and Handling

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Continuous Horizontal Wire Reinforcing and Ties: Provide for all masonry walls as per original Contract Drawings:

- B. Individual Wire Ties for Masonry: Provide the following where shown:

1. General: Provide the following:

- a. Reinforcing, wire, and ties of Cold-drawn steel wire complying with ASTM A82 and hot-dipped galvanized after fabrication with 1.5 ounces per square foot of zinc coating complying with ASTM A153

- b. Crimped with vee-drip for use in cavity wall construction and of length required for proper embedment in outer-most face shell walls of wythes of masonry shown or indicated.
 - c. Rectangular box ties and adjustable box ties fabricated of 3/16-inch diameter wire.
 - 2. Single-piece Ties (where facing and back-up joints align):
 - a. For use with hollow masonry units laid with cells vertical and with solid masonry units or hollow units laid with cells horizontal, provide four-inch-wide rectangular shaped box-ties.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Rectangular Box Ties, by Hohmann & Barnard, Inc.
 - 2) No. 253 Rectangular Wire Ties, by Heckmann Building Products.
 - 3) Or equal.
 - 3. Adjustable Two-piece Ties (where facing and back-up joints do not align):
 - a. For use with hollow masonry units laid with cells vertical, and with solid masonry units or hollow units laid with cells horizontal, provide four-inch wide adjustable rectangular shaped pintle and eye box-ties.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Rectangular Adjustable Wall Ties, by Hohmann & Barnard, Inc.
 - 2) No. 265 Adjustable Box Anchor, by Heckmann Building Products.
 - 3) Or equal.
- C. Anchoring Devices for Masonry: Provide as shown on 100 % submittal drawings.
- 8. Rebar Positioners: Provide the following:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) #RB Series and #RB-Twin Series Rebar Positioners, by Hohmann & Barnard, Inc.
 - 2) Rebar Positioners, by Heckmann Building Products.
 - 3) Or equal.

- b. Nine-gage reinforcing bar positioners that accommodate both horizontal and vertical reinforcing steel.
 - c. Fabricate units as required for the Work.
- D. Miscellaneous Masonry Accessories: Provide the following where shown:
 - 1. Reinforcing Bars:
 - a. Deformed carbon steel, ASTM A615, Grade 60 for bars No. 3 to No. 18, except as otherwise shown.
 - b. Plain carbon steel, ASTM A663, Grade 80 where No. 2 bars are shown or required.
 - c. Provide galvanized steel reinforcing bars complying with ASTM A153, Class B-1, where shown.
 - 2. Compressible Filler: Provide watertight joint filler where unit masonry construction abuts structural framework members, or as shown. Provide the following:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Polytite Standard, by Polytite Manufacturing Corp.
 - 2) Polyseal, by Sandell Manufacturing Company, Inc.
 - 3) Or equal.
 - b. Polyurethane foam strip saturated with polybutylene waterproofing material that, when installed at a compression ratio of two-to-one, is impermeable to water.
 - c. Resilient to -40 degrees F with 100 percent movement recovery.
 - d. Elongation of 140 percent with a tensile strength of not less than 53 pounds per square inch.
 - 3. Masonry Control Joint Components: Provide the following:
 - a. Pre-molded Control Joint Strips: Provide complete selection of solid extruded rubber and PVC strips with a Shore A durometer hardness of 80 to 90 complying with ASTM D2240 and ASTM D2287, designed to fit standard sash block and maintain lateral stability in masonry wall. Size and configuration shall be as shown.
 - 1) Products and Manufacturers: Provide one of the following:
 - a) #RS-12- Control Joints, by Hohmann & Barnard, Inc.

- b) #352-13 Control Joints, by Heckmann Building Products.
 - c) Or equal.
- b. Sealants: Refer to Section 07920, Joint Sealants.
- 4. Weep Holes: Provide the following:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) #342 - Plastic Weep Holes, by Hohmann & Barnard, Inc.
 - 2) No. 330 Plastic Weepholes, by Heckmann Building Products.
 - 3) Or equal.
 - b. Rectangular 3/8-inch wide by 1.5 inches high, 3.5 inches long clear butyrate tubes.
- 5. Weep Vents: Provide the following:
 - a. Products and Manufacturers: Provide one the following:
 - 1) Goodco Brick Vents, by Williams Products, Inc.
 - 2) No. 602 Louvered Weep Holes and Vents, by WIRE-BOND.
 - 3) Or equal.
 - b. Provide injection molded flexible polyvinylchloride brick vents of custom color to match face brick mortar color with top flap, flexible side wings, vertical louvers and water ridges.
- 6. Cavity Fill Mesh: Provide the following:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) #MGS - Mortar/Grout Screen, by Hohmann & Barnard, Inc.
 - 2) No. 267 Plastic Mesh Wall Ties, by Heckmann Building Products.
 - 3) Or equal.
 - b. Monofilament screen of polypropylene polymers 1/4-inch mesh hardware cloth. Provide below all block courses that are to be filled with mortar.

- 7. Cavity Drainage Material:
 - a. Manufactured of high density polyethelene or nylon strands woven into a 90 percent open mesh
 - 1) Product and Manufacturer: Provide one of the following:
 - a) Mortar Net, by Hohmann and Barnard, Inc.
 - b) Mortar Net, by Heckmann Building Products.
 - c) Or equal.

2.02 FABRICATION

- A. Weld-in-place all channel slots and other specified weld-on anchors at the shop. Field welding is unacceptable.
- B. Coordinate location of weld-on anchors and show on structural steel Shop Drawings required under Section 05 12 00, Structural Steel Framing.
- C. Weld anchor slots and other required accessories in place before shop priming of structural steel.
- D. Prime coat weld-on anchors and other accessories and passivate anchor coating in accordance with Section 09910, Painting.
- E. Shop-fabricate reinforcing bars that are shown or required to be bent or hooked. Comply with ACI 315 for fabricating reinforcing steel for unit masonry Work.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Refer to the following:
 - 1. Section 04050, Unit Masonry Construction.

END OF SECTION

SECTION 04220

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete unit masonry.
2. Extent of each type of concrete unit masonry is shown and indicated.
3. Types of materials and features required include:
 - a. Hollow load-bearing units.
 - b. Hollow non-load-bearing units.
 - c. Solid load-bearing units.
 - d. Slotted acoustic units.
 - e. Prefaced load-bearing units.
 - f. Split-face load-bearing units.
 - g. Ground-face load-bearing units.
 - h. Profile split-ribbed load-bearing units.
 - i. Units complying with USGBC LEED-NC Credits MR 4.1, 4.2, 5.1, and 5.2.
 - k. Integral waterproofing admixtures, lightweight aggregates, high recycle content, special and custom shapes required to complete the Work, complete selection of manufacturer's standard and custom colors and other special, and custom features.

B. Related Sections:

1. Section 04050, Unit Masonry Construction.
2. Section 09910, Painting.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. ASTM C33, Specification for Concrete Aggregates.
2. ASTM C90, Specification for Load bearing Concrete Masonry Units.
3. ASTM C129, Specification for Non-load-bearing Concrete Masonry Units.
4. ASTM C140, Test Methods for Sampling and Testing Concrete Masonry Units.
5. ASTM C331, Specification for Lightweight Aggregates for Concrete Masonry Units.
6. ASTM C426, Test Method for Drying Shrinkage of Concrete Masonry Units.
7. ASTM C744, Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
8. ASTM C1093, Practice for Accreditation of Testing Agencies for Unit Masonry.
9. ASTM C1262, Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units.
10. ASTM E84, Test Method for Surface Burning Characteristics of Building Materials.
11. ASTM E119, Test Methods for Fire Tests of Building Construction and Materials.
12. UL U 901, Bearing Wall Rating – 4 HR.; Nonbearing Wall Rating – 4 HR.
13. UL U 902, Bearing Wall Rating – 4 HR., Alternative Detail.
14. UL U 904, Bearing Wall Rating – 3 HR.; Nonbearing Wall Rating – 3 HR.
15. UL U 905, Bearing Wall Rating – 2 HR.; Nonbearing Wall Rating – 2 HR.
16. UL U 906, Bearing Wall Rating – 2 HR.; Nonbearing Wall Rating – 2 HR.
17. UL U 907, Nonbearing Wall Rating – 3 or 4 HR.
18. UL U 909, Nonbearing Wall Rating – 3 or 4 HR.
19. UL U 910, Bearing Wall Rating – 4 HR.; Nonbearing Wall Rating – 4 HR.
20. UL U 912, Bearing Wall Rating – 3 HR.; Nonbearing Wall Rating – 3 HR.
21. UL U 913, Bearing Wall Rating – 2 HR.; Nonbearing Wall Rating – 2 HR.
22. UL U 914, Bearing Wall Rating – 3 HR.; Nonbearing Wall Rating – 3 HR.

23. USGBC LEED-NC, LEED Reference Guide, For New Construction and Major Renovation.

1.03 QUALITY ASSURANCE

- A. Qualifications:
 1. Testing Laboratory: In accordance with ASTM C1093.
- B. Component Supply and Compatibility:
 1. Obtain each type of concrete masonry units from one manufacturer, cured by one process and of uniform texture and color or an established uniform blend texture and color.
- C. Regulatory Requirements:
 1. Where fire-resistance classification is shown (four-hour, three-hour, and similar designations) for concrete unit masonry construction, provide materials complying with requirements established by UL tests referenced in this Section (UL U901 through UL U914), Laws and Regulations including applicable building codes, and requirements of authorities having jurisdiction.

1.04 SUBMITTALS

- A. Action Submittals: Submit the following:
 1. Shop Drawings:
 - a. Complete layout of masonry walls showing modular planning, colors, patterns and all special shapes to be provided. Show details for each condition encountered in the Work. Provide plans and elevation at scale of 1/4-inch equals one foot, and details at scale of 1.5-inch equals one foot.
 2. Product Data:
 - a. Manufacturer's specifications, manufacturing procedures, and test data for each material specified. Include instructions for handling, storage, installation, and protection of each type of concrete masonry unit.
 - b. Laboratory test reports in accordance with ASTM C140.
 3. Samples:
 - a. Submit Sample of each type of concrete masonry unit required. Select each type of concrete masonry unit to show range of color and texture that will be provided in finished Work.

- b. Complete selection of manufacturer's standard and custom colors.
 - c. ENGINEER's review will be for color and texture only. Compliance with other requirements is responsibility of CONTRACTOR.
 - B. Informational Submittals: Submit the following:
 - 1. Source Quality Control Submittals:
 - a. Submit test results as specified in this Section.
 - 2. Sustainable Design Submittals:
 - a. Comply with LEED requirements in the Contract Documents.
 - 3. Qualifications Statements:
 - a. Testing laboratory, if not explicitly included in submittals furnished under other Sections.

1.05 DELIVERY, STORAGE AND HANDLING

- A. At time of unloading at Site, concrete masonry units shall comply with ASTM C90, Table 2.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements: Maintain temperature in area of storage and installation so that masonry products are above 20 degrees F when installed.

PART 2 – PRODUCTS

2.01 GENERAL, CONCRETE UNIT MASONRY

- A. General:
 - 1. Unless specifically modified by other requirements of the Contract Documents, provide concrete unit masonry in compliance with classifications, weights, grades, colors, textures, scores, thermal resistance values, and other features specified in this Section.
 - 2. Cure units by autoclave treatment at minimum temperature of 350 degrees F, and minimum pressure of 125 pounds per square inch.
- B. Hollow and Solid Load-bearing Concrete Masonry Units: ASTM C90, with minimum of 15 percent coal fly ash and 50 percent recycle aggregate as part of concrete mix.
 - 1. Minimum compressive strength: 1,900-psi average of three units.

- C. Hollow Non-load-bearing Concrete Masonry Units: ASTM C129, with minimum of 15 percent coal fly ash and 50 percent recycle aggregate as part of concrete mix.
- D. Size: Manufacturer's standard units with nominal face dimensions of 16 inches long by eight inches high (15-5/8 inches by 7-5/8 inches actual).
- E. Moisture Control:
 - 1. Limit total moisture absorption until time of installation to maximum percentage specified for the weight classification in ASTM C90, Table 2.
 - 2. Total linear dry shrinkage at time of installation shall be less than 0.065 percent.
- F. Special Shapes: Provide the following:
 - 1. Lintels, bond beams, reinforcing units, and flush-end reinforcing units, interior and exterior corner shapes, solid jambs, sash block, coves, pre-molded control joint blocks, headers, and other special conditions.
 - 2. Bullnose units for outside vertical corners including doors, windows, louvers and other openings, unless specifically shown on the Drawings indicating that such feature is not required.
 - 3. End blocks at locations where masonry walls abut concrete, or steel columns, to facilitate installation of compressible filler, backer rod, and sealant or fire-rated fire stop sealant systems, if required.
- G. Waterproofing Admixture: Manufacture all types of concrete unit masonry used for constructing exterior walls (including interior Wythe of cavity walls) with integral waterproofing admixture as follows:
 - 1. Products and Manufacturers: Provide one of the following:
 - a. DRY-BLOCK System, by Grace Construction Products Division, W. R. Grace & Company.
 - b. Eucon Blocktite Integral Water-Repellent Masonry Admixture, by Euclid Chemical Company.
 - c. Or equal.
 - 2. Material: Cross-linking acrylic polymer.
 - 3. Proportion: In accordance with manufacturer's instructions.
- H. Weight: Provide medium weight units using aggregate complying with ASTM C33 producing dry net weight of not more than 125 pounds per cubic foot.

1. Provide normal weight units as specified in 100 % Submittal Drawings using concrete aggregates complying with ASTM C33 producing dry net weight of not less than 125 pounds per cubic foot.
- I. Provide two-core concrete masonry units.
- J. Provide concrete masonry units complying with LEED-NC Credits MR 4.1, 4.2, 5.1, and 5.2.

2.02 SOURCE QUALITY CONTROL

- A. Tests:
 1. Provide test data verifying total linear drying shrinkage based on tests of concrete masonry units made with same materials, concrete mix proportions, manufacturing process, and curing method, conducted in accordance with ASTM C426. Tests shall have been conducted within 24 months prior to delivery to Site.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Refer to Section 04050, Unit Masonry Construction.

END OF SECTION

SECTION 05053
ANCHOR SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Scope:
 - 1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install anchor systems.
 - 2. This Section includes all anchor systems required for the Work, but not specified under other Sections.
- B. Coordination:
 - 1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before anchor systems Work.

1.02 REFERENCES

- A. Standards referenced in this Section are:
 - 1. ACI 318, Building Code Requirements for Structural Concrete.
 - 2. ACI 350, Code Requirements for Environmental Engineering Concrete Structures.
 - 3. ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete.
 - 4. ANSI B212.15, Cutting Tools - Carbide-tipped Masonry Drills and Blanks for Carbide-tipped Masonry Drills.
 - 5. ANSI/MSS SP-58, Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.
 - 6. ASTM A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
 - 7. ASTM A276, Specification for Stainless Steel Bars and Shapes.
 - 8. ASTM A493, Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging.
 - 9. ASTM A563, Specification for Carbon and Alloy Steel Nuts.
 - 10. ASTM A1011/A1011M, Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

11. ASTM B633, Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
12. ASTM C307, Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
13. ASTM C881/C881M, Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
14. ASTM E329, Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
15. ASTM E488, Test Methods for Strength of Anchors in Concrete and Masonry Elements.
16. ASTM F593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
17. ASTM F594, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
18. ASTM F1554, Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength.
19. ICC-ES AC58, Acceptance Criteria for Adhesive Anchors in Masonry Elements.
20. ICC-ES AC60, Acceptance Criteria for Anchors in Unreinforced Masonry Elements.
21. ICC-ES AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
22. ICC-ES AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
23. ISO 3506-1, Mechanical Properties of Corrosion-Resistant Stainless-Steel Fasteners - Part 1: Bolts, Screws and Studs.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Testing Laboratory: Shall comply with ASTM E329 and shall be experienced in tension testing of post-installed anchoring systems.
2. Post-installed Anchor Installer:
 - a. Mechanical Anchors: Installer shall be experienced and trained by post-installed anchor system manufacturer in proper installation of manufacturer's products. Product installation training by distributors or manufacturer's representatives is unacceptable unless the person furnishing the training is qualified as a trainer by the anchor manufacturer.

- b. Adhesive Anchors: Installation shall be performed by personnel certified under an applicable certification program. Certification shall include written and performance tests in accordance with the ACI/CRSI Adhesive Anchors Installer Certification Program, or equivalent. Description of equivalent programs shall be submitted for ENGINEER's approval and acceptance by the building official having jurisdiction.

1.04 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Shop Drawings:
 - a. Listing of all anchor systems products intended for use in the Work including product type, intended location in the Project, and embedded lengths.
 - 2. Product Data:
 - a. Manufacturer's specifications, load tables, dimension diagrams, acceptable base material conditions, acceptable drilling methods, and acceptable bored hole conditions.
 - b. When required by ENGINEER, copies of valid ICC ES reports that presents load-carrying capacities and installation requirements for anchor systems.
- B. Informational Submittals: Submit the following:
 - 1. Certificates:
 - a. For each type of anchor bolt or threaded rod, submit copies of laboratory test reports and other data required to demonstrate compliance with the Contract Documents.
 - 1) Reports shall demonstrate compliance with ductile steel element definition of ACI 350, Appendix D, or ACI 318 Chapter 17.
 - b. Post-installed anchor system manufacturer's certification that installer received training in the proper installation of manufacturer's products required for the Work.
 - c. For each adhesive anchor installer, submit ACI/CRSI Adhesive Anchor Installer Certification.
 - 2. Manufacturer's Instructions:
 - a. Installation instructions for each anchor system product proposed for use, including bore hole cleaning procedures and adhesive injection, cure and gel time tables, and temperature ranges (storage, installation and in-service).

1.05 DELIVERY, STORAGE AND HANDLING

- A. Storage and Protection:
 - 1. Keep materials dry during delivery and storage.
 - 2. Store adhesive materials within manufacturer's recommended storage temperature range.
 - 3. Protect anchor systems from damage at the Site. Protect products from corrosion and deterioration.

PART 2 – PRODUCTS

2.01 SYSTEM PERFORMANCE

- A. General:
 - 1. At locations where conditions dictate that Work specified in other Sections is to be of corrosion resistant materials, provide associated anchor systems of stainless-steel materials, unless other corrosion-resistant anchor system material is specified. Provide anchor systems of stainless-steel materials where stainless steel materials are required in the Contract Documents.
 - 2. Stainless Steel Nuts:
 - a. For anchor bolts and adhesive anchors, provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts for stainless steel anchors used for anchoring equipment, gates, and weirs, and other locations, if any, where the attachment will require future removal for operation or maintenance. Provide lock washer or double nuts on each anchorage device provided for equipment, as required by equipment manufacturer.
 - b. For other locations, provide for each anchorage device a **nutas** specified or as required by anchor manufacturer. When ASTM A194/A194M, Grade 8S (Nitronic 60) nuts are not required for anchor bolts and adhesive anchors as specified in this Section, provide anti-seizing compound where stainless steel rods are used with stainless steel nuts of the same type.
 - 3. Materials that can contact potable water or water that will be treated to become potable shall be listed in NSF/ANSI 61.
- B. Design Criteria
 - 1. Size, Length, and Load-carrying Capacity: Comply with the Contract Documents. When size, length or load-carrying capacity of anchor system is not otherwise shown or indicated, provide the following:
 - a. Anchor Bolts: Provide size, length, and capacity required to carry design load based on values and requirements of Paragraph 3.2.A

of this Section. For conditions outside limits of critical edge distance and spacing in Paragraph 3.2.A of this Section, minimum anchor bolt embedment as shown or indicated in Paragraph 3.2.A of this Section apply and capacity shall be based on requirements of Laws and Regulations, including applicable building codes.

- b. Adhesive Anchors, Expansion Anchors, or Concrete Inserts: Provide size, length, type, and capacity required to carry design load. Anchor capacity shall be based on the procedures required by the building code in effect at the Site. Where Evaluation Service Reports issued by the ICC Evaluation Service are required in this Section, anchor capacities shall be based on design procedure required in the applicable ICC Evaluation Service Report.
 - 1) General: Determine capacity considering reductions due to installation and inspection procedures, embedment length, strength of base fastening materials, spacing, and edge distance, as indicated in the manufacturer's design guidelines. For capacity determination, concrete shall be assumed to be in the cracked condition, unless calculations demonstrate that the anchor system will be installed in an area that is not expected to crack under any and all conditions of design loading.
 - 2) Concrete Adhesive Anchors: Unless otherwise shown or indicated in the Contract Documents or approved by ENGINEER, provide minimum embedment depth of the greater of the following: required to develop tensile strength of anchor, or a minimum embedment of 10 anchor diameters; and minimum anchor spacing and edge distance of 12 anchor diameters.
 - 3) Concrete Masonry Adhesive Anchors: Unless otherwise shown or indicated in the Contract Documents or approved by ENGINEER, provide minimum anchor spacing and edge distance as indicated in anchor manufacturer's instructions.
- 2. Design Loads. Comply with the Contract Documents. When design load of supported material, equipment, or system is not otherwise shown or indicated, provide the following:
 - a. Equipment Anchors: Use design load recommended by equipment manufacturer. When equipment can be filled with fluid, use loads that incorporate equipment load and load imposed by fluid.
 - b. Pipe Hangers and Supports: Use full weight of pipe, and fluid contained in pipe that are tributary to the support plus the full weight of valves and accessories located between the hanger or support being anchored and the next hanger or support.

- c. Hangers and Supports for Electrical Systems, and HVAC, Plumbing, and Fire Suppression Systems and Piping: Use the full weight of supported system that is tributary to the support plus the full weight of accessories located between the hanger or support being anchored and the next hanger or support. When piping or equipment is to be filled with fluid, anchor systems shall be sized to support such loads in addition to the weight of the equipment, piping, or system, as applicable.
 - d. Delegated Design: When anchor systems are used for supporting materials, equipment, or systems delegated to a design professional retained by CONTRACTOR, Subcontractor, or Supplier, provide anchor system suitable for loads indicated in delegated design documents and consistent with the design intent expressed in the Contract Documents.
- C. Application:
 - 1. Anchor Bolts:
 - a. Where anchor bolt is shown or indicated, use cast-in-place anchor bolt unless another anchor type is approved by ENGINEER.
 - b. Provide anchor bolts as shown or indicated, or as required to secure structural element to appropriate anchor surface.
 - 2. Concrete Adhesive Anchors:
 - a. Use where adhesive anchors are shown or indicated for installation in concrete.
 - b. Suitable for use where subject to vibration.
 - c. Suitable for use in exterior locations or locations subject to freezing.
 - d. Suitable for use in submerged, intermittently submerged, or buried locations.
 - e. Do not use in overhead applications, unless otherwise shown or approved by ENGINEER.
 - f. Do not use for pipe hangers, unless otherwise shown or approved by ENGINEER.
 - 3. Concrete Masonry Adhesive Anchors:
 - a. Use where adhesive anchors are shown or indicated for installation in grout-filled or hollow masonry units.
 - b. Suitable for use where subject to vibration.
 - c. Suitable for use in exterior locations or locations subject to freezing.

- d. Do not use for pipe hangers, unless otherwise shown or approved by ENGINEER.
- 4. For Use in Precast Concrete Planks:
 - a. To support piping or conduit two-inch diameter and smaller, use low-profile drop-in anchors, hollow concrete masonry adhesive anchors, or through-bolts.
 - b. For piping greater than two-inch diameter, or to support safety-related systems, use through-bolts. Each through-bolt shall consist of threaded rod, nuts, washers, and bearing plate.

2.02 MATERIALS

A. Anchor Bolts:

- 1. Interior Dry Non-Corrosive Locations: Provide straight threaded carbon steel rods complying with ASTM F1554, Grade (--1--), with heavy hex nuts complying with ASTM A563 Grade (--2--), unless otherwise shown or indicated on the Drawings. Hooked anchor bolts are unacceptable.
- 2. Exterior, Buried, Submerged Locations, or When Exposed to Wastewater: Provide stainless steel straight threaded rods complying with ASTM F593, AISI Type 316, Condition A, with ASTM F594, AISI Type 316, stainless steel nuts. Provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts where required. Other AISI types may be used when approved by ENGINEER. Hooked bolts are unacceptable.
 - a. Stainless steel straight threaded rod shall comply with ductility requirements of ACI 350 Appendix D or ACI 318 Chapter 17.
- 3. Anchoring of Structural Elements: Provide anchor bolts of size, material, and strength shown or indicated in the Contract Documents.

B. Concrete Masonry Adhesive Anchors:

- 1. General:
 - a. Grout-filled concrete masonry adhesive anchors shall consist of threaded rods anchored into grout-filled concrete block masonry using an adhesive system.
 - b. Hollow concrete masonry adhesive anchors shall consist of threaded rods with a cylindrical mesh steel or plastic screen tube anchored into hollow concrete block masonry using an adhesive system.
- 2. Products and Manufacturers: Provide one of the following:
 - a. HILTI HIT-HY 270 Adhesive Anchor System with HIT-Z anchors, by Hilti Fastening Systems, Inc.

3. Adhesive:
 - a. Adhesive system shall use two-component adhesive mix.
 - b. Adhesives shall have current ICC Evaluation Service Report for use in grout-filled concrete masonry, tested and assessed in accordance with ICC-ES AC 58 and ICC-ES AC 60.
4. Anchor:
 - a. Provide stainless steel adhesive anchor rod complying with ASTM F593, AISI Type 316, Condition CW, with ASTM F594, AISI Type 316 stainless steel nuts. Provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts where required.
5. Mesh Screen Tube (for hollow masonry applications):
 - a. Provide with mesh size, length, and diameter as specified by adhesive anchor manufacturer.
- C. Unless approved by ENGINEER, do not use power-actuated fasteners or other types of bolts and fasteners not specified in this Section.
- D. Anti-Seizing Compound:
 1. Products and Manufacturers: Provide one of the following:
 - a. Pure Nickel Never-Seez, by Bostik.
 - b. Nickel-Graf, by Anti-Seize Technology.
 - c. Or equal.
 2. Provide pure nickel anti-seizing compound.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine conditions under which materials will be installed and advise ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Anchor Bolts:
 1. Provide anchor bolts as shown or indicated in the Contract Documents, or as required to secure structural element to the appropriate anchor surface.
 2. Locate and accurately set anchor bolts using templates or other devices as required, prior to placing concrete. Wet setting of anchor bolts is unacceptable.

3. Protect threads and shank from damage during installation and subsequent construction operations.
4. Unless otherwise shown or approved by ENGINEER anchor bolts shall comply with Table 05 05 33-B:

TABLE 05053-B: SINGLE ANCHOR ALLOWABLE LOADS ON ANCHOR BOLTS 1								
	F1554 Grade 36 F593 Type 316, Condition A				F1554 Grade 55			
½	6	9	947	1,815	8.5	12.75	1,245	2,393
5/8	7.5	11.25	1,508	2,895	10.5	15.75	1,980	3,810
¾	9	13.5	2,231	4,290	13	19.5	2,933	5,640
7/8	10.5	15.75	3,080	5,918	15	22.5	4,050	7,793
1	12	18	4,040	7,770	17	25.5	5,318	10,088
1 1/8	13.5	20.25	5,090	9,789	19	28.5	8,930	12,435
1 ¼	15	22.5	6,463	12,429	21	31.5	8,505	15,030
Bolt Diameter (inch)	Minimum Embedment (inch)	Minimum Edge Distance and Spacing 2 (inch)	Shear 3,4 (lb)	Tension 3 (lb)	Minimum Embedment (inch)	Minimum Edge Distance and Spacing 2 (inch)	Shear 3,4 (lb)	Tension 3 (lb)
Table Notes:								
1	Table is based on ACI 318 Chapter 17 and ACI 350, Appendix D, f _c = 4000 psi. Table 05 05 33-B is not applicable to anchor bolts embedded in grouted masonry.							
2	Critical edge distance and spacing are indicated in the table. Capacity of anchor bolts for other combination of edge distances and spacing shall be evaluated in accordance with ACI 318 Chapter 17 and ACI 350, Appendix D.							
3	Values for shear and tension listed are not considered to act concurrently. Interaction of tension and shear will be evaluated by ENGINEER in accordance with ACI 318 Chapter 17 and ACI 350, Appendix D.							

B. Adhesive Anchors, Undercut Anchors, and Expansion Anchors – General:

1. Prior to drilling, locate existing reinforcing steel in vicinity of proposed holes. If reinforcing conflicts with proposed hole location, obtain ENGINEER's approval of alternate hole locations to avoid drilling through or damaging existing reinforcing bars.

C. Adhesive Anchors:

1. Installation conditions shall comply with all requirements of the approved product Evaluation Service Report (ESR), including "Conditions of Use." Comply with manufacturer's written installation instructions and the following.
2. Drill holes to adhesive system manufacturer's recommended drill bit diameter to the specified depth. Drill holes in hammering and rotation mode with carbide-tipped drill bits that comply with the tolerances of ANSI B212.15. Core-drilled holes are unacceptable.
3. Before setting adhesive anchor, hole shall be made free of dust and debris by method recommended by adhesive anchor system manufacturer. Hole shall be brushed with adhesive system manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove all dust and loose particles. Hole shall be dry as defined by adhesive system manufacturer.
4. Before injecting adhesive, obtain ENGINEER's concurrence that hole is dry and free of oil and other contaminants.
5. Prior to injecting adhesive into the drilled hole, dispense, to a location appropriate for such waste, an initial amount of adhesive from the mixing nozzle, until adhesive is uniform color.
6. Inject adhesive into hole through injection system-mixing nozzle and necessary extension tubes, placed to bottom of hole. Discharge end shall be withdrawn as adhesive is placed but kept immersed to prevent formation of air pockets. Fill hole to depth that ensures that excess material is expelled from hole during anchor placement.
7. Twist anchors during insertion into partially-filled hole to guarantee full wetting of rod surface with adhesive. Insert rod slowly to avoid developing air pockets.
8. Provide adequate curing in accordance to adhesive system manufacturer's requirements prior to continuing with adjoining Work that could place load on installed adhesive anchors. Do not begin adjoining Work until adhesive anchors are successfully tested or when allowed by ENGINEER.
9. Limitations:
 - a. At time of anchor installation, concrete shall have compressive strength (f'_c) of not less than 2,500 psi.
 - b. At time of anchor installation, concrete shall have age of not less than 21 days.

- c. Installation Temperature: Comply with manufacturer's instructions for installation temperature requirements. Provide temporary protection and other measures, such as heated enclosures, necessary to ensure that base material temperature complies with anchor systems manufacturer's requirements during installation and curing of adhesive anchor system.
 - d. Oversized Holes: Advise ENGINEER immediately if size of drilled hole is larger than recommended by anchor system manufacturer. Cost of corrective measures, including but not limited to redesign of anchors due to decreased anchor capacities, shall be paid by CONTRACTOR.
 - e. Embedment depths shall be based on installation in normal-weight concrete with compressive strength of 2,500 psi when embedded in existing concrete, and 4,000 psi when embedded in new concrete.
- G. Anti-Seizing Compound:
- 1. Provide anti-seizing compound in accordance with anti-seizing compound manufacturer's installation instructions, at locations indicated in Paragraph 2.1.B of this Section.
 - 2. Do not use anti-seizing compound at locations where anchor bolt or adhesive anchor will contact potable water or water that will be treated to become potable.

3.03 CLEANING

- A. After embedding concrete is placed, remove protection and clean bolts and inserts.

3.04 FIELD QUALITY CONTROL

- A. Site Tests:
- 1. OWNER Will employ testing agency to perform field quality tensile testing of production adhesive anchors at the Site, unless otherwise specified.
 - a. Testing shall comply with ASTM E488.
 - b. Test at least ten percent of all types of adhesive anchors. If one or more adhesive anchors fail the test, CONTRACTOR shall pay cost of testing all anchors of the same type installed in the Work. CONTRACTOR shall be responsible for retesting costs.
 - c. ENGINEER will direct which adhesive anchors are to be tested and indicate test load to be used
 - d. Apply test loads with hydraulic ram.
 - e. Displacement of post-installed anchors shall not exceed $D/10$, where D is nominal diameter of anchor being tested.

2. Mechanical Anchors:
 - a. Responsibility:
 - 1) OWNER Will employ testing agency to perform field quality control tensile testing of mechanical anchors at the Site.
 - 2) CONTRACTOR shall demonstrate competence in installing mechanical anchors by performing field quality control tests.
 - b. Perform field quality control tests on test anchors at location directed by ENGINEER. Test anchors shall not be part of the finished Work.
 - c. Test not less than one installation of each type of mechanical anchor used in the Work.
 - 1) Testing shall comply with ASTM E488.
 - d. Anchors that fail to reach the specified test load shall be considered as not passing the test and shall be re-tested at no additional cost to OWNER.
 - e. Testing agency shall submit test results to CONTRACTOR and ENGINEER within 24 hours of completion of test.
 3. Correct defective Work by removing and replacing or correcting, as directed by ENGINEER.
 4. CONTRACTOR shall pay for all corrections and subsequent testing required to confirm competence in the installation of post-installed mechanical anchors.
 5. Testing agency shall submit test results to CONTRACTOR and ENGINEER within 24 hours of completion of test.
- B. Manufacturer's Services:
1. Provide at the Site services of qualified adhesive manufacturer's representative during initial installation of adhesive anchor systems to train CONTRACTOR's personnel in proper installation procedures. Manufacturer's representative shall observe to confirm that installer demonstrates proper installation procedures for adhesive anchors and adhesive material.

END OF SECTION

SECTION 05120

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide professional services, labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install structural steel framing, including surface preparation and shop priming.
2. Structural steel framing is the Work defined in AISC 303, Section 2, and as shown or indicated in the Contract Documents. The Work also includes:
 - a. Providing openings in and attachments to structural steel framing to accommodate the Work under this and other Sections, and providing for structural steel framing items such as anchorage devices, studs, and all items required for which provision is not specifically included under other Sections.
 - b. Providing openings in and attachments to structural steel framing to accommodate the work under other contracts, and assisting other contractors in building on or attaching to the structural steel framing items such as anchorage devices, studs, and all items required for which provision is not specifically included under other contracts.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before structural steel framing Work.
2. Notify other contractors in advance of installing structural steel to provide other contractors with sufficient time for installing items included in their contracts to be installed with or before structural steel framing Work.

C. Related Sections:

1. Section 05053, Anchor Systems.
2. Section 09910, Painting.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. AISC 303, Code of Standard Practice for Steel Buildings and Bridges.

2. AISC 325, Steel Construction Manual.
3. AISC 360, Specification for Structural Steel Buildings.
4. ASME B46.1, Surface Texture (Surface Roughness, Waviness and Lay).
5. ASTM A6/A6M, Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
6. ASTM A36/A36M, Specification for Carbon Structural Steel.
7. ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
8. ASTM A108, Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
9. ASTM A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
10. ASTM A325, Specification for Structural Bolts, Steel, Heat-Treated, 120/105 ksi Minimum Tensile Strength.
11. ASTM A490, Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
12. ASTM A500/A500M, Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
13. ASTM A563, Specification for Carbon and Alloy Steel Nuts.
14. ASTM A572/A572M, Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
15. ASTM A1085/A1085M, Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).
16. ASTM A992/A992M, Specification for Structural Steel Shapes.
17. ASTM E329, for Agencies Engaged in Construction Inspection, Special Inspection, or Testing Materials Used in Construction.
18. ASTM F436, Specification for Hardened Steel Washers.
19. ASTM F593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
20. ASTM F959, Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.

21. ASTM F1852, Specification for "Twist off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
22. AWS D1.1/D1.1M, Structural Welding Code-Steel.
23. CMAA 74, Specifications for Top Running & Under Running Single Girder Electric Traveling Cranes Utilizing Under Running Trolley Hoist.
24. ISO 2859-1, Sampling Procedures for Inspection by Attributes -- Part 1: Sampling Schemes Indexed by Acceptance Quality Limit (AQL) for Lot-by-Lot Inspection.
25. ISO 4017, Hexagon Head Screws -- Product Grades A and B.
26. RCSC Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Steel Fabricator:
 - a. Structural steel fabricating plant shall possess current certificate from AISC stating that the fabrication facility complies with requirements for "Certified Building Fabricator" (BU) of AISC's quality certification program. Fabricating plant shall maintain this certification throughout time of fabrication for this Project.
2. Welders and Welding Processes:
 - a. Qualify welding processes and welding operators in accordance with AWS D1.1/D1.1M, Section 5, Qualification.
 - b. Each welder employed on or to be employed for the Work shall possess current AWS certification in the welding process with which welder will be working. Certifications shall be current and valid throughout the Work.
3. Surveyor:
 - a. Engage a registered professional land surveyor legally qualified to practice in the same jurisdiction as the Site, and experienced in providing surveying services of the kind indicated.
 - b. Responsibilities include but are not necessarily limited to:
 - 1) Performing or supervising performance of field survey work to check lines and elevations of concrete and masonry bearing

surfaces, and locations of anchorage devices and similar devices, before steel erection proceeds.

- 2) Notifying CONTRACTOR and ENGINEER in writing when surveyed Work does not comply with the Contract Documents.
- 3) Submit to CONTRACTOR field survey reports.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

- a. Complete details and schedules for fabrication and shop assembly of members and details, schedules, procedures, and diagrams showing proposed sequence of erection. Shop Drawings shall not be reproductions of Contract Drawings.
- b. Include complete information for fabrication of the structure's components, including but not limited to location, type, and size of bolts, details of blocks, copes and cuts, connections, camber, holes, member sizes and lengths, and other pertinent data. Clearly indicate welds using standard AWS notations and symbols, and clearly show or indicate size, length, and type of each weld.
- c. Setting drawings, templates, and directions for installing anchorage devices.

2. Product Data:

- a. Manufacturer's specifications and installation instructions for products listed below.
 - 1) High-strength bolts of each type, including nuts and washers.
 - 2) Welding electrodes and rods.
 - 3) Load indicator bolts and washers.
- b. Hollow structural section cavity connector manufacturer specifications, load tables, dimension diagrams, and acceptable base material conditions. Clearly indicate allowable strength design safety factors when ultimate load carrying capacities are submitted for approval.

B. Informational Submittals: Submit the following:

1. Certificates.

- a. Fabricator's AISC quality certification.

- b. Welders' certifications.
 - c. Certified reports of laboratory tests on previously-manufactured, identical materials, and other data as necessary, to demonstrate compliance with the Contract Documents for the materials listed below:
 - 1) Structural steel of each type, including certified mill reports indicating chemical and physical properties.
 - 2) High-strength bolts of each type, including nuts and washers.
- 2. Supplier Instructions:
 - a. Installation data, handling, and storage instructions.
- 3. Source Quality Control Submittals:
 - a. When performed or when required by ENGINEER, submit results of source quality control testing and inspections performed at the mill or shop.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Storage:
 - 1. Protect steel members and packaged materials from corrosion and deterioration.
 - 2. Do not store materials in or on the building or structure in manner that may cause distortion or damage to structural steel members, building, or supporting structures.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Steel Types:
 - 1. W-Shapes and WT-Shapes: ASTM A992/A992M.
 - 2. S-shapes and Channels: ASTM A572/A572M, Grade 50.
 - 3. Hollow Structural Sections: ASTM A1085 or ASTM A500/A500M, Grade C.
 - 4. Angles, Plates, and Bars: ASTM A36/A36M.
 - 5. Steel Pipe: ASTM A53/A53M, Grade B.
- B. Anchorages, Fasteners, and Connectors:

1. Anchorage Devices: Refer to Section 05 05 33, Anchor Systems.
 2. Hollow Structural Section (HSS) Cavity Connectors: High-strength fastening system for hollow structural sections, as follows:
 - a. General:
 - 1) Each connector shall be hexagon-headed, expansion anchor for connecting structural steel tubes.
 - 2) Use hollow structural section cavity connectors only in the sizes and at locations shown or indicated in the Contract Documents.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Hollo-Bolt, by Lindapter International.
 - 2) BoxBolt, by Key Safety, Inc.
 - 3) Or equal.
 - c. Materials:
 - 1) Body/shoulder and wedge manufactured from mild steel bars.
 - 2) Core bolt manufactured with high tensile steel ISO 4017.
 - 3) Finish: Hot-dip galvanized.
 - d. Test bolts at time of manufacture in accordance with ISO 2859-1. Do not ship bolts that do not successfully pass the test.
- C. Electrodes for Welding: E70XX complying with AWS D1.1/D1.1M.

2.02 FABRICATION

- A. Shop Fabrication and Assembly:
1. General:
 - a. Fabricate and assemble structural assemblies in the shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC 325, the Contract Documents, and as shown on approved Shop Drawings. Provide camber in structural members as shown or indicated.
 - b. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize handling of materials for storage and minimize handling at the Site.

- c. Where finishing is required, complete the assembly, including welding of units, before commencing finishing operations. Provide finish surfaces of members exposed-to-view in the completed Work that are free of markings, burrs, and other defects.

2. Connections:

- a. The design of connections for any part of the structure not indicated on the Contract Drawings shall be completed by the CONTRACTOR, under the supervision of a professional engineer registered in the same state as the Site. Professional engineer shall sign/seal all calculations and shop drawings related to connection design.

B. Connections:

1. Shop Connections:

- a. Unless otherwise shown or indicated, shop connections may be welded or high-strength bolted connections. Welds shall be 3/16-inch minimum.
- b. Where reaction values of beam are not shown or indicated, connections shall be detailed to support 70% of the total uniform load capacity tabulated in tables contained in part 10 of the AISC Manual for allowable loads on beams for the associated shape, span, and steel specified for the beam. Reaction used for design shall not be less than 6 kips.
- c. Shop-welded connections shall be detailed to eliminate or minimize eccentricity in the connection.
- d. End-connection angles fastened to webs of beams and girders, and the thickness of angles, size, and extent of fasteners or shop welds, shall comply with tables of "Framed Beam Connections" in AISC 325. Connections shall be two-sided, unless otherwise shown or indicated.

2. Field Connections:

- a. Field connections, unless otherwise shown or indicated, shall be made with high-strength bolts, and shall be bearing-type connections.
- b. Use field welding only where shown or indicated or where approved by ENGINEER.

3. High-Strength Bolted Construction:

- a. Provide high-strength threaded fasteners in accordance with RCSC Specifications for Structural Joints using ASTM A325 or ASTM A490 Bolts.
 - b. High-strength bolt design shear values shall be as specified in AISC 325 for bolts with threads in the shear plane for bearing type connections, or as specified in this Section for slip-critical connections.
 - c. Bolted connections shown or indicated as "SC" shall comply with slip-critical connection requirements in RCSC Specifications for Structural Joints Using ASTM A325 or ASTM A490 Bolts.
 - 1) Faying surfaces shall have a Class A surface condition.
 - 2) Slip-critical bolts shall be fully pre-tensioned to 70 percent of minimum specified tensile strength of the bolt using one of the following methods:
 - a) Turn of nut with matchmarking.
 - b) Twist-off tension control bolt (ASTM F1852).
 - c) Direct tension indicator washer (ASTM F959).
 - d. Minimum bolt diameter shall be 3/4-inch, unless otherwise shown or indicated.
4. Welded Construction: Comply with AWS D1.1/D1.1M for procedures, appearance, and quality of welds, and methods used in correcting defective welding Work.
- C. Structural Tubing: Properly seal structural tubing to protect internal surfaces.
- D. Holes and Appurtenances for Other Work:
- 1. Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on the approved Shop Drawings. If large block-outs are required and approved, reinforce the webs to develop specified shears. Provide threaded nuts welded to framing and other specialty items as shown or indicated to receive other work.
 - 2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.03 FINISHING

- A. Surface Preparation and Shop Priming: Structural steel shall be primed in the shop. For surface preparation and shop priming requirements refer to Section 09 91 00, Painting.

B. Inspection and Testing at the Mill or Shop:

1. Perform fabricator's standard procedures for source quality control, including inspections and testing.
2. Materials and fabrication procedures shall be subject to inspection and tests in mill and shop, conducted by a qualified inspection laboratory. Such inspections and tests do not relieve CONTRACTOR of responsibility for providing the Work in accordance with the Contract Documents.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which the Work will be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 ERECTION

- A. General: Comply with AISC 303, AISC 360, and the Contract Documents.
- B. Checking of Lines and Elevations: Before proceeding with structural steel erection, furnish services of a qualified surveyor to check lines and elevations of concrete and masonry bearing surfaces, and locations of anchorage devices and similar devices. Immediately report discrepancies to ENGINEER. Do not proceed with erection until defective Work that will support structural steel is corrected, including agreeing with ENGINEER upon compensating adjustments (if any) to structural steel Work.
- C. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy-lines to achieve proper alignment of structures as erection proceeds.
- D. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete the Work. Provide sufficient planking to comply with Laws and Regulations, and provide tightly-planked substantial floor within two stories or 30 feet, whichever is less, below each tier of steel beams on which work is performed.
- E. Anchorage Devices:
1. Provide anchorage devices, including anchor bolts, and other connectors required for securing structural steel to foundations and other in-place construction.
 2. Provide templates and other devices necessary for presetting anchorage devices to accurate locations.

3. Refer to Section 05053, Anchor Systems, for anchorage requirements.

F. Setting Bases and Bearing Plates:

1. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
2. Set loose and attached base plates and bearing plates for structural members on steel wedges or other adjusting devices.
3. Tighten anchorage devices after supported members are positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
4. Place grout between bearing surfaces and bases or plates in accordance with Section 03000, Grouting. Finish exposed surfaces, protect installed materials, and allow to cure in accordance with grout manufacturer's instructions, and as otherwise required.
5. Do not use leveling plates or wood wedges.

G. Field Assembly:

1. Set structural frames accurately to the lines and elevations shown and indicated. Align and adjust the various members forming part of a complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
2. Level and plumb individual members of structure within tolerances as specified in AISC 325. For members requiring accurate alignment, provide clip angles, lintels, and other members, with slotted holes for horizontal adjustment at least 3/8-inch in each direction, or more when required.
3. Splice members only where shown or indicated.

- H. Erection Bolts: On exposed-to-view, welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

I. Connections:

1. Comply with AISC 325 for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to field welds.
2. Do not enlarge inadequate holes in members by burning or by using drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

3. Hollow Structural Section Cavity Connectors:
 - a. Comply with manufacturer's written installation instructions and the following.
 - b. Cavity Connectors shall be torqued in accordance with manufacturer's instructions.
- J. Gas Cutting: Do not use gas-cutting torches for correcting fabrication defects in structural framing. Cutting will be allowed only on secondary members that are not under stress, as approved by ENGINEER. Finish gas-cut sections equal to a sheared appearance, when allowed.
- K. Touch-up Painting:
 1. Unless otherwise specified, comply with touch-up painting requirements in Section 09910, Painting.
 2. Immediately after erection, clean field welds, bolted connections, and damaged or abraded areas of shop-applied paint. Apply paint to exposed areas with the same paint or coating material applied in the shop. Apply by brush or spray to provide not less than the dry film thickness specified in Section 09910, Painting.

3.03 FIELD QUALITY CONTROL

1. OWNER will engage independent testing and inspection laboratory to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.
 - a. Testing laboratory shall conduct and interpret tests, prepare and state in each report of results whether test specimens comply with the Contract Documents and specifically indicate all deviations.
 - b. Welds: Each weld shall be visually inspected.
 - 1) Where visually defective welds are evident, further test welds using non-destructive methods. If welds are determined to be acceptable, OWNER will pay for non-destructive testing. When welds are defective, CONTRACTOR shall pay for non-destructive testing.
 - 2) Correct, or remove and replace, defective Work as directed by ENGINEER.
 - 3) CONTRACTOR shall pay for corrections and subsequent tests required to determine weld compliance with the Contract Documents.

END OF SECTION

SECTION 05503

MISCELLANEOUS METAL FABRICATIONS

PART 1 – GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish miscellaneous metal fabrications including surface preparation and shop priming.
2. The Work also includes:
 - a. Providing openings in miscellaneous metal fabrications to accommodate the Work under this and other Sections and attaching to miscellaneous metal fabrications all items such as sleeves, bands, studs, fasteners, and all items required for which provision is not specifically included under other Sections.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate the Work to be installed with or attached to miscellaneous metal fabrications Work.
2. Hot-dip Galvanizing: Coordinate with steel fabricator detailing for and fabrication of assemblies to be hot-dip galvanized, to minimize distortion during galvanizing process.

C. Related Sections:

1. Section 05053, Anchor Systems.
2. Section 09910, Painting,

1.02 REFERENCES

A. Standards referenced in this Section are:

1. ASTM A36/A36M, Specification for Carbon Structural Steel.
2. ASTM A123/A123M, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A153/A153M, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

4. ASTM A240/A240M, Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.
5. ASTM A320/A320M, Specification for Alloy-Steel and Stainless-Steel Bolting Materials for Low-Temperature Service.
6. ASTM A384/A384M-02 Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
7. ASTM A500, Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
8. ASTM A793, Specification for Rolled Floor Plate, Stainless Steel.
9. ASTM A992/A992M, Specification for Structural Steel Shapes.
10. AWS D1.1/D1.1M, Structural Welding Code – Steel.
11. AWS D1.6, Structural Welding Code – Stainless Steel.
12. NAAMM, Metal Finishes Manual.

1.03 QUALITY ASSURANCE

- A. Qualifications:
 1. Welding:
 - a. Qualify welding processes and welding operators in accordance with AWS D1.1/D1.1M, D1.2/D1.2M, or D1.6, as applicable.
 - b. When requested by ENGINEER, provide certification that each welder employed on or to be employed for the Work have satisfactorily passed AWS qualification tests within previous 12 months. Ensure that all certifications are current.
- B. Regulatory Requirements: Conform to the following:
 1. 29 CFR 1910, Occupational Health and Safety Standards.

1.04 SUBMITTALS

- A. Action Submittals: Submit the following:
 1. Shop Drawings:
 - a. Fabrication and erection details for assemblies of miscellaneous metal Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Include setting

drawings and templates for locating and installing miscellaneous metal items and anchorage devices.

2. Product Data:

- a. Copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions for products to be used in miscellaneous metal Work.

B. Informational Submittals: Submit the following:

1. Test and Evaluation Reports:

- a. Mill test report that indicates chemical and physical properties of each type of material, when requested by ENGINEER.

2. Qualifications Statements:

- a. Copies of welder's certifications, when requested by ENGINEER.

1.05 STORAGE, AND HANDLING

A. Packing, Shipping, Handling and Unloading:

- 1. Deliver products to Site to ensure uninterrupted progress of the Work. Deliver anchorage materials to be embedded in other construction in ample time to prevent delaying the Work.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Steel:

- 1. W-Shapes and WT-Shapes: ASTM A992/A992M.
- 2. S-Shapes and Channels: ASTM A572/A572M, Grade 50.
- 3. Hollow Structural Sections: ASTM A500, Grade B.
- 4. Angles, Plates, Bars: ASTM A36/A36M.
- 5. Steel Pipe: ASTM A53/A53M, Grade B.

B. Zinc-coated Hardware: ASTM A153/A153M.

2.02 MISCELLANEOUS METAL ITEMS

A. Shop Assembly:

1. Pre-assemble items in the shop to the greatest extent possible to minimize field-splicing and field-assembly of units at the Site. Disassemble units only to extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Miscellaneous Framing and Supports:

1. Provide miscellaneous metal framing and supports that are not part of structural steel framework and are required to complete the Work.
2. Fabricate miscellaneous units to sizes, shapes, and profiles shown on the Drawings or, if not shown, of required dimensions to receive adjacent grating, plates, tanks, doors, and other work to be retained by the framing.
3. Except as otherwise shown, fabricate from structural shapes, plates, and bars, of all-welded construction using mitered corners, welded brackets, and splice plates and minimum number of joints for field connection.
4. Cut, drill, and tap units to receive hardware and similar items to be anchored to the Work.
5. Furnish units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units are to be installed after concrete is placed.
 - a. Except as otherwise shown, space anchors, 2.0 feet on centers, and provide units the equivalent of 1.25-inch by 1/4-inch by eight-inch strips.
 - b. Galvanize exterior miscellaneous frames and supports.
 - c. Where shown or indicated, galvanize miscellaneous frames and supports that are not to be installed outdoors.
6. Miscellaneous steel framing and supports shall be hot-dip galvanized and finish-painted, unless otherwise shown or indicated.
7. Surface preparation and painting of galvanized surface shall conform to Section 09910, Painting

2.03 FINISHING

- A. Surface Preparation and Shop Priming: Perform surface preparation and apply primer coat to miscellaneous metal fabrications in the shop. Conform to surface preparation and shop priming requirements in Section 09910, Painting.

B. Galvanizing:

1. Galvanizing of fabricated steel items shall comply with ASTM A123/A123M.
2. Details of fabrication of steel items and assemblies to be hot-dip galvanized shall conform to recommendations of ASTM A384/A384M to minimize the potential for distortion.

2.04 SOURCE QUALITY CONTROL

A. Tests and Inspections:

1. Materials and fabrication procedures shall be subject to inspection and tests in the mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve CONTRACTOR of responsibility for providing materials and fabrication procedures complying with the Contract Documents.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine conditions under which the Work is to be performed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Install miscellaneous metal fabrications accurately in location, alignment, and elevation, plumb, level, true, and free of rack, measured from established lines and levels. Brace temporarily or anchor temporarily in formwork where fabrications are to be built into concrete, masonry, or other construction.
- B. Anchor securely as shown and as required for the intended use, using concealed anchors where possible.
- C. Fit exposed connections accurately together to form tight, hairline joints. Field-weld steel connections that are not to be exposed joints and cannot be shop-welded because of shipping size limitations. Comply with AWS D1.1/D1.1M, D1.2/D1.2M and D1.6, as applicable to the material being welded. Grind steel joints smooth and touch-up shop paint coat. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

END OF SECTION

SECTION 06103

MISCELLANEOUS ROUGH CARPENTRY

PART 1 – GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide all labor, material, tools, equipment, and incidentals as shown, specified, and required to furnish and install all miscellaneous rough carpentry Work.
2. The Work also includes:
 - a. Providing openings in miscellaneous rough carpentry to accommodate the Work under this and other Sections and building into miscellaneous rough carpentry items such as sleeves, anchorages, inserts and other items to be embedded in or penetrating miscellaneous rough carpentry for which placement is not specifically provided under other Sections.
3. Extent of miscellaneous rough carpentry is shown or indicated.
4. Types of materials required include:
 - a. Miscellaneous blocking, furring strips, and other miscellaneous wood framing.
 - b. Lumber for temporary protection.
 - c. Lumber for temporary support.
 - d. Pressure treatment of lumber specified in this Section.
 - e. Miscellaneous accessories.
 - f. Air and water infiltration barrier system.
 - g. Vapor barrier system.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before miscellaneous rough carpentry Work.

C. Related Sections:

1. Section 05053, Anchor Systems.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. ALSC PS 20, American Softwood Lumber Standard.
2. ASME B18.2.1 Square and Hex Bolts and Screws, Inch Series.
3. ASME B18.6.1 Wood Screws, Inch Series.
4. ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
5. ASTM D2898, Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
6. ASTM D5516, Test Method for Evaluating the Flexural Properties of Fire-Retardant Treated Softwood Plywood Exposed to Elevated Temperatures.
7. ASTM D5664, Test Method for Evaluating the Effects of Fire-Retardant Treatments and Elevated temperatures on Strength Properties of Fire-Retardant Treated Lumber.
8. ASTM D6305, Practice for Calculating Bending Strength Design Adjustment Factors for Fire-Retardant-Treated Plywood Roof Sheathing.
9. ASTM D6841, Practice for Calculating Design Value Treatment Adjustment Factors for Fire-Retardant-Treated Lumber.
10. ASTM F1667, Specification for Driven Fasteners: Nails, Spikes, and Staples.
11. AWWA M4, Care of Preservative Treated Wood Products.
12. AWWA P5, Waterborne Preservatives.
13. AWWA P17, Fire Retardant Formulations.
14. AWWA T1, Use Category System: Processing and Treatment Standard.
15. AWWA U1, Use Category System: User Specification for Treated Wood.
16. APA E445S, Performance Standards and Policies for Structural-Use Panels (APA PRP-108).
17. NIST PS-1, Construction and Industrial Plywood.
18. National Lumber Grade Authority (NLGA), Standard Grading Rules for Canadian Lumber.

19. Northeastern Lumber Manufacturers Association (NELMA), Standard Grading Rules for Northeastern Lumber.
20. Southern Pine Inspection Bureau (SPIB), Standard Grading Rules for Southern Pine Lumber.
21. West Coast Lumber Inspection Bureau (WCLIB), Standard Grading Rules.
22. Western Wood Products Association (WWPA), Western Lumber Grading Rules.

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and the building code for size, spacing and attachment of wood members, unless more stringent requirements are shown or specified in the Contract Documents.
- B. Certifications:
 1. Pressure Treatment: For each type of pressure treatment specified, submit certification by wood treating plant stating chemicals and process used, and certifying conformance with applicable standards referenced in the Contract Documents.
 - a. For water borne preservatives, include statement that moisture content of treated materials was reduced to maximum of 19 percent prior to shipment to the Site.
 2. Certificates of Grade: Where appearance of wood is important and grade marks will deface the Work, in lieu of grade markings on wood, submit certificates attesting that materials comply with grade requirements specified.

1.04 SUBMITTALS

- A. Action Submittals; Submit the following:
 1. Shop Drawings:
 - a. List of species and grade of lumber proposed for each use.
 - b. Fastener schedule with location, size, material and type of each fastener to be used in the Work.
- B. Informational Submittals: Submit the following:
 1. Certificates:
 - a. Lumber treater's certification of compliance, in accordance with Paragraph 1.3.B.1 of this Section.

- b. Certificates of grade in accordance with Paragraph 1.3.B.2 of this Section.
- 2. Tests and Evaluation Reports:
 - a. For fire retardant treated structural panels, test data and design adjustment values in accordance with ASTM D5516 and ASTM D6305.
 - b. For fire retardant treated lumber, test data and design adjustment in accordance with ASTM D5664 and ASTM D6841.
- 3. Manufacturer's Instructions:
 - a. Chemical treatment manufacturer's instructions for proper use of each type of treated material.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling, and Unloading:
 - 1. Deliver products to Site to ensure uninterrupted progress of the Work. Deliver anchorage products that are to be embedded in concrete or masonry in ample time to prevent delaying the Work.
 - 2. Handle treated materials in accordance with AWWA M4.
 - 3. Comply with Section 01650, Product Delivery Requirements.
- B. Storage and Protection:
 - 1. Keep materials dry during delivery and storage.
 - 2. Keep materials off ground using pallets, platforms, or other appropriate supports. Protect materials from corrosion and deterioration. Stack lumber and provide air circulation within stacks.
 - 3. Comply with Section 01660, Product Storage and Handling Requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Lumber, General:
 - 1. Factory-mark each piece of lumber with type, grade, mill and grading agency. Surfaces that will be exposed to view shall not have grade marks or other types of identifying marks.

2. Nominal sizes are shown or indicated, unless otherwise shown or indicated in the Contract Documents. Provide actual sizes as required by ALSC PS 20 for moisture content specified for each use.
 - a. Provide dressed lumber, surfaced four sides (S4S), unless otherwise shown or specified.
 - b. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing.
 3. Provide the following grade and species:
 - a. Construction Grade, for material up to and including four-inch wide.
 - b. No. 2 or better for material greater than four-inch wide up to and including 12-inch wide.
 - c. Southern Pine, SPIB.
 4. Lumber for Protection and Temporary Support: Size and grades to conform to Laws and Regulations, including OSHA.
- B. Plywood for Diaphragms: Provide the following:
1. NIST PS-1 rated sheathing, exterior exposure, Grade C-C, with minimum thickness shown on the Drawings, and span rating not less than 24/0.
 - a. Mark each sheet to identify plywood by species group or span rating, exposure durability classification, grade, and compliance with NIST PS-1) Surfaces that will be exposed to view shall not bear grade marks or other identifying marks.
- C. Oriented Strand Board for Roof Sheathing: Provide the following:
1. APA E445S, sheathing grade with durability equivalent to Exposure 1 and span rating not less than 24/16.
 - a. Mark each panel with a mark that identifies end use, span rating, and exposure durability classification.
- D. Vapor Barrier:
1. Provide reinforced rubber, modified high density polyethylene vapor barrier with perm rating of 0.045 maximum. Provide maximum widths to minimize field seaming.
 2. Provide adhesive, tapes and flashings as recommended by vapor barrier manufacturer, of type that maintains perm rating of entire vapor barrier installation

3. Products and Manufacturers: Provide one of the following:
 - a. Rufco SS-300 Vapor Retarder and Adhesives by Raven Industries, Inc.
 - b. Or equal.
- E. Water and Air Infiltration Barrier:
1. Provide vapor permeable membrane recommended by manufacturer for installation on outside face of plywood wall siding.
 2. Provide minimum moisture vapor transmission of 35 grains per square meter per 24-hour period.
 3. Products and Manufacturers: Provide one of the following:
 - a. Tyvek Housewrap by DuPont Company Textile Fibers Department.
 - b. Typar Housewrap by Reemay, Incorporated.
 - c. Or equal.
- F. Fasteners and Anchorages:
1. Fasteners exposed to the weather as well as fasteners embedded in, or in contact with, preservative treated wood shall be hot-dip galvanized.
 2. Fasteners for fire retardant-treated lumber exposed to the weather shall be copper alloy.
 3. Common wire nails shall conform to ASTM F1667.
 4. Wood screws shall conform to ASME B18.6.1.
 5. Lag screws and lag bolts shall conform to ASME B18.2.1.
 6. Anchorage devices shall conform to Section 05 05 33, Anchor Systems.
 7. Use joist hangers, framing anchors and clips where shown or specified.
 - a. Joist hangers shall be steel, zinc coated, sized to fit the supporting member, of sufficient strength to develop full strength of the supported member in accordance with applicable building code, and furnished complete with special nails required by joist hanger manufacturer.
 - b. Framing anchors shall be hot-dip galvanized steel conforming to ASTM A653/A653M, Z275 G90. Steel shall not be lighter than 18-gage. Use special nails furnished by manufacturer for nailing.

- c. Clips shall consist of hot-dip galvanized conforming to ASTM A653/A653M, Z275 G90 steel angles, minimum 3/16-inch thick.
- G. Wood Trim:
 - 1. Western red cedar, custom grade.
 - 2. Provide solid wood boards and battens complying with ALSC PS 20 and with applicable grading rules of authorized lumber inspection bureau or association under which each species is produced, S4S, with square edges.
 - 3. Provide dressed, seasoned boards and battens with 15 percent maximum moisture content complying with dry size requirements of ALSC PS 20. Mark boards "MC-15" (moisture content 15 percent) or "KD" (kiln dried).
- H. Panel edge clips: Extruded galvanized steel, H-shaped clips to prevent differential deflection of roof sheathing.

2.02 WOOD TREATMENT

- A. Preservative Treatment: Where lumber is specified in this Section as treated, comply with AWPAP5, "Alkaline Copper Quat Mixture". Mark each treated item to comply with AWPAP5 quality mark requirements.
 - 1. Pressure-treat above ground items with water-borne preservatives in accordance with AWPAP5 U1 and AWPAP5 T1. After treatment, kiln-dry to maximum moisture content of 19 percent. Treat materials indicated on the Drawings and the following:
 - a. Wood nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood, plates, blocking, furring, stripping, and similar concealed members and wood in contact with masonry, concrete, or steel.
 - c. Soffit and rain drainage framing.
 - 2. Complete the fabrication of treated items prior to treatment, wherever possible. If wood is cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment. Inspect each piece of wood after drying and discard damaged or defective pieces.
- B. Fire Retardant Treatment: Where lumber is shown as fire retardant-treated, comply with the following:
 - 1. Fire retardants shall conform to AWPAP5 P17. Fire retardant treatment of wood products shall conform to the requirements of AWPAP5 U1 and AWPAP5 T1. Treat materials indicated on the Drawings.

2. Treated materials to be exposed to rain wetting shall be subjected to an accelerated weathering technique in accordance with ASTM D2898 prior to being tested.
3. Treated materials that will be exposed to heat or humidity, shall receive exterior retardant treatment.
4. Fire retardant treated wood shall be free of sulfates, halogens, ammonium phosphate, and formaldehyde.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine substrates and supporting structure and conditions under which miscellaneous rough carpentry Work will be installed and notify ENGINEER in writing of conditions detrimental to proper completion of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Coordination: Fit miscellaneous rough carpentry Work to other Work and work under other contracts, as applicable, and scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other construction.
- B. General:
 1. Discard units of material with defects that might impair quality of the Work, and units too small to fabricate the Work with minimum joints or optimum joint arrangement.
 2. Set miscellaneous rough carpentry Work accurately to required levels and lines, with members plumb and true, accurately cut and fitted.
 3. Securely attach miscellaneous rough carpentry Work to substrates by anchoring and fastening as shown and indicated in the Contract Documents. Countersink nail heads on exposed miscellaneous rough carpentry Work and fill holes. Make tight connections between members.
 4. Install fasteners without splitting of wood, pre-drill as required and for masonry anchors fastened to wood stud wall framing.
- C. Wood Grounds, Nailers, and Blocking:
 1. Provide where shown or indicated, and where required for attachment of other construction. Form to shapes as shown or indicated and cut as required for true line and level of Work to be attached. Coordinate location with other work involved.
 2. Attach substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown or indicated.

3. Provide permanent grounds of dressed, preservative-treated, key-bevelled lumber not less than 1.5-inch wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

D. Plywood, General:

1. Install in accordance with the Contract Documents and requirements of authorities having jurisdiction.
2. Allow for installed clearances between individual plywood panels as specified by plywood manufacturer. Provide 1/4-inch space at panel edge joints and 1/8-inch space at panel end joints, unless otherwise recommended by manufacturer.
3. Install plywood with long dimension across supports.
4. Install roof sheathing using 8d helical or annular nails spaced six inches at panel edges and 12 inches at intermediate framing.
5. Provide panel edge clips at unsupported edges of roof sheathing.

E. Plywood, Diaphragm:

1. Diaphragms shall be blocked or unblocked, as shown or indicated on the Drawings. Comply with nailing schedule on the Drawings.
2. Provide continuous lumber blocking at unsupported edges of blocked diaphragms. Do not use panel edge clips in blocked diaphragms.

F. Air and Water Infiltration Barrier:

1. Install air and water infiltration barrier over entire wall area of wood framed building, as shown or indicated in the Contract Documents.
2. Comply with manufacturer's written installation instruction and provide large head sheathing nails sufficiently long to penetrate and grip framing studs, sills, and plates.
3. Fabric shall be snugly taut before nailing with all fabric lapped 12-inches minimum, at splices.
4. Tape all seams along sills.

G. Vapor Barrier:

1. Install vapor barrier over entire interior room-side surfaces of exterior gypsum board perimeter walls, and over entire interior room-side surface plane of bottom of ceiling joists.
2. Install in accordance with manufacturer's written recommendations and using all taped joints and all taped fastener location to maintain perm

rating of entire installed system in accordance with the Contract Documents.

END OF SECTION

SECTION 07920

JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install joint sealants.
2. Extent of each type of calking and sealant is shown or indicated and includes the following:
 - a. Interior and exterior joints in equipment and construction systems not filled by another material, and that are not required to be open for operation.
 - b. Exposed-to-view joints of all fire-rated sealants.
 - c. Joints specified to be re-calked.

B. Coordination:

1. Review installation procedures under other Sections and coordinate installation of items to be installed with or before joint sealants.
2. Coordinate final selection of joint sealants so that materials are compatible with all calking and sealant substrates specified.

C. Related Sections:

1. Section 03 15 00, Concrete Accessories.
2. Section 04 05 11, Masonry Anchorage and Reinforcing.
3. Section 04 05 05, Unit Masonry Construction.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. ASTM C510, Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
2. ASTM C661, Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.

3. ASTM C793, Test Method for Effects of Accelerated Weathering on Elastomeric Joint Sealants.
4. ASTM C794, Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
5. ASTM C920, Specification for Elastomeric Joint Sealants.
6. ASTM C1021, Practice for Laboratories Engaged in Testing Building Sealants.
7. ASTM C1087, Test method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
8. ASTM C1193, Guide for Use of Joint Sealants.
9. ASTM C1247, Practice for Durability of Sealants Exposed to Continuous Immersion in Liquids.
10. BAAQMD Regulation 8, Rule 51.
11. FS TT-S-00227, Sealing Compound: Elastomeric Type, Multi-component (for Calking, Sealing, and Glazing in Buildings and Other Structures).
12. FS TT-S-00230 Sealing Compound: Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures).
13. NSF/ANSI Standard 61, Drinking Water System Components - Health Effects.
14. SCAQMD Rule 1168.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Installer:
 - a. Engage a single installer, approved by product manufacturer, regularly engaged in calking and sealant installation and with successful experience in applying types of products required, and who employs only tradesmen with specific skill and successful experience in the type of Work required.
2. Testing Laboratory:
 - a. Furnish services of independent testing laboratory qualified according to ASTM C1021, for conducting testing required.

B. Component Supply and Compatibility:

1. Obtain materials only from manufacturers who will, if required:
 - a. Furnish at the Site services of a qualified technical representative to advise installer of proper procedures and precautions for using materials.
 - b. Test joint sealants for compatibility with substrates for conformance with FS-TT-S-00227, and recommend remedial procedures as required.
2. Before purchasing each sealant, investigate its compatibility with joint surfaces, joint fillers, and other materials in joint system. Provide products that are fully compatible with actual installation condition, verified by manufacturer's published data or certification, and as shown on approved Shop Drawings and other approved submittals.

C. Product Testing: Provide test results of laboratory pre-construction compatibility and adhesion testing, as specified in Article 3.1 of this Section, by qualified testing laboratory, based on testing of current sealant formulations within a 36-month period preceding the Notice to Proceed for the Work.

1. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920 and, where applicable, to other standard test methods.
2. Test other joint sealants for compliance using specified post-construction field adhesion test.

D. Mock-ups:

1. Prior to installing joint sealant Work but after ENGINEER's approval of Samples, provide Sample of each type of calking and sealant in areas selected by ENGINEER to show representative installation of calkings and sealants. Obtain ENGINEER's approval of visual qualities of mock-ups before starting calking and sealant Work. Retain and protect mock-ups during construction as a standard for judging completed calking and sealant Work. Do not alter or destroy mock-ups until so allowed by ENGINEER.
2. Perform the following testing on calking and sealant mock-up, as specified in this Section: Post-construction field adhesion testing and water leak test.
3. Work that does not comply with test requirements on Sample areas will be considered defective.

E. Pre-installation Conference:

1. Prior to installing joint sealants and associated Work, schedule and meet at the Site with calking and sealant installer, calking and sealant manufacturer's technical representative, other trades involved in coordinating with calking and sealant Work, ENGINEER, and OWNER. Record discussions of pre-installation conference and decisions, agreements, and disagreements, and furnish copy of record to each party attending conference. Review foreseeable methods and procedures related to calking and sealant Work, including reviewing:
 - a. Required submittals, both completed and yet to be completed.
 - b. Status of test reports.
 - c. Mock-up construction results.
 - d. Status of substrate and similar considerations.
 - e. Each major calking and sealant application required.
 - f. Availability of products, tradesmen, equipment, and facilities required for avoiding delays.
2. Reconvene conference at earliest opportunity if additional information must be developed to conclude subjects under consideration.
3. Record revisions or changes agreed upon, reasons therefore, and parties agreeing or disagreeing with them.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Schedule of joint sealants installation, indication each specific surface where calking or sealants are to be provided and the material proposed for each application.
2. Product Data:
 - a. Copies of manufacturer's data sheets including color charts, specifications, recommendations, and installation instructions for each type of sealant, calking compound, and associated miscellaneous material required. Include manufacturer's published data, indicating that each product complies with the Contract Documents and is intended for the applications shown or indicated.
 - b. Product test reports.

3. Samples:
 - a. Each type of actual cured material of each calking and sealant specified, in each of manufacturer's standard colors.
 - b. Samples will be reviewed by ENGINEER for color and texture only. Compliance with other requirements is responsibility of CONTRACTOR.
- B. Informational Submittals: Submit the following:
 1. Certificates:
 - a. Certify that materials are suitable for intended use and materials meet or exceed requirements of the Contract Documents.
 - b. Certification from manufacturer that products furnished are appropriate for surfaces and conditions to which they will be applied.
 - c. Certify that applicator is approved by manufacturer.
 2. Field Quality Control Submittals:
 - a. Results of tests on job mock-ups.
 - b. Pre-construction and post-construction field test reports.
 - c. Compatibility and adhesion test reports.
 - d. Contractor's Field Test Report Logs:
 - 1) Indicate time present at the Site.
 - 2) Include observations and results of field tests, and document compliance with manufacturer's installation instructions and supplemental instructions provided to installers.
 3. Pre-installation conference record.
 4. Qualifications: Submit qualifications for:
 - a. Installer.
 - b. Testing laboratory (if not already submitted under Section 01453, Testing Laboratory Services Furnished by Owner, or Section 01453, Testing Laboratory Services Furnished by Contractor).
- C. Closeout Submittals: Submit the following:
 1. Operation and Maintenance Data:

- a. Recommended inspection intervals.
 - b. Instructions for repairing and replacing failed sealant joints.
2. Warranty: Submit written warranties as specified in this Section.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Comply with Section 01610, Transportation and Handling and the following:
- 1. Delivery of Products:
 - a. Deliver products in calking and sealant manufacturer's original unopened, undamaged containers, indicating compliance with approved Shop Drawings and approved Sample color selections.
 - b. Include the following information on label:
 - 1) Name of material and Supplier.
 - 2) Formula or Specification Section number, lot number, color and date of manufacture.
 - 3) Mixing instructions, shelf life, and curing time, when applicable.
 - 2. Storage of Products:
 - a. Do not store or expose materials to temperature above 90 degrees F or store in direct sunlight.
 - b. Do not use materials that are outdated as indicated by shelf life.
 - c. Store sealant tape in manner that will not deform tape.
 - d. In cool or cold weather, store containers for sixteen hours before using in temperature of approximately 75 degrees F.
 - e. When high temperatures prevail, store mixed sealants in a cool place.
 - 3. Handling:
 - a. Do not open containers or mix components until necessary preparatory Work and priming are complete.

1.06 JOB CONDITIONS

- A. Environmental Conditions:

1. Do not install joint sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.
2. Proceed with the Work when forecasted weather conditions are favorable for proper cure and development of high-early bond strength.
3. Where joint width is affected by ambient temperature variations, install elastomeric sealants when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures.
4. When high temperatures prevail, avoid mixing sealants in direct sunlight.
5. Supplemental heat sources required to maintain both ambient and surface temperatures within the range recommended by manufacturer for material applications are not available at the Site.
6. Provide supplemental heat and energy sources, power, equipment, and operating, maintenance, and temperature monitoring personnel.
7. Do not use heat sources that emit carbon dioxide or carbon monoxide into areas of calking, sealants, and painting Work, and areas where OWNER's personnel or construction personnel may work. Properly locate and vent such heat sources to outdoors so that joint sealants and other Work are unaffected by exhaust.

1.07 WARRANTY

- A. Provide written warranty, signed by manufacturer and CONTRACTOR, agreeing to repair or replace sealants that fail to perform as air-tight and watertight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appear to deteriorate in any other manner not clearly specified in approved Shop Drawings and other submittals, as an inherent quality of material for exposure indicated.
 1. Provide manufacturer warranty for period of one year from date of Substantial Completion of joint sealants Work.
 2. Provide installer warranty for period of two years from date of Substantial Completion of joint sealants Work.

PART 2 – PRODUCTS

2.01 SYSTEM PERFORMANCE

- A. Provide elastomeric joint sealants for interior and exterior joint applications that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. VOC Performance Criteria:

1. VOC content of sealants used shall comply with current VOC content limits of SCAQMD Rule 1168. Sealants used as fillers shall comply with or exceed requirements of BAAQMD Regulation 8, Rule 51.
 - a. Sealants: 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: 250 g/L.
 - c. Sealant Primers for Porous Substrates: 775 g/L.

- C. Provide colors selected by ENGINEER from calking and sealant manufacturer's standard and custom color charts. "Or equal" manufacturers shall provide same generic products and colors as available from manufacturers specified.

2.02 MATERIALS

A. Exterior and Interior Vertical Joints; Non-submerged:

1. Two-component Polyurethane Sealant:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Sikaflex- 2c NS by Sika Corporation.
 - 2) Dymeric 240 FC by Tremco Sealant/Waterproofing Division of RPM International, Inc.
 - 3) Or equal.
 - b. Polyurethane based, two-component elastomeric sealant complying with:
 - 1) FS TT-S-00227E: Type II (non-sag) Class A and ASTM C920, Type M, Grade NS, Class 25.
 - 2) Adhesion-in-Peel, FS TT-S-00227E and ASTM C794: (Minimum five pounds per linear inch with no adhesion failure): 10 pounds.
 - 3) Hardness (Standard Conditions), ASTM C661: 25 to 35 (Shore A).
 - 4) Stain and color change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
 - 5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.

- 6) Rheological Vertical Displacement at 120 degrees F, FS TT-S-00227E: No sag.
- 7) VOC Content: 100 g/L, maximum.

B. Exterior and Interior Horizontal Joints; Non-submerged:

1. Two-component Polyurethane Sealant:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Sikaflex- 2c SL by Sika Corporation.
 - 2) THC/900 by Tremco Sealant/Waterproofing Division of RPM International, Inc.
 - 3) Or equal.
 - b. Polyurethane based, two-component elastomeric, self-leveling sealant complying with the following:
 - 1) FS TT-S-00227E, Type I (self-leveling) Class A. and ASTM C920, Type M, Grade P, Class 25
 - 2) Water Immersion Bond, FS TT-S-00227E: Elongation of 50 percent with no adhesive failure.
 - 3) Hardness (Standard Conditions), ASTM C661: 35 to 45.
 - 4) Stain and Color Change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
 - 5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
 - 6) VOC Content: 165 g/L, maximum.

C. Miscellaneous Materials:

1. Joint Cleaner: As recommended by calking and sealant manufacturer.
2. Joint Primer and Sealer: As recommended for compatibility with calking and sealant by calking and sealant manufacturer.
3. Bond Breaker Type: Polyethylene tape or other plastic tape a for compatibility with calking and sealant by calking and sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of calking and sealant. Provide self-adhesive tape where applicable.

4. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable nonabsorptive material as recommended for compatibility with calking and sealant by calking and sealant manufacturer. Provide size and shape of rod that will control joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide highly-compressible backer to minimize possibility of sealant extrusion when joint is compressed.
 5. Low-temperature Catalyst: As recommended by calking and sealant manufacturer.
- D. Products for Other Applications:
1. Compressible Filler: Refer to Section 04051, Masonry Anchorage and Reinforcing.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine joint surfaces, substrates, backing, and anchorage of units forming sealant rabbet, and conditions under which calking and sealant Work will be performed, and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work and performance of sealants. Do not proceed with calking and sealant Work until unsatisfactory conditions are corrected.
- B. Laboratory Pre-construction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers for testing indicated below samples of materials that will contact or affect joint sealants.
 1. Use ASTM C1087 to determine whether priming and another specific joint preparation technique are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 2. Submit at least eight pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 4. For products that fail tests, obtain joint-sealant manufacturer's written instructions for corrective measures including using specially formulated primers.
 5. Immersion Testing: ASTM C1247 for potable water and wastewater.
 6. Testing will not be required if joint sealant manufacturers submit joint preparation data based on previous testing of current sealant products for

adhesion to, and compatibility with, joint substrates and other materials matching those submitted and mock-up field testing is acceptable.

3.02 PREPARATION

- A. Protection: Do not allow joint sealants to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces including rough textured materials. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or calking and sealant materials.
- B. Joint Surface Preparation:
 - 1. Clean joint surfaces immediately before installing sealant compound. Remove dirt, weakly adhering coatings, moisture and other substances that would interfere with bonds of sealant compound as recommended in sealant manufacturer's written instructions as shown on approved Shop Drawings.
 - 2. If necessary, clean porous materials by grinding, sandblasting, or mechanical abrading. Blow out joints with oil-free compressed air or by vacuuming joints prior to applying primer or sealant.
 - 3. Roughen joint surfaces on vitreous coated and similar non-porous materials, when sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or steel wool to produce a dull sheen.
 - 4. Concrete Joint Preparation: Refer to Section 03150, Concrete Accessories
- C. Mixing:
 - 1. Comply with sealant manufacturer's written instructions for mixing multi-component sealants.
 - 2. Thoroughly mix components before use.
 - 3. Add entire contents of activator can to base container. Do not mix partial units.
 - 4. Mix contents for minimum of five minutes or as recommended by sealant manufacturer, until color and consistency are uniform.

3.03 INSTALLATION

- A. Install joint sealants after adjacent areas have been cleaned and before joint has been cleaned and primed, to ensure calking and sealant joints will not be soiled. Replace calking and sealant joints soiled after installation.
- B. Comply with sealant manufacturer's written instructions except where more stringent requirements are shown or indicated in the Contract Documents, and

except where manufacturer's technical representative directs otherwise, only as acceptable to ENGINEER.

- C. Prime or seal joint surfaces as shown on approved Shop Drawings and approved other submittals. Do not allow primer or sealer to spill or migrate onto adjoining surfaces. Allow primer to dry prior to applying sealants.
- D. Apply masking tape before installing primer, in continuous strips in alignment with joint edge to produce sharp, clean interface with adjoining materials. Remove tape immediately after joints have been sealed and tooled as directed.
- E. Confirm that compressible filler is installed before installing sealants. Refer to Section 04050, Unit Masonry Construction, for locations.
- F. Do not install sealants without backer rods and bond breaker tape.
- G. Roll back-up rod stock into joint to avoid lengthwise stretching. Do not twist, braid, puncture, or prime backer rods.
- H. Employ only proven installation techniques that will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
- I. Install sealants to depths recommended by sealant manufacturer but within the following general limitations, measured at the center (thin) section of bead.
 - 1. For horizontal joints in sidewalks, pavements, and similar locations sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to depth equal to 75 percent of joint width, but not more than 5/8-inch deep or less than 3/8-inch deep.
 - 2. For vertical joints subjected to normal movement and sealed with elastomeric sealants and not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2-inch deep or less than 1/4-inch deep.
- J. Remove excess and spillage of compounds promptly as the Work progresses.
- K. Cure caulking and sealant compounds in compliance with manufacturer's instructions and recommendations, to obtain high-early bond strength, internal cohesive strength, and surface durability.

3.04 EXISTING JOINTS

- A. Mechanically remove existing sealant and backer rod.

- B. Clean joint surfaces of residual sealant and other contaminants capable of affecting sealant bond to joint surface.
- C. Conduct laboratory pre-construction compatibility and adhesion testing on joint surfaces in accordance with Paragraph 3.1.B of this Section.
- D. Allow joint surfaces to dry before installing new sealants.

3.05 FIELD QUALITY CONTROL

- A. Post-construction Field Adhesion Testing: Before installing elastomeric sealants, field-test joint sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform ten tests for the first 1,000 feet of joint length for each type of elastomeric sealant and joint substrate.
 - b. Perform one test for each 1,000 feet of joint length thereafter, and minimum of one test per each floor per elevation.
 - c. Test Method: Test joint sealants according to Method A, Field-applied Sealant Joint Hand Pull Tab, and Method D, Water Immersion in Appendix X1 of ASTM C1193. For joints with dissimilar substrates, verify adhesion to each substrate separately by extending cut along one side and verifying adhesion to opposite side. Repeat procedure for opposite side.
 - d. Inspect joints for complete fill, absence of voids, and joint configuration complying with specified requirements. Record results in a log of field adhesion tests.
 - e. Inspect tested joints and report on whether:
 - 1) Sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - 2) Sealants filled the joint cavities and are free of voids.
 - 3) Sealant dimensions and configurations comply with specified requirements.
 - f. Record test results in a log of field adhesion tests. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

- g. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
 - h. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other requirements will be satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.
 - i. Do not proceed with installation of elastomeric sealants over joint surfaces that have been painted, lacquered, waterproofed, or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with FS TT-S-00227, has successfully demonstrated that sealant bond is not impaired by the coating or treatment. If laboratory test has not been performed or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.
- B. Water Leak Testing: Field test for water leaks as follows:
 - 1. Flood the joint exposure with water directed from a 3/4-inch diameter garden hose, without nozzle, held perpendicular to wall face, two feet from joint and connected to water system with 30 psi minimum normal water pressure. Move stream of water along joint at an approximate rate of 20 feet per minute.
 - 2. Test approximately five percent of total joint system, in locations that are typical of every joint condition, and that can be inspected easily for leakage on opposite face. Conduct test in presence of ENGINEER, who will determine actual percentage of joints to be tested and actual period of exposure to water from hose, based on extent of observed leakage or lack of observed leakage.
 - 3. Where nature of observed leaks indicates potential of inadequate joint bond strength, ENGINEER may direct that additional testing be performed at a time when joints are fully cured, and before Substantial Completion.

3.06 ADJUSTING AND CLEANING

- A. Where leaks and lack of adhesion are evident, replace sealant.
- B. Clean adjacent surfaces of sealant and soiling resulting from the Work. Use solvent or cleaning agent recommended by sealant manufacturer. Leave all finish Work in neat, clean condition.
- C. Protect sealants during construction so that they will be without deterioration, soiling, or damage at time of readiness for final payment of the Contract.

3.07 PROTECTION

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

END OF SECTION

SECTION 08111

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install hollow metal doors and frames.
2. Extent of hollow metal doors and frames is shown.
3. Types of products required include the following:
 - a. Fully welded, galvanized steel, internally reinforced, door frames.
 - b. Fully welded, galvanized steel, fire-rated, internally reinforced, door frames.
 - c. Miscellaneous supports; special, supplemental and standard finish hardware reinforcements and preparation items; fasteners and accessories; all for high frequency, high-endurance use.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before the hollow metal doors and frames Work.

C. Related Sections:

1. Section 04050, Unit Masonry Construction.
2. Section 06105, Miscellaneous Rough Carpentry.
3. Section 07920, Joint Sealants.
4. Section 09910, Painting.

1.02 REFERENCES

A. Standards referenced in this Section are listed below:

1. American National Standards Institute, (ANSI).

- a. ANSI in association with Steel Door Institute, ANSI/SDI 100, Steel Doors and Frames.
 - b. ANSI in association with Door and Hardware Institute, ANSI/A115.1-A115.17/DHI, Specifications for Steel Door and Frame Preparation for Hardware.
 - c. ANSI A224.1, Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - d. ANSI A250.3, Test Procedure and Acceptance Criteria for Factory-Applied Finish Painted Steel Surfaces for Steel Doors and Frames.
 - e. ANSI A250.4, Test Procedures and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing.
 - f. ANSI A250.5, Accelerated Physical Endurance Test Procedure for Steel Doors, Frames, and Frame Anchors.
 - g. ANSI/NFPA 252, Fire Tests of Door Assemblies.
2. American Society for Testing and Materials, (ASTM).
 - a. ASTM A 153/A 153M, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - b. ASTM A 366, Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
 - c. ASTM A 653/A 653M, Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by The Hot-Dip Process.
 - d. ASTM B 117, Practice for Operating Salt Spray (Fog) Apparatus.
 - e. ASTM E 1408, Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems.
3. Door and Hardware Institute, (DHI).
 - a. DHI, Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
4. National Fire Protection Association, (NFPA).
 - a. NFPA 80, Fire Doors and Fire Windows.
5. Steel Door Institute, (SDI/Door).
 - a. SDI/Door 105, Erection Instructions for Steel Frames.

- b. SDI/Door 106, Standard Door Type Nomenclature.
 - c. SDI/Door 112, Zinc-Coated (Galvanized/Galvannealed) Standard Steel Doors and Frames.
 - d. SDI/Door 117, Manufacturing Tolerances Standard Steel Doors and Frames.
 - e. SDI/Door 122, Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
 - f. SDI/Door 128, Guidelines for Acoustical Performance of Standard Steel Doors and Frames.
6. The Society for Protective Coatings, (SSPC).
- a. SSPC Paint 2, Cold Phosphate Surface Treatment.
 - b. SSPC Paint 27, Basic Zinc Chromate-Vinyl Butyral Wash Primer.
7. Underwriters' Laboratories Inc., (UL).
- a. UL 10B, Fire Tests of Door Assemblies.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

- 1. Manufacturer shall have a minimum of five years' experience producing substantially similar equipment and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.
- 2. Provide hollow metal doors, frames, and accessories manufactured by a single firm specializing in the production of this type of Work and complying with specified standards of ANSI, NFPA, SDI and UL.
- 3. Provide hollow metal doors and frames from a manufacturer who is a member of SDI.

B. Component Supply and Compatibility:

- 1. Obtain all equipment included in this Section regardless of the component manufacturer from a single hollow metal doors and frames manufacturer.
- 2. The hollow metal doors and frames equipment manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
- 3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the hollow metal doors and frames manufacturer.

C. Regulatory Requirements:

1. Fire-Resistance-Rated Assemblies: Wherever a fire-resistance classification is shown or scheduled for hollow metal doors and frames (3-hour, 1-1/2-hour, and similar designations), provide fire-resistance-rated hollow metal doors and frames tested as a fire door assembly, complete with type of fire door hardware to be used.
2. Identify each fire-resistance-rated door and frame with recognized testing laboratory labels, indicating applicable fire-resistance-rating of both door and frame. Provide fire-resistance-rated doors and frames with metal labels permanently fastened to door and frame. Labels shall display all UL required information.
3. Temperature Rise Rating: Wherever a temperature rise rating is required by the building code, provide doors for fire-resistance-ratings shown and in accordance with UL 10B.
 - a. For a UL 3-hour (A) classification, provide doors with a temperature rise rating of not more than 250°F maximum to 30 minutes of exposure.
 - b. For a UL 1-1/2-hour (B) classification, provide doors with a temperature rise rating of not more than 450°F or 650°F maximum to 30 minutes of exposure.
4. Door and frame assemblies shall comply with NFPA 80, and as specified. Modify specified hollow metal door and frame system components to comply with requirements of governing jurisdictions for fire-resistance-rated construction.
5. Oversize Assemblies: Wherever hollow metal assemblies are larger than size limitations established by ANSI/NFPA 252 and UL10B provide manufacturer's certification that assembly has been constructed with materials and methods equivalent to labeled construction.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Fabrication and installation drawings of hollow metal doors and frames. Include details of each frame type, elevations of each door type, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints, connections and every composite member. Show all door and frame reinforcements, including welds, plate lengths, locations and gauges, identified for each component of finish hardware.

- b. Provide a schedule of doors and frames using same reference numbers for details and openings as those shown.
- 2. Samples:
 - a. Pressed metal corner section of frame, 12-inches by 12-inches minimum, showing all special, supplemental and standard reinforcements, attachments, supports and anchors specified. Provide corner sample for each type of frame specified.
 - b. Stick system components showing corner detail and glazing stops of all types specified, 12-inches by 12-inches, minimum.
 - c. Cut-away section of all door types specified, showing internal construction, edge details and reinforcements for butts, closers and similar items of finished hardware, 2 foot-0 inches by 2 foot-0 inches minimum. Include louver sections, vision panel and glazing stops.
 - d. ENGINEER reserves the right to require samples showing fabrication techniques and workmanships of all component parts, and the detailing and fabrication of accessories and auxiliary items for all door and frame Work, before fabrication of the Work proceeds.
- B. Informational Submittals: Submit the following:
 - 1. Certificates:
 - a. Certification of Labeled Construction for fire-resistance-rated doors and frames.
 - b. Oversize Fire-resistance-rated Doors and Frames: Submit for approval UL certification for oversized fire-resistance-rated doors and frames verifying that each assembly has been constructed with materials and methods equivalent to requirements for labeled construction.
 - 2. Test and Evaluation Reports:
 - a. Test reports indicating compliance with ANSI A250.4 and ANSI A250.5.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading:
 - 1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded in cast-in-place concrete in ample time to prevent delay of that Work.

2. Deliver hollow metal doors and frames cartoned or crated to provide protection during transit and job storage.
- B. Storage and Protection:
1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
 2. Store doors and frames at the Site under cover.
 3. Place units up off floors in a manner that will prevent rust and damage.
 4. Avoid the use of non-vented plastic or canvas shelters, which could create a humidity chamber. If cardboard wrapper on the door becomes wet, remove the carton immediately.
 5. Provide a 1/4-inch space between stacked doors to promote air circulation.
- C. Acceptance at Site:
1. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. CONTRACTOR shall notify ENGINEER, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 SYSTEM PERFORMANCE

- A. Frame Construction:
1. Form frames of cold-rolled sheet material, 14-gauge minimum. Provide seamless frames for all Work, unless specifically specified and shown as permitting exposed fasteners.
 2. Provide hollow metal frames for existing masonry openings and doors of size and profile to match existing.

2.02 MANUFACTURERS

- A. Products and Manufacturers: Provide one of the following:
1. Series CH with DURA-WELD seams with Series F 14 Frames by Pioneer Industries, Incorporated.
 2. Or equal.

2.03 MATERIALS

- A. Door Faces and Frames: Zinc-coated, cold-rolled carbon steel sheets of commercial quality, complying with ASTM A 366, and ASTM A 653/A 653M, G 60 zinc coating, mill-phosphatized.
- B. Honeycomb Core: Phenolic resin-impregnated, nominal 1-inch hexagonal cell size, one piece, Kraft fiber core board, with 42 psi minimum crushing strength.
- C. Supports and Anchors: Formed sheet metal, hot-dip galvanized after fabrication complying with ASTM A 153/A 153M, Class B, and in compliance with requirements of ANSI A250.5. Provide supports and anchors as follows:
 - 1. Jamb Anchors: 16-gauge minimum, and of the following types:
 - a. Masonry Construction: Adjustable, corrugated or perforated, T-shaped to suit frame size with leg not less than 2-inches wide by 10-inches long.
 - b. In-Place Concrete or Masonry Construction: 3/8-inch concealed bolts and expansion shields or inserts.
 - 2. Floor and Head Anchors: 14-gauge minimum, and of the following types:
 - a. Monolithic Concrete Slabs: Clip-type, with two holes to receive fasteners, welded to bottom of jambs and mullions.
 - b. Separate Topping Concrete Slabs: Adjustable-type with extension clips, allowing not less than 2-inches height adjustment. Terminate bottom of frames at finish floor surface.
- D. Inserts, Bolts and Fasteners: Sheet metal hot-dip galvanized complying with ASTM A 153/A 153M, Class C or D as applicable.
- E. Miscellaneous Accessories:
 - 1. Head Strut Supports: 3/8-inch by 2-inch hot-dipped galvanized steel.
 - 2. Structural Reinforcing Members: Provide structural reinforcing members as part of frame assembly, where shown at mullions, transoms, or other locations that are to be built into frame.
 - 3. Head Reinforcing: For frames over 4 feet-0 inch wide, in masonry openings, provide continuous steel channel or angle stiffener, not less than 12-gauge for full width of opening, welded to back of frame at head.
 - 4. Spreader Bars: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.
 - 5. Plaster Guards: 26-gauge minimum galvanized steel.

6. Stops and Moldings: 16-gauge minimum, cold-rolled, hot-dipped galvanized, formed sheet metal.

2.04 FABRICATION

A. General:

1. Fabricate hollow metal units to be rigid, neat in appearance and free for defects, warp or buckle. Accurately form metal to required sizes and profiles.
2. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify Work that cannot be permanently factory-assembled before shipment, to assure proper assembly at the Site. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible. Filler to conceal manufacturing defects shall not be acceptable.
3. Exposed Fasteners: Unless otherwise shown or specified, do not use exposed fasteners in the Work. Where exposed fasteners are shown or specified, provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.

B. Frame Construction:

1. Fabricate all hollow metal frames in compliance with ANSI A250.5 and as specified.
2. Fabricate frames with reinforced, mitered corners that are continuously arc-welded for the full depth and width of the frame, with bottom spreader bar; except provide drywall frames as specified.
3. Grind all exposed welds flush and smooth.
4. Knock-down-type frames shall be used for drywall construction only and shall provide the following additional features:
 - a. Specifically designed for drywall construction.
 - b. Frames shall be knocked down, designed to be securely installed in the rough opening after the wallboard is applied.
 - c. Jamb and head connection shall be a neat, flush, miter with head securely locked to top of jamb.
 - d. Mitered corners shall be reinforced with a concealed corner cup to provide a firm interlock of jamb to head.
 - e. Provide two anchors at head of frames exceeding 3 foot-6 inches wide.

- f. Provide vertical steel head support struts extending from top of frame at each jamb to supporting construction above. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable bolted anchorage to frame jamb members.
 - 5. Head Reinforcing: Where installed in masonry, leave vertical mullions in frames open at the top so they can be filled with grout.
 - 6. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
 - 7. Head Anchors: Provide two anchors at head of frames exceeding 3 foot-6 inches wide for frames mounted in drywall partitions.
 - 8. Head Strut Supports: Provide vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable bolted anchorage to frame jamb members.
 - 9. Rubber Door Silencers: Drill stop to receive three silencers on single-door frames and four silencers on double-door frames. Install plastic plugs to keep holes clear during construction.
 - 10. Plaster Guards: Provide manufacturer's standard plaster guards or dust cover boxes.
- C. Finish Hardware Preparation:
- 1. General:
 - a. Prepare hollow metal units to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling and tapping in accordance with approved Finish Hardware Schedule and templates provided by finish hardware supplier and as specified. Comply with applicable requirements of ANSI/DHI A115.1 to A115.17 and ANSI A250.4.
 - b. Obtain approved hardware schedule, hardware templates, and samples of finish hardware where necessary to ensure correct detailing and fabrication of the hollow metal doors and frames, from finish hardware supplier.
 - 2. Frames:
 - a. Reinforce frames in location required to align with existing door hardware. Reinforce frames for required finish hardware with minimum gauges as follows:

- 1) Hinges and Pivots: Special full width of frame, 3/16-inch-thick steel plate by 8-inches longer than hinge, secured to both rabbets by not less than twelve spot or projection welds.
- 2) Strike Plate Clips: 10-gauge steel plate by 1-1/2-inches wide by 3-inches long with mortar guard boxout secured with not less than six spot or projection welds.
- 3) Surface-Applied Closers: 3/16-inch steel plate, secured with not less than six spot or projection welds. Coordinate closer function and presence of overhead stops and weather-stripping, with location of reinforcement plate.
- 4) Concealed Closers: Removable steel access plate, 12-gauge internal reinforcement of size and shape required, and enclosing housing to keep closer pocket free of mortar or other materials.

2.05 SHOP PAINTING

- A. Clean, treat and paint exposed surfaces of fabricated hollow metal units, including galvanized surfaces.
- B. Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before the application of the shop coat of paint.
- C. Apply pretreatment to cleaned metal surfaces, using cold phosphate solution (SSPC Paint 2), or basic zinc chromate-vinyl butyral solution (SSPC Paint 27).
- D. Refer to Section 09 91 00, Painting, for field-applied primer and finish paint for exterior or interior exposed ferrous, non-ferrous, or galvanized surfaces.
- E. Apply shop-coat of prime paint within time limits recommended by pretreatment manufacturer. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 1.5-mils.
- F. Finish shall be rust inhibitive primer capable of passing a 500-hour salt spray and a 1,000-hour humidity test in accordance with ASTM B 117 as certified by an independent laboratory.

2.06 SOURCE QUALITY CONTROL

- A. After Shop Drawings approval, manufacturer shall not make any further detailing, fabrication or changes to approved methods of support and anchorage, nor shall doors and frames be brought to the Site, which do not conform, in all ways, to performance criteria specified.
- B. Allowable Tolerances: Provide door and frame manufacturing tolerances in compliance with SDI 117 and as follows:
 1. Nominal Clearance between Door and Frame Head and Jamb: 1/8-inch.

2. Nominal Clearance between Meeting Edges of Pairs of Doors: 1/8-inch.
3. Nominal Clearance at Bottom of Door: 3/4-inch.
4. Nominal Clearance between Face of Door and Door Stop: 1/16-inch.
5. Provide all Work plumb and true to adjoining surfaces with all miters and copes accurately formed.
6. Provide completely water and vapor tight joints.

PART 3 - EXECUTION

3.01 INSPECTION

- A. CONTRACTOR shall examine the substrate and conditions under which hollow metal doors and frames are to be installed and notify ENGINEER, in writing, of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Frames that are bowed, twisted or otherwise unacceptable shall be removed from the Site and replaced with properly constructed frames.

3.02 PREPARATION

- A. CONTRACTOR to carefully disconnect hardware from existing frames. Remove existing doors with hardware mounted to them and place in a safe area for reinstallation in new frames.
- B. Drilling and tapping for surface-applied, finish hardware may be done at Site.
- C. Protective Coating: Protect inside, concealed, faces of door frames in plaster or masonry construction using fibered asphalt emulsion coating. Apply over shop primer approximately 1/8-inches thick and allow to dry before installation.

3.03 INSTALLATION

- A. Install hollow metal units and accessories in accordance with approved Shop Drawings, SDI 105 and as shown and specified.
 1. Do not install doors and frames until all the Work, which could damage doors and frames, has been completed.
 2. Provide temporary doors until construction sequencing allows installation of permanent doors and frames.
 3. Do not proceed with the re-installation of permanent hollow metal doors until CONTRACTOR can provide finished Work complying with all requirements of these Specifications.

4. Protect built-in frame Work with temporary wood protection.

B. Placing Frames:

1. Place frames at fire-rated openings in accordance with NFPA 80.
2. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged. Remove spreader bars only after frames have been properly set and secured.
3. Make field splices in frames as detailed on approved Shop Drawings, welded and finished to match factory work.

C. Setting Masonry Anchorage Devices:

1. In masonry construction, building in of anchors and grouting of frames is included in Section 04050, Unit Masonry Construction.
2. Set anchorage devices opposite each anchor location, in accordance with details on approved Shop Drawings and anchorage device manufacturer's instructions as follows:
 - a. Masonry Walls: Install at least three jamb anchors per jamb up to 7 feet-6 inches height; four anchors up to 8 feet-0-inch jamb height; one additional anchor for each 2 foot-0 inch or fraction thereof over 8 feet-0-inch height.
 - b. Cast-In-Place Concrete and Existing Rough Openings: Anchor frame jambs with concealed bolts into expansion shields or inserts at 6-inches from top and bottom and 2 foot-0 inches on center. Apply removable stop to cover anchor bolts.
3. Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so, indicated on approved Shop Drawings.

D. Door Re-Installation:

1. Fit hollow metal doors accurately in their respective frames, with the following clearances:
 - a. Jambs and Head: 3/32-inch.
 - b. Meeting Edges, Pairs of Doors: 1/8-inch.
 - c. Bottom: 3/4-inch, where no threshold or carpet.
 - d. Bottom: At threshold or carpet, 1/8-inch.

2. Place fire-resistance-rated doors with clearances as specified in NFPA 80.
3. Replace finish hardware to match existing locations and in accordance with Door and Hardware Institute, Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.

3.04 ADJUSTMENT AND CLEANING

- A. Check and readjust operating finish hardware items in hollow metal door and frame Work just prior to final inspection. Leave Work in complete and proper operating conditions.
- B. Where problems of installation or damage are cause for rejection of hollow metal door and frame Work, consult SDI 122 and the recommendations of the hollow metal door and frame manufacturer, for suggestions concerning required adjustments in the Work. Submit recommendations to ENGINEER for approval. Replace and repair unacceptable Work, as directed by ENGINEER, so that there will be no doubt as to the acceptability of the Work at the time of Substantial Completion.
- C. Prime Coat Touch-Up: Immediately after installation, sand smooth all rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
- D. Protection: Protect installed hollow metal doors and frames against damage from other construction activities.

END OF SECTION

SECTION 09625
CONCRETE FLOOR TOPPINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install all trowel-applied concrete toppings. The Work also includes:
 - a. Providing openings in concrete toppings to accommodate the Work under this and other Sections and building into the concrete toppings all items to be embedded in, or penetrate, the concrete topping floor system.
2. Extent of concrete toppings is shown and, in addition, includes the following:
 - a. Concrete toppings on sides of all equipment pads and curbs, of same type as used for floor in that area.
3. Types of products required include the following:
 - a. Heavy-duty epoxy, trowel-applied concrete topping.
 - b. Auxiliary materials and accessories.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the concrete toppings Work.
2. Coordinate and schedule preparation of substrates, before equipment and similar items are installed to avoid later difficulty, or delay, in performing the Work of this Section, to provide substrates within tolerances and surface profile specified.
3. Coordinate the protection of existing equipment to remain in place during substrate preparation.
4. Coordinate floor drain mounting heights and types. Provide floor drain type that accommodates 1/4-inch-thick concrete floor topping.

C. Related Sections:

1. Section 03300, Cast-In-Place Concrete.

1.02 REFERENCES

- A. Standards referenced in this Section are listed below:

1. American Society for Testing and Materials, (ASTM).
 - a. ASTM C 150, Specification for Portland cement.
 - b. ASTM C 267, Test Methods for Chemical Resistance of Mortars, Grouts and Monolithic Surfacing and Polymer Concretes.
 - c. ASTM C 307, Test Method for Strength of Chemical-Resistant Mortar, Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
 - d. ASTM C 321, Test Method for Bond Strength of Chemical-Resistant Mortars.
 - e. ASTM C 413, Test Method for Absorption of Chemical-Resistant Mortars, Grouts and Monolithic Surfacing and Polymer Concretes.
 - f. ASTM C 531, Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - g. ASTM C 579, Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes.
 - h. ASTM C 580, Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - i. ASTM D 635, Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
 - j. ASTM D 790, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - k. ASTM D 2047, Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
 - l. ASTM D 2240, Test Method for Rubber Property - Durometer Hardness.
 - m. ASTM D 4060, Test Method for Abrasion Resistance of Organic Coatings by the Taber Abaser.
 - n. ASTM D 4226, Test Methods for Impact Resistance of Rigid Poly (Vinyl Chloride) (PVC) Building Products.
 - o. ASTM D 4258, Practice for Surface Cleaning Concrete for Coating.
 - p. ASTM D 4259, Practice for Abrading Concrete.
 - q. ASTM D 4262, Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.

- r. ASTM D 4263, Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
 - s. ASTM D 4541, Test Method for Pull-Off Strength of Coatings Using Portable Abrasion-Testers.
 - t. ASTM E 84, Test Method for Surface Burning Characteristics of Building Materials.
 - u. ASTM E 329, Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
2. Military Specifications, (MIL).
- a. MIL-D-3134, Deck Covering Materials.

1.03 QUALITY ASSURANCE

- A. Installer's Qualifications:
- 1. Engage a single installer, certified or licensed by the flooring materials manufacturer, regularly performing concrete toppings installation, and with documented skill and successful experience in the installation of the types of materials required; and who agrees to employ only tradesmen who are trained, skilled and have successful experience in installing the types of materials specified.
 - 2. Submit name and qualifications to ENGINEER along with the following information on a minimum of three successful projects:
 - a. Names and telephone numbers of owners, architects or engineers responsible for projects.
 - b. Approximate contract cost of the concrete toppings.
 - c. Amount of area installed.
 - 3. Submit proof of acceptability of installer by manufacturer to ENGINEER.
- B. Testing Agency Qualifications: The independent testing agency shall demonstrate to ENGINEER'S satisfaction, based on evaluation of criteria submitted by testing agency, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work in accordance with ASTM E 329.
- C. Source Quality Control:
- 1. Engage a single concrete toppings manufacturer who shall furnish the services of a technical representative who shall assist CONTRACTOR, ENGINEER and OWNER by providing technical opinions on the adequacy of materials and methods of installation and field quality control testing.

2. Furnish such services during the time of delivery, storage, mock-up construction, installation and field quality control testing of all concrete topping components.
3. Engage a manufacturer who will provide complete technical services including preparation and review of Shop Drawings, installation methods and proposed detailing. Where the manufacturer requires additions, or changes to the Contract Documents these shall be at no additional cost to the OWNER and only as acceptable to ENGINEER.
4. Provide all components of each concrete topping system produced by a single manufacturer, including recommended primers (if any), basecoat, aggregate, and topcoat materials.
5. Certify product shelf-life history for each product.
6. Constantly, store material to be used in the Work between 60°F and 75°F, and in accordance with the manufacturer's approved written recommendations, for not more than six months. Certify to ENGINEER that concrete topping materials have been manufactured within six months of installation and have not, nor will be, subjected to freezing temperatures.

D. Mock-Ups:

1. Prior to the installation of each concrete topping system, but after ENGINEER'S approval of Samples and Shop Drawings, install stepped-back mock-ups using substrate preparation, materials and application techniques specified for final Work. Provide all components of the concrete topping systems showing the correct installation, substrate preparation and the workmanship quality that shall be achieved in the Work.
2. Build mock-ups at the Site, in location approved by ENGINEER, of full thickness and approximately 12 feet square, minimum. Include methods of installation typical to the Work including penetrations, crack and joint sealer system and cove details using all system components required for the Work.
3. Obtain ENGINEER'S acceptance of visual qualities, color, tolerances and slip-resistance of the mock-ups before start of concrete topping Work. Retain and protect mock-ups during construction as a standard for judging completed concrete topping Work. Do not alter mock-up after acceptance by ENGINEER.
4. Build as many mock-ups as necessary to achieve ENGINEER'S acceptance of the concrete topping systems.
5. Concrete topping Work that proceeds without an acceptable mock-up shall be stopped, and a mock-up prepared for acceptance.

6. Concrete toppings that do not meet the standard acceptance on the acceptable sample areas shall be removed and replaced with new material.

E. Pre-Installation Conference:

1. Before erecting sample mock-up, CONTRACTOR, installer, and technical representative of each concrete topping system manufacturer shall meet on-Site with ENGINEER to discuss approved products and workmanship to ensure proper application of concrete topping system components and substrate preparation requirements.
2. Review foreseeable methods and procedures related to the concrete topping Work, including, but not necessarily limited to, the following:
 - a. Review Project requirements and the Contract Documents.
 - b. Review required submittals, both completed and yet to be completed.
 - c. Review status of substrate work, including acceptance of surface preparations, drying, structural loading limitations and similar considerations.
 - d. Review requirements of field quality control testing and requirements for preparing Site Quality Control Report, as specified herein.
 - e. Review availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
 - f. Review required inspection, testing and certifying.
 - g. Review environmental conditions, other Project conditions, and procedures for coping with unfavorable conditions.
 - h. Review regulations concerning code compliance, environmental protection, health, safety, fire and similar considerations.
 - i. Review procedures needed for protection of concrete toppings during the remainder of the construction period.
3. Record the discussions of the Pre-Installation Conference and the decisions and agreements or disagreements reached, and furnish a copy of the record to each party attending. Record any revisions or changes agreed upon, reasons therefore, and parties agreeing or disagreeing with them.
4. Reconvene the conference at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

- a. Drawings showing the extent where concrete toppings occur in each space. Show Interface details with other items occurring in the spaces such as thresholds, floor drains, floor hatches, coves, equipment pads, steps and stair nosings, trench drains and horizontal pipe chases.
- b. Furnish drawings coordinated with cast-in-place concrete and showing all construction and other conditions encountered in the Work and manufacturer's approved and recommended details appropriate to construction, expansion and seismic joints as required for full concrete topping systems performance, whether or not specific indication is shown to the details of the specified manufacturer. Show recommended locations of all control and expansion joints in concrete topping Work.

2. Product Data:

- a. Copies of specifications, technical information, test results, installation instructions and general recommendations from the concrete toppings manufacturer, for each type of concrete toppings product required. Include requirements for environmental conditions, and other conditions required for an acceptable installation providing features and performance as stated in manufacturer's literature.

3. Samples:

- a. Stepped-back concrete topping systems applied to a 12-inch by 12-inch by 2-inch-thick concrete sample exposing each system component and demonstrating required surface preparation to be used on sample mock-ups and required thicknesses of concrete toppings. Apply concrete toppings to only one-half of the sample board, leaving the other half visible and with required substrate preparation.
- b. Full selection of manufacturer's standard and custom colors for selection by ENGINEER. ENGINEER will preliminarily select a maximum of three colors for consideration for use in the Work. Prepare 12-inch by 12-inch Samples of each color. From these ENGINEER will select a maximum of one color to be used in the Work. ENGINEER will provide CONTRACTOR with locations of each color after this final selection.
- c. In addition to color, provide range of textures from smooth to heavily non-slip for selection for use on sample mock-up panel.

- d. Samples will be reviewed by ENGINEER for color selection, general appearance and as examples of the types of components to be installed on the mock-ups. Compliance with other requirements is the responsibility of CONTRACTOR.
- B. Informational Submittals: Submit the following:
- 1. Certifications:
 - a. Certificates stating that materials meet or exceed this Section's requirements and stating that materials have been provided as specified to meet performance criteria and installation requirements specified.
 - b. Evidence of shelf-life history for all products, verifying compliance with requirements specified.
 - c. Evidence of acceptance of the substrate and primers by the concrete topping materials manufacturer's technical representative.
 - d. CONTRACTOR'S Review: Accompanying request, submit to ENGINEER a written statement signed by CONTRACTOR, stating that the Contract Documents have been reviewed with the concrete topping materials manufacturer who confirms that the selected systems are proper, compatible and that the details proposed for use in the Work are not in conflict with the manufacturer's details.
 - e. Statement of Application: Upon completion of the concrete topping Work, submit a notarized statement to ENGINEER signed by CONTRACTOR stating that the Work complies with the requirements of these Specifications, was installed in compliance with manufacturer's written recommendations, and that the installation methods were proper and adequate for the conditions of installation and use. Include evidence of acceptance of substrate by installer and manufacturer.
 - 2. Test Reports:
 - a. Copies of test reports verifying compliance with physical properties specified.
 - b. Final Site Quality Control Report: Provide ENGINEER with testing results in each area of the Work, and CONTRACTOR'S recommended remedial measures, weather, humidity and dew point conditions during the time of installation and curing of the Work, and other requirements as specified for final approval. Final payment for the concrete topping Work is contingent upon ENGINEER'S acceptance of final Site Quality Control Report, including recommendations for and completion of all remedial Work.
 - 3. Qualifications Data:

- a. Installer's.
 - b. Testing laboratory.
 - c. Manufacturers of "or equal" products shall provide direct property comparison with the material specified in addition to complying with all other requirements of these Specifications. "Or equal" products shall employ the same generic materials and system components as the product specified.
- C. Closeout Submittals: Submit the following:
 - 1. Maintenance Manual: Submit five copies of a detailed maintenance manual for each product, including the following information:
 - a. Product name and number.
 - b. Name, address, e-mail address and telephone number of manufacturer and local distributor.
 - c. Detailed procedures for routine maintenance and cleaning.
 - d. Detailed procedures for light repairs such as dents, scratches and staining.
 - e. Manufacturers' installation procedures and recommendations.
 - 2. Warranty Documentation: Submit CONTRACTOR'S and manufacturer's written warranties.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading:
 - 1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices, which are to be embedded in concrete in ample time to prevent delay of that Work.
 - 2. Deliver materials in concrete topping manufacturer's original unopened and undamaged containers, with information accurately representing container contents, as accepted by ENGINEER.
 - 3. Include the following information on the label:
 - a. Name of material, manufacturer and supplier.
 - b. Brand name, contents, color stock number, and order number.
 - c. Installation, handling and protection requirements.
 - 4. Deliver materials in sufficient quantities to allow uninterrupted continuity of the Work.
 - 5. Packages showing indications of damage that may affect condition of contents are not acceptable.

6. Do not handle, open or mix component materials, unless concrete toppings can be properly handled as recommended by the manufacturer of the concrete toppings.
 7. Do not open containers or expose materials to detrimental conditions. Remove materials so exposed from the Site.
 8. Handle materials in a manner that prevents contamination and inclusion of foreign materials.
 9. Do not open packages or containers until all necessary preparatory Work is complete, approved and installation will begin immediately.
 10. Handle all materials in strict compliance with manufacturer's recommended safety precautions.
- B. Storage and Protection:
1. Store materials to permit easy access for inspection and identification.
 2. Store only accepted materials on Site.
 3. Store materials in original, undamaged containers with manufacturer's labels and seals intact.
 4. Store all materials in a dry, enclosed area, off the ground and away from all possible contact with water and in a location where temperature can be constantly maintained between 60°F and 75°F and out of direct sunlight and away from open flame, sparks or other hazards.
 5. Prevent damage to materials during storage primarily by minimizing the amount of time they are stored at the Site before being incorporated into construction systems.
- C. Acceptance at Site:
1. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. CONTRACTOR shall notify ENGINEER, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions:
1. Remove all chemicals, compounds and other materials, where such materials are unacceptable to manufacturers of concrete topping systems, from substrates to receive the concrete topping specified at no additional cost to the OWNER, even if chemicals, compounds and other materials are permitted by other Sections of these Specifications.

2. Proceed with concrete topping Work only when temperature and moisture content of concrete slabs, building air temperature, relative humidity, dew point and other conditions comply with the concrete topping manufacturer's written recommendations and when no damaging environmental conditions are forecasted for the time when the materials will be subject to such environmental damage. Record all such conditions and include in final Site Quality Control Report.
 3. Maintain substrate temperature and room temperature before, during and after installation above 60°F and rising in accordance with concrete topping material manufacturer's instructions.
 4. Do not begin concrete topping Work until buildings are enclosed and manufacturer's recommended environmental conditions can be maintained, and only when manufacturer and installer are willing to guarantee the Work as required, and without additional reservations and restrictions.
 5. Supplemental Heat:
 - a. Provide supplemental heat and protection as required to maintain concrete toppings at minimum of 60°F during and after installation.
 - b. Supplemental heat and power sources, as may be required should ambient temperature fall below 60°F, are not available at the Site. The provision of all supplemental heat, including fuel, equipment, operating and maintenance personnel and power sources, is the responsibility of CONTRACTOR.
 - c. Distribute heat uniformly and provide deflection or protective screens as required to prevent concentration of heat on concrete toppings near heat source.
 - d. Source of supplemental heat shall not emit contaminants that will adversely affect the color, cure or performance of the concrete toppings. Concrete topping systems so affected shall be removed and replaced with new.
- B. Protection and Precautions:
1. Protect materials against damage by construction activities.
 2. Protect all concrete topping materials and system components from all contact with non-associated construction traffic.
 3. Do not install concrete toppings when adequate protection of the Work is not, or cannot, be made available.
 4. Comply with manufacturers' written safety precautions for storage, handling, mixing and installation of each component, and with the requirements of governing authorities having jurisdiction at the Site.

5. Environmentally isolate and enclose the Work area so that adjacent work, and personnel adjacent to the Work area, will be unaffected by the Work of this Section.
 6. Provide adequate ventilation, not only during installation but also after installation until the system has totally cured, with exhaust air adequately diluted and discharged to a safe location. Avoid build-up of hazardous vapors or the creation of hazardous conditions or conditions that may retard the cure of the system.
- C. Sequencing and Scheduling:
1. Proceed with the concrete toppings Work only after projections and penetrations through the substrates have been installed, and when the substrate construction and framing of openings is complete.
 2. Coordinate and schedule shot blasting, grinding and filling of cast-in-place concrete with underlayments, in order to bring substrate within tolerances specified.
 3. Provide concrete toppings on top of equipment pads, within horizontal pipe chases and similar locations where installation of equipment, piping and similar items would cause concrete topping installation difficulties, before such equipment, piping and similar items have been installed. In order to advance the Work, be prepared to schedule multiple visits of concrete topping installer to the Site for the purpose of installing concrete topping in areas that will become inaccessible with the installation of equipment or piping, as may be required for proper sequencing of the Work.
 4. Sequence the Work so that other installers do not interfere with, or need to cross, the concrete topping installation areas until such time as the concrete toppings can be adequately protected from potential damage.
- D. Substitutions:
1. Do not change products, system components, colors or manufacturers after Shop Drawings and Samples have been accepted by ENGINEER.
 2. Clearly identify, in a manner which is highlighted to ENGINEER, all proposed substitutions, modifications, variations, unspecified features and "or equal" products. Provide complete comparative data with specified products at time of Shop Drawing submission.

1.07 WARRANTY

- A. General: The special warranties specified in this Article shall not deprive OWNER of other rights or remedies OWNER may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by CONTRACTOR under the Contract Documents.

B. Special Warranties:

1. Provide written warranty, signed by CONTRACTOR and running to benefit of OWNER, agreeing to remove and replace, for a period of three-years from the date of Substantial Completion, concrete topping materials that show defects in installation and workmanship or defects in material such as cracking, flaking, eroding in excess of specified requirements, peeling, delamination, abnormal aging or loss of color.
2. Repairs and replacements required because of acts of God, occupant damages, improper maintenance, fire or exposure to environmental conditions other than those for which the concrete toppings materials were tested and recommended by the manufacturer, and other events beyond CONTRACTOR'S, installer's or manufacturer's control (and that exceed limits of specified performance requirements) are excluded from this warranty.

PART 2 - PRODUCTS

2.01 SYSTEM PERFORMANCE

A. Performance Criteria:

1. General:
 - a. Standards: Comply with applicable standards, recommendations and specified publications of ASTM, except to the extent more stringent requirements are specified or required by governing authorities having jurisdiction at the Site.
2. Heavy-Duty Concrete Floor Topping Physical Properties: The completed system when thoroughly cured shall have the following physical properties:
 - a. Tensile Strength, ASTM C 307: 2,200 pounds per square inch, minimum.
 - b. Flexural Strength, ASTM, C 580: 5,000 pounds per square inch.
 - c. Impact Resistance, ASTM D 4226: 160 inch-pounds.
 - d. Bond Strength, ASTM D 4541: 400 pounds per square inch, minimum.
 - e. Flammability, ASTM D 635: Self-extinguishing.
 - f. Coefficient of Friction, ASTM D 2047: 0.75.
 - g. Resistance to Elevated Temperature, MIL-D-3134: No Slip or flow.

- h. Thermal Coefficient of Linear Expansion, ASTM C 531: 2×10^{-5} inches per inch per degree C, maximum; temperature range, -12°F to 140°F.
- i. Abrasive Resistance, ASTM D 4060: 0.08 grams, maximum weight loss.
- j. Flexural Strength Modulus of Elasticity, ASTM C 580: 1.7×10^6 pounds per square inch.
- k. Compressive Strength, ASTM C 579: 11,500 pounds per square inch minimum.
- l. Surface Hardness - Shore D Durometer, ASTM D 2240: 87 to 90.
- m. Water Absorption, ASTM C 413: 0.2 percent.
- n. Heat Resistance Limitation: 200°F, continuous exposure.
- o. Chemical Resistance, ASTM C 267:

REAGENT	FILM INTEGRITY
Ten percent Nitric Acid	Unaffected
Ten percent Phosphoric Acid	Unaffected
Ten percent Hydrochloric Acid	Unaffected
Ten percent Sulfuric Acid	Unaffected
Ten percent Sodium Hydroxide	Unaffected
Ten percent Potassium Hydroxide	Unaffected
Gasoline	Unaffected

2.02 MANUFACTURERS

- A. For Heavy-Duty Concrete Floor Topping:
 - 1. Products and Manufacturers: Provide one of the following:
 - a. STONCLAD HT with Clear STONKOTE HT4 Topcoat by Stonhard, Incorporated, Part of the StonCor Group.
 - b. Or equal.

2.03 MATERIALS

- A. Heavy-Duty Concrete Floor Topping: Provide the following trowel-applied epoxy mortar composition flooring system recommended by the manufacturer for resisting heavy-duty trucking and heavy traffic.

1. Acid Etch: Provide manufacturer's recommended ten percent muriatic acid etching compound in addition to shot blast scarification, grinding and other required surface preparations.
 2. Primer: Two-component, penetrating, moisture-tolerant epoxy.
 3. Binder: Type I Portland cement, ASTM C 150, with additives.
 4. Mortar: Three-component mortar consisting of epoxy resin, curing agent and selected, graded aggregates blended with inorganic pigments.
 5. Topcoat: Two-component, 100 percent solids, chemical resistant epoxy.
 6. Termination Strips, Accent Strips and Control Joints: White metal, neoprene filled type as recommended by the manufacturer.
 7. Colors: To be selected by ENGINEER from manufacturer's full selection of standard and custom colors.
 8. Textures: Non-slip surface.
- C. Auxiliary System Components:
1. Underlayment Grout: Heavy-duty, three-component, fast-setting, high temperature resistant, 100 percent solids epoxy grout for filling and leveling deep holes, erosions, modifying pitch in trench drains and similar uses in the Work, and recommended by the concrete topping manufacturer for compatibility with concrete toppings specified.
 2. Epoxy Grout Primer: Compatible primer as recommended by the concrete topping manufacturer.
 3. Epoxy Sealants: Two-component, self-leveling and non-sag, chemical resistant, flexible epoxy/polyamide sealants.
 4. Waterproof Membrane: 100 percent solids, liquid-applied membrane providing a positive barrier against water penetration.
 5. Protective Joint Sealer: Two-component, traffic bearing, fluoro-elastomeric joint sealer, recommended by the concrete toppings manufacturer for sealing and protecting floor sealant joints.
 6. Heavy-Duty Industrial Detergent: Concentrated, biodegradable, industrial cleaner and degreaser.

PART 3 - EXECUTION

3.01 INSPECTION

- A. CONTRACTOR shall examine the surfaces to receive concrete toppings, and the conditions under which the concrete toppings are to be installed, and notify ENGINEER, in writing, of conditions detrimental to the proper and timely completion of the Work and the performance of the concrete topping systems.

Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

- B. Subfloor shall have a wood float finish. Concrete shall have cured for 28 days prior to initiation of this Work and shall contain maximum 14 percent moisture.
- C. Do not proceed with concrete topping installation until manufacturer's technical representative approves condition of subfloor for warranted construction. Correct all unsatisfactory conditions, as required by manufacturer's technical representative, at no additional cost to the OWNER. Record all such requirements and remedial actions as part of the final Site Quality Control Report.

3.02 PREPARATION

- A. Test concrete to ensure moisture and alkalinity content are within allowable range recommended by concrete topping manufacturer.
 - 1. Perform tests in compliance with ASTM D 4262 and ASTM D 4263, report findings to ENGINEER and include results in Site Quality Control Report. Provide suitable testing materials in order to carry out alkalinity and moisture tests.
 - 2. Adjust subfloor pH to be within range acceptable to the concrete topping manufacturer before installation of concrete toppings primer.
 - 3. If concrete is not within moisture range, CONTRACTOR may institute accelerated drying procedures or provide appropriate underlayment or waterproof membranes.
- B. Shot Blast Scarification and Acid Etching:
 - 1. Fill or grind concrete substrate as may be required to achieve a smooth uniform, level finished appearance on finished Work in compliance with allowable tolerances specified.
 - 2. All areas to receive the Work of this Section shall be given a heavily scarified shot blast finish in compliance with ASTM D 4258 and ASTM D 4259 to ensure maximum topping adhesion, followed by concrete topping manufacturer's recommended acid etching and neutralizing treatment. After acid neutralization, flush all surfaces with clean water and allow to dry completely.
 - 3. Additional substrate preparation shall be required if a 40 to 60-grit uniform texture is not achieved and substrate laitance is not completely removed to expose pea gravel.
- C. Provide cast-in-place concrete substrates free from voids and sharp projections before placing any concrete topping system.
 - 1. Remove surface irregularities on cast-in-place concrete and fill all holes, honeycombs, spalls and cracks using manufacturer's recommended epoxy grout underlayment, flexible membrane, fiberglass woven roving

and epoxy grout primer as indicated on manufacturer's details shown on approved Shop Drawings.

2. The prepared substrate shall have a minimum tensile strength of 250 pounds per square inch when tested in compliance with ASTM D 4541. Repair areas of unacceptable consolidation.
- D. Slope or fill concrete substrate using epoxy grout underlayment and epoxy grout primer as may be required to achieve a uniform, smooth slope-to-drain finished appearance.
- E. Prior to start of applying concrete toppings, dry or wet vacuum surfaces to be covered and inspect the substrate. Remove all dust, loose stones and debris. Concrete shall be thoroughly dry before application of primer.
- F. Primer: Apply primer as recommended by concrete topping manufacturer, prior to application of the basecoat. Apply in accordance with manufacturer's instructions as accepted by ENGINEER at time of Shop Drawing submission.
- G. As part of final Site Quality Control Report, include confirmation that the substrate was prepared as specified and was acceptable to install the Work conforming to the requirements of this Section.

3.03 INSTALLATION

- A. Do not power trowel concrete toppings, unless manufacturer provides written certification, accepted by ENGINEER, that material shall experience no loss in compressive strength or tensile strength.
- B. Apply termination and expansion joint strips at the junction of the flooring with other materials and at expansion joints as recommended by the manufacturer. Locate accent strips as shown.
- C. Mix materials and apply bonding coat in accordance with manufacturer's instructions.
- D. Apply epoxy mortar floor topping body coat to not less than 1/8-inch dry cured minimum thickness, or as specifically recommended by the manufacturer to achieve the physical properties and dimensional tolerances specified.
- E. Apply topcoat-sealers for maximum chemical resistance and cleanability as recommended by the manufacturers. Apply a final topcoat to match texture of the accepted sample mock-up. Apply following manufacturer's approved written instructions.

3.04 FIELD QUALITY CONTROL

- A. General: Before start of installation of concrete toppings, perform the following field quality control tests and include procedures and results in final Site Quality Control Report. Incorporate installation or system improvements, as may be recommended based on test results, into the remainder of the Work.

- B. At the end of the quality control test periods and before installation commences, installer, CONTRACTOR, technical representative and ENGINEER shall make final inspections of concrete topping systems and CONTRACTOR shall prepare a written report to ENGINEER describing all methods, observations, results and deterioration or damage found in the Work with recommendations for correcting such damage.
 - 1. Include photographic records of all test areas before, during and after the tests and photos of all damage and physical changes in the concrete toppings. The report shall contain all comments made by all parties, test results, and manufacturer's performance claims as accepted by ENGINEER at time of Shop Drawing submittal as compared to the actual results of the field-testing. Make changes to report as required by ENGINEER. Include quality control test report as part of final Site Quality Control Report.
- C. Allowable Installation Tolerances:
 - 1. Do not install the Work until substrate preparation and tolerances have been accepted by ENGINEER, concrete topping manufacturer's technical representative and the concrete topping installer and CONTRACTOR has verified to ENGINEER that substrates are within tolerances and profiles specified and acceptable to produce acceptable Work. Work advanced, for any reason, without such verification shall be stopped, and concrete toppings removed and replaced with new material if substrates are determined to be unacceptable for the Work.
 - 2. Substrate Tolerances:
 - a. Out-of-Plane: 1/8-inch maximum in ten feet and 1/16-inch maximum in any 12-inches measured along the plane.
 - b. Maximum Offset in Plane Alignment: 1/16-inch.
 - c. Variation from Slope: 1/8-inch maximum in ten feet.
 - 3. Concrete Floor Toppings Tolerances:
 - a. Finished concrete toppings level to 1/8-inch in ten feet with smooth continuous uniformly sloped-to-drain planes.
 - b. Provide smooth continuous color with no color streaks or inconsistencies with smoothly textured non-slip finish.

3.05 PROTECTION, ADJUSTMENT AND CLEANING

- A. Upon completion of the Work, installer shall advise CONTRACTOR of recommended procedures for its surveillance and protection of the concrete topping Work during the remainder of the construction period.
- B. Do not allow construction traffic that is not associated with the installation of the concrete toppings and related materials in the area of Work. Concrete toppings

shall be kept free of all traffic for a minimum of seven days after completion of topcoating. Protect installed concrete toppings from damage, by use of heavy Kraft paper and other covering placed after topcoat is tack-free.

- C. Concrete topping damaged in any manner shall be replaced.
- D. Only the original installer shall replace deteriorated or defective Work found at the time of final inspection. Only the original installer shall be engaged by CONTRACTOR to repair damages to the concrete toppings that occur subsequent to concrete topping installation and prior to final inspection.
- E. After the Work has been completed in the areas of concrete toppings, and before Substantial Completion, clean all floors and other surfaces containing concrete toppings, using methods recommended by the concrete topping manufacturer.
- F. The concrete toppings at the time of Substantial Completion shall be clean and without damage, and shall not be soiled in any way. Vacuum and wet mop areas that become soiled after initial cleaning, up to the time of Substantial Completion.

END OF SECTION

SECTION 09910

PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and apply paint systems.
 - a. CONTRACTOR is responsible for surface preparation and painting of all new and existing interior and exterior items and surfaces throughout the Project areas included under this and other Sections.
2. Extent of painting includes the Work specified below. Painting shown in schedules may not provide CONTRACTOR with complete indication of all painting Work. Refer to Article 2.2 of this Section where all surfaces of generic types specified are specified for preparation and painting according to their status, intended function, and location, using the painting system for that surface, function, and location as specified, unless specifically identified on the Drawings as a surface not to receive specified painting system.
 - a. All new and specifically identified existing surfaces and items except where the natural finish of the material is specified as a corrosion-resistant material not requiring paint; or is specifically indicated in the Contract Documents as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint them the same as adjacent similar materials or areas.
 - b. Mechanical and process items to be painted include:
 - 1) Piping, pipe insulation, pipe hangers, and supports, including electrical conduit.
 - 2) Heat exchangers.
 - 3) Tanks.
 - 4) Ductwork and insulation.
 - 5) Motors, mechanical equipment, and supports.
 - 6) Accessory items.
 - c. Surface preparation and painting of all new and specifically identified existing items, both interior and exterior, and other

surfaces, including items furnished by OWNER, are included in the Work, except as otherwise shown or specified.

- d. Removal of all substances, top coats, primers and all intermediate coats of paint and other protective or decorative coatings on those items and surfaces to remain that are identified to receive a painting system under this Section, to provide surfaces acceptable for application of painting specified.
- e. Approved stepped-down mock-ups for all painting systems showing all components of the surface preparation and paint system application before start of Work. Check all dry film thicknesses; demonstrate methods of surface preparation, and methods of application, and obtain ENGINEER's approval of colors and textures to be used in the Work.

B. Coordination:

- 1. Review installation, removal, and demolition procedures under other Sections and coordinate them with the Work specified in this Section.
- 2. Coordinate painting of areas that will become inaccessible once equipment, laboratory furniture, lockers and similar fixed items have been installed.
- 3. Coordinate primers with finish paint materials to provide primers that are compatible with finish paint materials. Review other Sections and other contracts where primed surfaces are provided, to ensure compatibility of total painting system for each surface. CONTRACTOR is responsible for coordinating compatibility of all shop primed and field painted items in other Sections and in general contract and other contracts.
- 4. Furnish information to ENGINEER on characteristics of finish materials proposed for use and ensure compatibility with prime coats used. Provide barrier coats over incompatible primers or remove and repaint as required. Notify ENGINEER in writing of anticipated problems using specified painting systems with surfaces primed by others. Reprime equipment primed in factory and other factory-primed items that are damaged or scratched.

C. Related Sections:

- 1. Section 07920, Joint Sealants.

D. Work Not Included: The following Work is not included as painting Work, or are included under other Sections or in other contracts:

- 1. Shop Priming: Shop priming of structural metal, miscellaneous metal fabrications, other metal items and fabricated components such as shop-fabricated or factory-painted process equipment, plumbing equipment, heating and ventilating equipment, electrical equipment, and accessories

shall conform to applicable requirements of this Section but are included under other Sections.

2. Pre-finished Items:
 - a. Items furnished with such finishes as baked-on enamel, porcelain, and polyvinylidene fluoride shall only be touched up at Site by CONTRACTOR using manufacturer's recommended compatible field-applied touchup paint.
 - b. Items furnished with finishes such as chrome plating or anodizing.
3. Concealed Surfaces: Non-metallic wall or ceiling surfaces in areas not exposed to view, and generally inaccessible areas, such as furred spaces, pipe chases, duct shafts, and elevator shafts.
4. Concrete surfaces below the finished floor elevation of Electrical Building #2, unless otherwise shown or specified.
5. Concrete floors, unless specifically shown as a surface to be painted.
6. Face brick, glazed structural tile, and prefaced, ground-faced or split-faced concrete unit masonry.
7. Exterior face of architectural precast concrete.
8. Collector bearings, shafts and chains, wood flights, wood stop logs, and wood or fiberglass baffles.
9. Corrosion-Resistant Metal Surfaces: Where the natural oxide of item forms a barrier to corrosion, whether factory- or Site-formed, including such materials as copper, bronze, muntz metal, terne metal, and stainless steel.
10. Operating Parts and Labels:
 - a. Do not paint moving parts of operating units, mechanical and electrical parts such as valve and damper operators, linkages, sensing devices, interior of motors, and fan shafts.
 - b. Do not paint over labels required by governing authorities having jurisdiction at Site, or equipment identification, performance rating, nameplates, and nomenclature plates.
 - c. Cover moving parts and labels during the painting with protective masking. Remove all protective masking upon completion of Work. Remove all paint, coatings, and splatter that comes in contact with such labels.
11. Structural and miscellaneous metals covered with concrete need not receive primers, intermediate, or finish coats of paint.

12. Existing structures, equipment, and other existing surfaces and items unless otherwise shown or specified.

E. Description of Colors and Finishes:

1. Color Selection:

- a. A maximum of ten different colors will be selected by ENGINEER in addition to color coding of pipelines, valves, equipment, ducts, and electrical conduit.
- b. ENGINEER reserves the right to select non-standard colors for paint systems specified within ability of paint manufacturer to produce such non-standard colors. Provide such colors at no additional expense to OWNER.

2. Color Coding of Pipelines, Valves, Equipment, and Ducts:

- a. In general, color-coding of pipelines, valves, equipment and ducts shall comply with applicable standards of ANSI A13.1, ANSI Z535.1 and 40 CFR 1910.144. Provide color-coding for pipelines per Table 09 91 00-B, Pipeline Color Table.
- b. For equipment on roofs or exposed to view, such as on exterior building facades and in offices and lobbies, color shall be selected by ENGINEER.

3. Color Coding of Pipelines and Equipment:

- a. Finish coats of paint for pipelines and equipment shall be coded in basic colors. Colors shall be brilliant, distinctive shades matching the following safety and pipeline colors per ANSI Z535.1, Recommended Standards for Water Works; Recommended Standards for Wastewater Facilities, color specifications for safety colors and other primary colors, and colors that match existing color coding being used on the site.

4. After approval by ENGINEER of colors and Shop Drawings and prior to commencing painting Work, ENGINEER will furnish color schedules for surfaces to be painted.

F. Abbreviations and Symbols:

1. Abbreviations and symbols used in painting systems are explained in Article 2.2 of this Section and provide information on generic composition of required materials, manufacturers, number of coats and dry mil film thickness per coat (DMFTPC), and coverage for determining required number of gallons for the Work.

1.02 REFERENCES

A. Referenced Standards: Standards referenced in this Section are:

1. ANSI A13.1, Scheme for Identification of Piping Systems.

2. ANSI Z535.1, Safety Color Code.
3. ANSI/NSF Standard 60, Drinking Water Treatment Chemicals - Health Effects.
4. ANSI/NSF Standard 61, Drinking Water System Components – Health Effects.
5. ASTM D16, Terminology for Paint, Related Coatings, Materials and Applications.
6. ASTM D2200, Pictorial Surface Preparation Standards for Painting Steel Surfaces.
7. ASTM D4258, Practice for Surface Cleaning Concrete for Coating.
8. ASTM D4259, Practice for Abrading Concrete.
9. ASTM D4262, Testing Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
10. ASTM D4263, Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
11. ASTM D4285, Test Method for Indicating Oil or Water in Compressed Air.
12. ASTM D4417, Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.
13. ASTM D4541, Test Methods for Pull-Off Strength of Coatings Using Portable Adhesion-Testers.
14. ASTM E329, Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
15. AWWA C652, Disinfection of Water-Storage Facilities.
16. AWWA D102, Coating Steel Water-Storage Tanks.
17. Green Seal, Inc. Paint, (GS-11).
18. Great Lakes Upper Mississippi River Board of Public Health and Environmental Managers (GLUMRB) Recommended Standards for Water Works.
19. GLUMRB, Recommended Standards for Wastewater Facilities.
20. National Association of Piping Fabricators, NAPF 500-03, Surface Preparation Standard For Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings And/or Special Internal Linings.

21. Ozone Transport Commission, (OTC), OTC Model Rule for Architectural and Industrial Maintenance Coatings.
22. SSPC PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
23. SSPC SP 1, Solvent Cleaning.
24. SSPC SP 3, Power Tool Cleaning.
25. SSPC SP 6, Commercial Blast Cleaning.
26. SSPC SP 10, Near-White Blast Cleaning.
27. SSPC SP 11, Power Tool Cleaning To Bare Metal.
28. SSPC VIS 1, Visual Standard for Abrasive Blast Cleaned Steel.
29. SSPC VIS 2, Method of Evaluating Degree of Rusting/Painted Steel Surfaces.
30. SSPC Volume 2, Systems and Specifications.

1.03 DEFINITIONS

- A. Standard coating terms defined in ASTM D16 apply to this Section, including:
 1. Paint: Pretreatment and all painting system materials, such as primer, emulsion, enamel, organic/inorganic polymer coating, stain sealer and filler, and other applied materials whether used as prime, filler, intermediate, or finish coats.
 2. Exposed: All items not covered with cement plaster, concrete, or fireproofing. Items covered with these materials shall be provided with specified primer only, except where specified as a surface not to be painted. Exposed-to-view surfaces include areas visible after permanent or built-in fixtures, convactor covers, ceiling tile, covers for finned tube radiation, grilles, and similar covering products are in areas scheduled to be painted.
 3. Low VOC: All interior and exterior field-applied coatings that have maximum VOC content as listed in OTC Model Rule for Architectural and Industrial Maintenance Coatings.
 4. OTC: Ozone Transport Commission, which recommends standard VOC content levels in several Northeastern and Mid-Atlantic states.

1.04 QUALITY ASSURANCE

- A. Applicator Qualifications:

1. Engage a single applicator that regularly performs installation of paint materials, with documented skill and successful experience in installing types of products required and that agrees to employ only trained, skilled tradesmen who have successful experience in installing types of products specified.
 2. Submit name and qualifications to ENGINEER along with following information for at least three successful, completed projects:
 - a. Names and telephone numbers of owner and design professional responsible for project.
 - b. Approximate contract cost of paint products.
 - c. Amount of area painted.
 3. Submit to ENGINEER proof of acceptability of applicator by manufacturer.
- B. Testing Agency Qualifications: Provide an independent testing agency for testing specified in this Section. Testing agency shall be selected by OWNER and paid for by CONTRACTOR. When requested, submit documentation demonstrating to satisfaction of ENGINEER, that testing agency has experience and capability to satisfactorily conduct testing required without delaying the Work, in accordance with ASTM E329.
- C. Source Quality Control:
1. Obtain materials from manufacturers that will provide services of a qualified manufacturer's representative at Site at commencement of painting Work, to advise on products, mock-ups, installation, and finishing techniques and, at completion of Work, to advise ENGINEER on acceptability of completed Work and during the course of the Work as may be requested by ENGINEER.
 2. Certify long-term compatibility of all coatings with surfaces.
 3. Do not submit products that decrease number of coats, surface preparation, or generic type and formulation of coatings specified. Products exceeding VOC limits and chemical content specified will not be approved.
 4. ENGINEER may review manufacturers' recommendations concerning methods of installation and number of coats of paint for each painting system. CONTRACTOR shall prepare construction costs based on painting systems, number of coats, coverage's and installation methods specified.
 5. Submit "or equal" products, when proposed, with direct comparison to products specified, including information on durability, adhesion, color and gloss retention, percent solids, VOC's grams per liter, and the ability to recoat after curing.

6. "Or equal" manufacturers shall furnish same color selection as manufacturers specified, including intense chroma and custom pigmented colors in all painting systems.
7. Color Pigments: Provide pure, non-fading, applicable types to suit surfaces and services to be painted.
8. Obtain each product from one manufacturer. Multiple manufacturing sources for the same system component are unacceptable.
9. Certify product shelf-life history for each product source for materials manufactured by the same manufacturer, but purchased and stored at different locations or obtained from different sources.
10. Constantly store materials to be used for painting Work between 60 degrees F and 90 degrees F, and per paint manufacturer's written recommendations, for not more than six months. Certify to ENGINEER that painting materials have been manufactured within six months of installation and have not, nor will be, subjected to freezing temperatures.

D. Regulatory Requirements:

1. Comply with VOC content limits of OTC Model Rule for Architectural and Industrial Maintenance Coatings:
 - a. Industrial Maintenance Coatings: 340 grams per liter.
 - b. Interior and Exterior Non-Flat Coatings: 250 grams per liter.
2. Comply with the following:
 - a. 29 CFR 1910.144, Safety Color Code for Marking Physical Hazards.
 - b. 40 CFR, Subpart D-2001, National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - c. Resource Conservation and Recovery Act of 1976 (RCRA).
 - d. SW-846, Toxic Characteristic Leaching Procedure (TCLP).
3. Comply with authorities having jurisdiction at Site for blast cleaning, confined space entry, and disposition of spent abrasive and debris.

E. Stepped-down Mock-ups:

1. Demonstrate installation of specified painting systems on actual wall surfaces and building components at locations selected by ENGINEER.
2. Provide 4-foot by 8-foot stepped-down sample area for each painting system. Prior to application of painting system, but after ENGINEER's approval of the components of each painting system, apply a 4-foot-wide

sample of each operation and application step required by this Section and specified manufacturer's written application recommendations. Show each application step as a 2-foot-long section that shall remain exposed to demonstrate work performed in that step. Continue application procedures until topcoat is provided. Topcoat shall be a minimum of two feet long. When completed, finished mock-up for each paint system shall reveal each step and each coat of paint required for paint system with 2-foot-wide strips revealing Work performed to prepare surface and apply each coat. Lengthen overall mock-up as required to completely demonstrate each painting system. Use tinted shades differing from coat to coat for each component of each painting system.

3. ENGINEER may approve or disapprove each component of each painting system on an individual component basis.
4. Painting Work that does not meet standard approved on sample areas shall be removed and replaced.
5. Painting Work advanced without approved mock-ups shall stop, and mock-ups prepared for approval by ENGINEER.

F. Pre-painting Conference:

1. Prior to installing painting systems, arrange a meeting at Site with painting applicator and its foreman, paint manufacturer's technical representative, installers of other work in and around painting that must follow painting Work, ENGINEER, and other representatives directly concerned with performance of painting Work. Record discussions of conference and decisions and agreements and disagreements and furnish a copy of record to each party attending. Review foreseeable methods and procedures relating to painting Work including:
 - a. Review Project requirements including Contract Documents, approved Shop Drawings, pending and approved Change Orders, requests for information that submitted by CONTRACTOR to ENGINEER, and other pertinent documents.
 - b. Review required samples and submittals, both completed and to be completed.
 - c. Review status of surfaces including drying, surface preparations, and similar considerations.
 - d. Review availability of materials, tradesmen, equipment, and facilities required for progress, to avoid delays, and to protect Work from damage.
 - e. Review required inspection, testing, certifying, and quality control procedures.

- f. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions. Supplemental heating sources required to for working in low-temperature conditions, shall be operating and acceptable to paint applicator and ENGINEER.
 - g. Review methods for complying with regulations of authorities having jurisdiction at Site, such as compliance with environmental protection, health, safety, fire, and similar regulations.
 - h. Review laws and procedures covering removal and disposal of blast debris.
- 2. Reconvene meeting at earliest opportunity if additional information must be developed to conclude the required topics of the meeting.
 - 3. Record revisions or changes agreed upon, reasons therefore, and parties agreeing or disagreeing with them.

1.05 SUBMITTALS

A. Action Submittals: Submit the following:

- 1. Product Data:
 - a. Copies of manufacturer's technical information and test performance data, including paint analysis, VOC and chemical component content in comparison to maximum allowed by the Contact Documents, and application instructions for each product proposed for use.
 - b. Submit proof of acceptability of proposed application techniques by paint manufacturer selected.
 - c. Copies of CONTRACTOR's proposed protection procedures in each area of the Work explaining methods of protecting adjacent surfaces from splatter, for confining application procedures in a manner that allows other work adjacent to surface preparation and painting Work to proceed safely and without interruption, and for maintaining acceptable application, curing, and environmental conditions during and after painting systems application.
 - d. List each material and cross-reference to the specific painting system and application, including a list of site-specific surfaces to which painting system will be applied. Identify by manufacturer's catalog number and general classification. State number of gallons of each product being purchased for delivery to Site and square foot area calculated to be covered by each painting system specified based on theoretical loss of 20 percent. Where actual area to be covered by paint system exceeds area submitted to ENGINEER for that system, proof of additional material purchase shall be provided to ENGINEER. Calculated coverage shall be as specified for each

component of each painting system specified. This requirement does not take precedence over CONTRACTOR's responsibility to provide dry film thickness required for each component of each painting system.

- e. Identify maximum exposure times allowable for each paint system component before next coat of paint can be applied. Submit proposed methods for preparing surfaces for subsequent coats if maximum exposure times are exceeded.
- f. Information on curing times and environmental conditions that affect curing time of each paint system component and proposed methods for accommodating variations in curing time. Identify this information for each painting system in the Work.
- g. Specification for spray equipment with cross-reference to paint manufacturer's recommended equipment requirements.

2. Samples:

- a. Copies of manufacturer's complete color charts for each coating system.
- b. Mock-ups specified for the Site.

B. Informational Submittals: Submit the following:

1. Certificates:

- a. Certificate from paint manufacturer stating that materials meet or exceed Contract Documents requirements.
- b. Evidence of shelf-life history for all products verifying compliance with the requirements of the Contract Documents.
- c. CONTRACTOR shall provide notarized statement verifying that all painting systems are compatible with surfaces specified. All painting systems components shall be reviewed by an authorized technical representative of paint manufacturer for use as a compatible system. Verify that all painting systems are acceptable for exposures specified and that paint manufacturer is in agreement that selected systems are proper, compatible, and are not in conflict with paint manufacturer's recommended specifications. Show by copy of transmittal form that a copy of letter has been transmitted to paint applicator.

2. Test Reports:

- a. Certified laboratory test reports for required performance and analysis testing in compliance with ASTM E329.

- b. Adhesion testing plan and procedures.
 - c. Results of adhesion testing on existing surfaces containing paints or other coatings to have a top coat with paint systems specified. Prior to adhesion testing, submit a testing plan establishing methods, procedures and number of tests in each area where existing coatings are to remain and become substrate for painting Work. Based on results of adhesion testing, recommend methods, procedures, and painting system modifications, if necessary, for proceeding with Work.
 - d. Locations of and test methods for soil sampling before beginning Work and after Substantial Completion.
 - e. Proposed methods for testing, handling, and disposal of waste generated during Work.
 - f. Results of alkalinity and moisture content tests performed in accordance with ASTM D4262 and ASTM D4263.
 - g. Results of tests of film thickness, holidays, and imperfections.
- 3. Manufacturer's Instructions: Provide paint manufacturer's storage, handling, and application instructions prior to commencing painting Work at Site.
- 4. Manufacturer's Site Reports: Provide report of paint manufacturer's representative for each visit to Site by paint manufacturer's representative.
- 5. Special Procedure Submittals:
 - a. Proposed protection procedures for each area of Work, explaining methods of protecting adjacent surfaces from splatter, for confining application procedures in a manner that allows other work adjacent to surface preparation and painting Work to proceed safely and without interruption.
 - b. Site-specific health and safety plan.
 - c. Procedures for maintaining acceptable application, curing and environmental conditions during and after painting systems application.
 - d. Procedures for providing adequate lighting, ventilation, and personal protection equipment relative to painting Work.
- 6. Qualifications:
 - a. Applicator.

b. Testing laboratory

C. Closeout Submittals: Submit the following:

1. Maintenance Manual: Upon completion of the painting Work, furnish ENGINEER five copies of detailed maintenance manual including the following information:
 - a. Complete and updated product catalog of paint manufacturer's currently available products including complete technical information on each product. Identify product names and numbers of each product used in the painting Work.
 - b. Name, address, e-mail address and telephone number of manufacturers, local distributor, applicator and technical representative.
 - c. Detailed procedures for routine maintenance and cleaning.
 - d. Detailed procedures for light repairs such as dents, scratches and staining.
2. Statement of Application: Upon completion of the painting Work, submit a notarized statement to ENGINEER signed by CONTRACTOR and painting applicator stating that Work complies with requirements of the Contract Documents and that application methods, equipment, and environmental conditions were proper and adequate for conditions of installation and use.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Product Delivery Requirements: Deliver products to Site in original, new, and unopened packages and containers, accurately and legibly and accurately labeled with the following:
1. Container contents, including name and generic description of product.
 2. Manufacturer's stock number and date of manufacture.
 3. Manufacturer's name.
 4. Contents by volume, for major pigment and vehicle constituents.
 5. Grams per liter of volatile organic compounds.
 6. Thinning instructions, where recommended.
 7. Application instructions.
 8. Color name and number.

B. Product Storage Requirements:

1. Store acceptable materials at Site.
2. Store in an environmentally controlled location as recommended in paint manufacturer's written product information. Keep area clean and accessible. Prevent freezing of products.
3. Store products that are not in actual use in tightly covered containers.
4. Comply with health and fire regulations of authorities having jurisdiction at Site.

C. Product Handling Requirements:

1. Handle products in a manner that minimizes the potential for contamination, or incorrect product catalyzation.
2. Do not open containers or mix components until necessary preparatory work has been completed and approved by ENGINEER and painting Work will start immediately.
3. Maintain containers used in storing, mixing, and applying paint in a clean condition, free of foreign materials and residue.

1.07 SITE CONDITIONS

A. Site Facilities:

1. Supplemental heat sources, as required to maintain both ambient and surface temperatures within range recommended by paint manufacturer for paint system application, are not available at Site.
2. Provision of supplemental heat energy sources, power, equipment, and operating, maintenance and temperature monitoring personnel is responsibility of CONTRACTOR.
3. Do not use heat sources that emit carbon dioxide or carbon monoxide into areas being painted. Properly locate and vent such heat sources to exterior such that paint systems are unaffected by exhaust.

B. Existing Conditions:

1. Existing surfaces to receive painting Work shall be surface-prepared to meet requirements of painting systems specified. Prior to commencing painting Work, perform adhesion tests on existing surfaces to be painted. Perform testing per ASTM D4541 or other method acceptable to ENGINEER. Number and location of tests shall be sufficient to determine condition of existing coatings and suitability of existing coatings to remain to provide acceptable substrate for new coatings. Submit testing plan prior to testing and provide ENGINEER a copy of adhesion test results.

2. Provide abrasive blasting, scraping, or other abrading or surface film removal, or preparatory techniques accepted by ENGINEER.
3. Before commencing painting in an area, surfaces to be painted and floors shall be cleaned of dust using commercial vacuum cleaning equipment equipped with high-efficiency particulate air (HEPA) filters and dust containment systems.

C. Environmental Requirements:

1. Apply water-based paints when the temperature of surfaces to be painted and ambient air temperatures are between 55 degrees F and 90 degrees F, unless otherwise permitted by paint manufacturer's published instructions.
2. Surfaces to be painted shall be at least 5 degrees F above dew point temperature and be dry to the touch. Apply paint only when temperature of surfaces to be painted, paint products, and ambient air temperatures are between 65 degrees F and 95 degrees F, unless otherwise permitted by paint manufacturer's published instructions.
3. Apply paint system within shortest possible time consistent with manufacturer's recommended curing instructions for each coat. If chemical, salt, or other contamination contacts paint film between coats, remove contamination per SSPC SP 1 and restore surface before applying paint.
4. Do not paint tanks or pipelines containing fluid without specific permission of ENGINEER and only under conditions where "sweating" of outside surface of vessel being painted is not likely to occur within 24 hours of paint application.
5. Do not apply epoxy paints if ambient temperature is expected to go below 50 degrees F within twelve hours of application. Follow manufacturer's instructions when manufacturer's published recommendations require a higher minimum ambient temperature.
6. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent. Do not apply paint to damp or wet surfaces or when surfaces will reach dew point due to falling or rising temperatures and humidity conditions during course of paint application, unless otherwise permitted by paint manufacturer's published instructions.
7. Do not paint unacceptably hot or cold surfaces until such surfaces can be maintained within temperature and dew point ranges acceptable to paint manufacturer. Arrange for surfaces to be brought within acceptable temperature and dew point ranges as part of painting Work.
8. Moisture content of surfaces shall be verified to ENGINEER as acceptable prior to commencement of painting using methods recommended by paint manufacturer.

9. Painting may be continued during inclement weather only if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer for application and drying.
 10. Provide adequate illumination and ventilation where painting operations are in progress.
- D. Protection:
1. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently, or not to be painted.
 2. During surface preparation and painting, facility shall remain in operation. Use procedures that prevent contamination of process or cause or require facility shutdown.
 3. Coordinate and schedule surface preparation and painting to avoid exposing personnel to hazards associated with painting Work. Provide required personnel safety equipment per requirements of authorities having jurisdiction at Site.
 4. Submit protection procedures to be employed. Do not begin surface preparation and painting Work until ENGINEER accepts protection techniques proposed by CONTRACTOR.
 5. When working with flammable materials, provide fire extinguishers and post temporary signs warning against smoking and open flame.

1.08 MAINTENANCE

- A. Extra Materials: Furnish, tag, and store an additional one percent by volume of all coatings and colors installed. Provide a minimum of one gallon of each coating and color. Store in unopened containers as specified until turned over to OWNER.

PART 2 - PRODUCTS

2.01 PAINTING SYSTEM MANUFACTURERS

- A. Products and Manufacturers: Where referenced under painting systems provide products manufactured by the following:
1. Tnemec Company, Inc. (TCI).
 2. The Carboline Company, part of StonCor Group, an RMP Company (TCC).
 3. Sherwin-Williams Company (SWC).
 4. Benjamin Moore & Company (BMC).

5. ICI Paints (ICI).
6. Righter Group Inc. (RGI)
7. Duron Inc. (DI)

2.02 PAINTING SYSTEMS

- A. New and Existing Concrete Unit Masonry Walls; Moderate Corrosion and Abrasion Resistant, Non-submerged, Interior:
 1. Surface Preparation: Refer to Paragraphs 1.5.A.2., 3.2.A., 3.2.B.1., 3.2.B.2. and 3.2.B.8.
 2. Filler, Surfacer and Patching Compound:
 - a. Generic Components:
 - 1) Minimum 68 percent volume solids, high-build, three-component, waterborne cementitious acrylic block filler; 75 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Series 130 Envirofill (TCI); Sanitile 600 TG (TCC); Cement-Plex 875 (SWC): One coat, 10 to 14 dry mils.
 3. Intermediate/Finish:
 - a. Generic Components:
 - 1) Minimum 80 percent volume solids, high-build, chemical-resistant, high-gloss, modified, polyamine or polyamido-amine catalyzed epoxy finish; 180 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Series 280 Theme-Glaze (TCI); Carboguard 890 LT (TCC); Cor-Cote HP (SWC):
 - a) Horizontal Surfaces: Two coats, 6.0 to 12.0 dry MIL, per coat.
 - b) Vertical Surfaces: Two coats, 4.0 to 8.0 dry MIL, per coat.
- B. New and Existing Ferrous Metals, Structural Steel (With or Without Sprayed Fireproofing), Miscellaneous Ferrous Metals, Exterior Surfaces of Valves, Exterior Surfaces of Ferrous Piping, and Exterior Surfaces of All Ferrous Metal (Both Exposed and to be Later Covered with Insulation); Non-submerged, Interior:

1. Surface Preparation: Refer to Paragraphs 1.5.A.2., 3.2.A., 3.2.C.1., 3.2.C.2.
 2. Shop Primer:
 - a. Generic Components:
 - 1) Minimum 67 percent volume solids, build, two-component, cycloaliphatic amine-catalyzed epoxy or polyamido-amine epoxy coating; 250 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Series N69 Hi-Build Epoxoline (TCI); Carboguard 954 HB (TCC); Macropoxy HS Epoxy (SWC): One coat, 4.0 to 6.0 dry mils.
 3. Field Primer and Touch-Up:
 - a. Generic Components:
 - 1) Minimum 100 percent volume solids, high-build, two-component, polyamide-catalyzed epoxy; 8 grams per gallon VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Series 165 Epoxoline 100 (TCI); Carboguard 954 HB (TCC); Cor-Cote HP (SWC): One coat, 8.0 to 12.0 dry mils.
 4. Finish: High-Gloss:
 - a. Generic Components:
 - 1) Minimum 80 percent volume solids, high-build, chemical-resistant, high-gloss, modified, polyamine- or polyamidoamine-catalyzed epoxy finish; 25 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Series 280 Thene-Glaze (TCI); Carboguard 890 LT (TCC); Cor-Cote HP (SWC):
 - a) Horizontal Surfaces: One coat, 6.0 to 12.0 dry mils.
 - b) Vertical Surfaces: One coat, 4.0 to 8.0 dry mils.
- C. New and Existing Ferrous Metals, Non-Ferrous Metals, and Galvanized Metals, including Water Storage Tanks; Low VOC Content, Non-Submerged, Exterior:

1. Surface Preparation: Refer to Paragraphs 1.5.A.2., 3.2.A., 3.2.C.1., 3.2.C.2., 3.2.D., 3.2.E., and 3.2.F.
2. Ferrous Metal Primer:
 - a. Generic Components:
 - 1) Minimum 67 percent volume solids, build, two-component, cycloaliphatic amine-catalyzed epoxy coating; 250 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Series V69 Hi-Build Epoxoline (TCI); Carboguard 890 LT (TCC); Macropoxy HS (SWC): One coat, 4.0 to 6.0 dry mils.
3. Ferrous Metal Touch-Up:
 - a. Generic Components:
 - 1) For Low-temperature Curing Conditions: Minimum 80 percent solids, modified polyamido-amine or polyamine epoxy; 296 grams per liter VOC, maximum.
 - 2) For Warm-temperature Curing Conditions: Minimum 80 percent volume solids, modified polyamido-amine or polyamine epoxy; 296 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) For Low-temperature Curing Conditions: Series 136, Chembuild FC (TCI); Carboguard 890 LT (TCC); Macropoxy HS Epoxy (SWC): One coat, 10.0 dry mils.
 - 2) For Warm-temperature Curing Conditions: Series 166 Epoxoline HS (TCI); Carboguard 1207 HB (TCC); Macropoxy HS Epoxy (SWC): One coat, 6.0 dry mils.
4. Galvanized and Non-Ferrous Primer.
 - a. Generic Components:
 - 1) Refer to Paragraph 2.2.R.2.a.1), above.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Refer to Paragraph 2.2.R.2.b.1), above.
5. Intermediate – Ferrous Metals Only:
 - a. Generic Components:

- 1) Refer to Paragraph 2.2.R.3.a.1), above.
 - 2) Refer to Paragraph 2.2.R.3.a.1), above.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Refer to Paragraph 2.2.R.3.a.1), above.
 - 2) Refer to Paragraph 2.2.R.3.b.1), above.
 6. Finish: Semi-Gloss:
 - a. Generic Components:
 - 1) Minimum 49 percent volume solids, two-component, waterborne acrylic polyurethane or aliphatic acrylic polyurethane coating; 247 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Series 1080 Endura-Shield WB (TCI); Carbothane 134 VOC (TCC); Centurion WB Urethane (SWC): Two coats, 2.0 to 3.0 dry mils.
- D. New and Existing Galvanized Metal, Non-Ferrous Metal, and Fiberglass; Non-submerged, Interior:
1. Surface Preparation: Refer to Paragraphs 1.5.A.2., 3.2.A., 3.2.D., 3.2.E. and 3.2.F.
 2. Primer:
 - a. Generic Components:
 - 1) Minimum, 39 percent volume solids single-component, self-cross linking acrylic primer-sealer, 140 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Series 115 Uni-Bond DF (TCI); Galoseal Wash Primer (TCC); Pro-Cryl Universal Primer (SWC): One coat, 2.0 to 4.0 dry mils.
 3. Finish: Satin:
 - a. Generic Components:
 - 1) Minimum, 41 percent volume solids, single component, self-cross-linking acrylic; 208 grams per liter VOC, maximum.

- b. Products and Manufacturers: Provide one of the following:
 - 1) Series 116 Uni-Bond (TCI); Carbocrylic 3359 (TCC); DTM Acrylic Coating (SWC): One coat, 2.0 to 4.0 dry mils.
- E. New and Existing Aluminum in Contact with Dissimilar Materials:
 - 1. Surface Preparation: Refer to Paragraphs 1.5.A.2., 3.2.A. and 3.2.D.
 - 2. Primer/Finish:
 - a. Generic Components:
 - 1) Minimum 100 percent volume solids, high-build, two-component, polyamido-amine or polyamine epoxy; 49 grams per gallon VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Series 165 Epoxoline 100 (TCI); Carboguard 954 HB (TCC); Dura-Plate UHS (SWC): Two coats, 8.0 to 15.0 dry mils, per coat.

2.03 CALKING AND SEALANTS

- A. Refer to Section 07920, Joint Sealants.

2.04 INSTRUMENTS

- A. Instruments:
 - 1. Provide one new dry-film thickness gauge for checking film thickness, one holiday detector to detect holidays or holes in the coating, and one set of visual standards to check surface preparation. Calibrate dry film thickness gauge at Site using Bureau of Standards standard shim blocks.
 - 2. Products and Manufacturers: Provide the following:
 - a. Film Thickness Testers: Model FM-III manufactured by Mikrotest, or equal.
 - b. Holiday detector shall be Model M-1 as manufactured by Tinker & Rasor, or equal.
 - c. Visual Standards: ASTM D2200, Swedish Standards, SSPC VIS 1.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which painting Work is to be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film capable of performing in accordance with claims made in paint manufacturer's product literature for surfaces and conditions encountered.
- C. Do not paint over existing paint where there is no assurance that existing paint will provide an acceptable surface for long-term adherence and durability of painting systems specified or where paint manufacturer requires removal of all existing paint to recommend use of specified painting system.

3.02 SURFACE PREPARATION

- A. General:
 - 1. Test for moisture content of surfaces before commencement of painting Work. Test for moisture in concrete in compliance with ASTM D4263. Report results to ENGINEER before commencing Work.
 - 2. Prepare existing surfaces to be painted as specified for new surfaces. Submit substitute methods of preparing existing surfaces, when proposed, with Shop Drawing submittal. ENGINEER's acceptance of substitute surface preparation methods does not relieve CONTRACTOR of performance required under the Contract Documents. To provide surfaces acceptable for application of painting system specified:
 - a. Clean and roughen surfaces of existing paint and other decorative or protective toppings on surfaces to remain that are to receive a painting system under this Section.
 - b. Where existing surfaces to be painted have corrosion, peeling paint, or unacceptably adhering coatings, remove all topcoats, primers, and intermediate coats of paint, and other protective or decorative coatings.
 - 3. Perform preparation and cleaning procedures as specified herein and in strict accordance with paint manufacturer's approved instructions for each surface and atmospheric condition.
 - 4. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items already in place that do not require field painting, or provide effective surface-applied protection prior to surface preparation and painting.
 - 5. Remove as necessary items that must be field-painted where adjacent surfaces cannot be completely protected from splatter or overspray.

Following completion of painting of each space or area, the removed items shall be reinstalled by workers skilled in the trades involved.

6. Clean surfaces to be painted before applying painting system components. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning.
7. Prepare surfaces that were improperly shop-painted and abraded or rusted shop-painted surfaces as specified.

B. Cast-In-Place Concrete, Precast Concrete and Masonry Surfaces:

1. Prepare surfaces of concrete unit masonry to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, and other contamination using soap and water. Surfaces shall be clean and dry at time of paint system application.
2. Concrete unit masonry that cannot be adequately cleaned using soap and water shall be acid etched with a commercial solution of 15 percent muriatic acid.
3. Prepare and clean cast-in-place concrete and precast concrete surfaces per ASTM D4259 to provide a uniform and continuous anchor profile of approximately one mil. Provide mechanical abrading and abrasive blasting per ASTM D4259. Use 40 to 80-mesh abrasive and clean, dry, compressed air. Compressed air cleanliness shall be per ASTM D4285. Pressure at blasting nozzle shall not exceed 80 pounds per square inch. Do not concentrate blast on surface; instead, move at a fairly rapid rate to provide a surface free of laitants and contaminants. Provide post-surface preparation cleaning per ASTM D4258 to remove loose material. Surface preparation shall open all surface air holes by removing laitance shoulders surrounding air holes. Vacuum surfaces to remove dust and sand, and wash with potable water.
4. Where paint system is for chemical containment barrier protection, repair cracks and expansion joints in concrete and provide 2-inch radiused cove base fillets at equipment pads and containment walls as part of complete chemical containment paint system Work. Use materials and techniques recommended by manufacturers of the paint and concrete repair products.
5. Remove from cast-in-place concrete fins, projections, and other surface irregularities that would protrude above level of finished intermediate fillers and surfacers. Remove by chipping and scarification by mechanical abrasion.
6. Using specified filler and surfacer, patch cast-in-place concrete and precast concrete surfaces as required to completely fill surface air holes and honeycombing. Level all protrusions, grind filler and surfacing compounds smooth, and level with adjacent surfaces.

7. Perform tests per ASTM D4262 and ASTM D4263 to verify alkalinity and moisture content of surfaces to be painted, and report findings to ENGINEER. If, in ENGINEER's opinion, surfaces are sufficiently alkaline to cause blistering and burning of paint, correct the condition before applying paint. Provide suitable testing materials for alkalinity and moisture tests. Do not paint surfaces where the moisture content exceeds eight percent.
8. Where a concrete unit masonry block filler is specified, spot patch holes and cracks with a putty knife using specified block filler. Apply to large surfaces by airless spray and back roll uniformly using a roller with a synthetic nap cover. Follow with a rubber squeegee to provide a smooth finish.

C. Ferrous Metals:

1. Ferrous Metals Except Ductile and Cast Iron:
 - a. Comply with paint manufacturer's recommendations for type and size of abrasive to provide a surface profile that meets manufacturer's painting system requirements for type, function, and location of surface. Verify that paint manufacturer-recommended profiles have been achieved on prepared surfaces. Report profiles to ENGINEER using Test Method C of ASTM D4417.
 - b. Clean non-submerged ferrous surfaces including structural steel and miscellaneous metal to be shop-primed, of all oil, grease, dirt, mill scale, and other contamination by commercial blast cleaning complying with SSPC SP 6 at time of paint system application, using SSPC VIS 1 as a standard of comparison.
 - c. Clean submerged ferrous surfaces including structural steel and miscellaneous metal to be shop-primed of all oil, grease, dirt, mill scale, and other contamination by near-white blasting complying with SSPC SP 10 at time of painting system application, using SSPC VIS 1 as a standard of comparison.
 - d. Clean non-submerged, ferrous surfaces that have not been shop-coated of all oil, grease, dirt, loose mill scale, and other contamination by commercial blasting complying with SSPC SP 6 at the time of painting system application, using SSPC VIS 1 as a standard of comparison.
 - e. Clean submerged ferrous surfaces that have not been shop-coated or that have been improperly shop-coated of all oil, grease, dirt, mill scale, and other contamination by near-white blasting complying with SSPC SP 10 at time of painting system application, using SSPC VIS 1 as a standard of comparison.
 - f. Touch-up shop-applied prime coats that have damaged or have bare areas with primer recommended by paint manufacturer after

commercial blasting complying with SSPC SP 6 at the time of painting system application, using SSPC VIS 1 as a standard of comparison, to provide a surface profile of not less than one mil.

- g. Power tool-clean per SSPC SP 3 to remove welding splatter and slag.
 - h. Remove all rust and contamination on ferrous metals to sound surfaces by power tool-cleaning complying with SSPC SP 11 to provide a surface profile of not less than one mil.
- D. Non-Ferrous Metal Surfaces: Prepare non-ferrous metal surfaces for painting by light whip blasting or by lightly sanding with 60- to 80-mesh sandpaper.
- E. Galvanized (Zinc-Coated) Surfaces: Prepare galvanized surfaces for painting by lightly sanding with 60- to 80-mesh sandpaper or by light whip blasting.

3.03 PROTECTION OF PROPERTY AND STRUCTURES

- A. Protect property and structures adjacent to the Work from waste residues resulting from cleaning, surface preparation and paint application.
- B. Use shrouding, vacuum blasting, or other approved methods for cleaning and surface preparation of exterior surfaces.
- C. During blast cleaning and surface preparation of interior and exterior surfaces, control discharge of dust and grit, using shrouding, negative-pressure containment/dust collection systems, or other means to protect adjacent property and structures and prevent dust/grit from escaping. Similarly control removal and temporary storage of residues to protect adjacent property and structures.
- D. For painting of exterior surfaces, use rollers, shrouding or other approved methods as required to protect adjacent property and structures from wind-blown paint residues.
- E. Submit proposed procedures for cleaning, surface preparation and paint application describing methods for protecting adjacent property and structures from residues. Do not proceed with cleaning, surface preparation or painting until proposed procedures are approved by ENGINEER.

3.04 MATERIALS PREPARATION

- A. General:
 - 1. Mix and prepare paint products in strict accordance with paint manufacturer's product literature.
 - 2. Do not mix painting materials produced by different manufacturers, unless otherwise permitted by paint manufacturer's instructions.

3. Where thinners are required, they shall be produced by paint system manufacturer unless otherwise permitted by paint manufacturer's product literature and submitted to and accepted by ENGINEER with Shop Drawings.

B. Tinting:

1. Where multiple coats of the same material are to be provided, tint each undercoat a lighter shade to facilitate identification of each coat of paint.
2. Tint undercoats to match color of finish coat of paint, but provide sufficient difference in shade of undercoats to distinguish each separate coat. Provide a code number to identify material tinted by manufacturer.

C. Mixing:

1. For products requiring constant agitation, use methods in compliance with manufacturer's product literature to prevent settling during paint application.
2. Mix in containers placed in suitably sized non-ferrous or oxide resistant metal pans to protect floors from slashes or spills that could stain the floor or react with subsequent finish floor material.
3. Mix and apply paint in containers bearing accurate product name of material being mixed or applied.
4. Stir products before application to produce a mixture of uniform density and as required during the application. Do not stir into the product film that forms on surface; instead, remove film and, if necessary, strain product before using.
5. Strain products requiring such mixing procedures. After adjusting mixer speed to break up lumps and after components are thoroughly blended, strain through 35 to 50-mesh screen before application.

3.05 APPLICATION

A. General:

1. Apply paint systems by brush, roller, or airless spray per manufacturer's recommendations and in compliance with Paint Application Specifications No. 1 in SSPC Volume 2, where applicable. Use brushes best suited for type of paint applied. Use rollers of carpet, velvet back, or high pile sheep's' wool as recommended by paint manufacturer for product and texture required. Use air spray and airless spray equipment recommended by paint manufacturer for specific painting systems specified. Submit a list of application methods proposed, listing paint systems and location.

2. Paint dry film thicknesses required are the same regardless of the application method. Do not apply succeeding coats until previous coat has completely dried.
3. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint, until paint film is uniform finish, color, and appearance, particularly for intense chroma primary colors. Ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a film thickness equivalent to that of flat surfaces.
4. Surfaces of items not normally exposed-to-view require the same color as other components of system of which they are part, and require the same painting system specified for exposed surfaces of system.
5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint before final installation of registers or grilles.
6. Paint backs of access panels and removable or hinged covers to match exposed surfaces.
7. Paint aluminum parts in contact with dissimilar materials with specified paint system.
8. Paint tops, bottoms, and side edges of doors the same as exterior surfaces.
9. Omit field-applied primer on metal surfaces that have been primed in the shop. Touch-up paint shop-primed coats and pre-finished items only when approved by ENGINEER using compatible primers and manufacturer's recommended compatible field-applied finishes.
10. Welds shall be stripe-coated with intermediate or finish coat of paint after application of prime coat.

B. Minimum/Maximum Paint Film Thickness:

1. Apply each product at not less than, nor more than, manufacturer's recommended spreading rate, and provide total dry film thickness as specified.
2. Apply additional coats of paint if required to obtain specified total dry film thickness.
3. Maximum dry film thickness shall not exceed 100 percent of minimum dry film thickness, except where more stringent limitations are recommended by paint manufacturer for a specific product.

C. Scheduling Surface Preparation and Painting:

1. As soon as practical after preparation, apply first-coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting. Apply first-coat material before subsequent surface deterioration due to atmospheric conditions existing at time of surface preparation and painting. Surfaces that have started to rust before first-coat application is complete shall be brought back to required standard by abrasive blasting.
 2. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and application of another coat of paint does not cause lifting or loss of adhesion to undercoat.
 3. Scarify primers and other painting system components by brush-blasting if paint has been exposed for lengths of time or under conditions beyond manufacturer's written recommendations for painting systems required, intended use, or method of application proposed for subsequent coats of paint.
 4. Schedule cleaning and painting so that dust and other contaminants from leaning process do not fall on wet, newly painted surfaces.
- D. Prime Coats: Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects caused by insufficient sealing.
- E. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage.
- F. Brush Application:
1. Brush out and work all brush coats onto surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections are unacceptable. Neatly draw all glass and color break lines.
 2. Brush-apply primer or first coats, unless otherwise permitted to use mechanical applicators.
- G. Mechanical Applicators:
1. Use mechanical methods for paint application when permitted by governing ordinances, manufacturer, and approved by ENGINEER.
 2. Limit roller applications, if approved by ENGINEER, to interior wall finishes for second and third coats. Apply each roller coat to provide the equivalent hiding as brush-applied coats.
 3. Where spray application is used, apply each coat to provide equivalent hiding of brush-applied coats. Do not double back with spray equipment for purpose of building up film thickness of multiple coats in one pass.

- H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint Work not in compliance with specified requirements as required by ENGINEER.

3.06 FIELD QUALITY CONTROL

- A. ENGINEER may invoke the following material testing procedure at any time for a maximum of five times during field painting Work:
 - 1. CONTRACTOR shall engage service of an independent testing laboratory to sample paints used, as designated by ENGINEER. Samples of products delivered to Site shall be obtained, identified, sealed, and certified as to being products actually applied to surfaces in each area, in presence of CONTRACTOR.
 - 2. A testing laboratory selected by OWNER and paid for by CONTRACTOR shall perform appropriate tests for any or all of the following:
 - a. Abrasion resistance.
 - b. Apparent reflectivity.
 - c. Flexibility.
 - d. Washability.
 - e. Absorption.
 - f. Accelerated weathering.
 - g. Dry opacity.
 - h. Accelerated yellowness.
 - i. Recoating.
 - j. Skinning.
 - k. Color retention.
 - l. Alkali resistance.
 - m. Quantitative materials analysis.
 - 3. If test results show that products being used do not comply with specified requirements, CONTRACTOR may be directed to stop painting Work and remove non-complying paint, and shall prepare and repaint surfaces coated with rejected paint with material complying with the Contract Documents.

- B. Notify ENGINEER after completing each coat of paint. After inspection and checking of film thickness, holidays, and imperfections, and after acceptance by ENGINEER, proceed with succeeding coat. Perform testing using testing instruments specified in Article 2.4 of this Section.
 - 1. ENGINEER will witness all testing and shall be notified of scheduled testing at least twenty-four hours in advance.
 - 2. Apply additional coats, if required, to produce specified film thickness and to correct holidays and to completely fill all surface air holes.
- C. For magnetic substrates, measure thickness of dry film nonmagnetic coatings following recommendations of SSPC PA-2. These procedures supplement manufacturers' approved instructions for manual operation of measurement gauges and do not replace such instructions.
- D. Record time, location, number of coats, dry film thickness, holidays, and other imperfections and submit testing results to ENGINEER.

3.07 PROTECTION OF NEW FINISHES

- A. Provide signs that read, "Wet Paint" as required to protect newly painted finishes. Remove temporary wrappings provided for protection of the Work after completion of painting.

3.08 ADJUSTING AND CLEANING

- A. Correct damages to work of other trades through cleaning, repairing or replacing, and repainting, as acceptable to ENGINEER.
- B. During progress of Work, remove from Site all discarded paint materials, rubbish, cans, and rags at end of each workday.
- C. Upon completion of painting, clean paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, while avoiding scratching or otherwise damaging finished surfaces.
- D. At completion of work of other trades, touch-up and restore damaged or defaced painted surfaces as determined by ENGINEER.

3.10 SCHEDULES

- A. The schedules listed below, following the "End of Section" designation, are a part of this Specification section.
 - 1. Table 09 91 00-C, Painting Schedule.

END OF SECTION

**TABLE 09910-C
PAINTING SCHEDULE**

Facility or Surface *	Room Number	Painting System	Remarks
All CMU walls in the Electrical Room and HVAC Room to a height above the ceiling tile plane that matches the existing height.		A	
New steel miscellaneous metal work. Any existing structural or miscellaneous steel work damaged before or during construction due to the settling of the building.		B	
New and existing doors and frames in the Electrical Room and the HVAC Room		C	
New galvanized electrical conduit (GRS). Existing conduit (GRS) that has had its paint coating damaged before or during construction		D	
Any temporary or permanent aluminum in contact with dissimilar materials		E	
<p>* Refer to Drawings for facility locations and for facilities not listed above. ** Refer to Article 2.2 of this Section.</p>			