Jacksonville FMS #11 Construct
PEMB Parts Storage

9900 Normandy Blvd.
Jacksonville, Florida

Florida Department of Military Affairs
Project No. 12219016

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A Full Service Design Firm

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FLORIDA DEPARTMENT OF MILITARY AFFAIRS
JACKSONVILLE FMS #11 CONSTRUCT PEMB PARTS STORAGE
JACKSONVILLE, FLORIDA

GENERAL

CIVIL

ARCHITECTURAL

MECHANICAL

ELECTRICAL

SECTION 01 10 00

SUMMARY

PART 1 GENERAL

1.01 SUMMARY OF WORK

A. Project involves construction of an 1800 square foot pre-engineered metal building, (30' x 60') with a poured in place concrete foundation. Building shall include one overhead roll up door, two walk doors and a 12' wide x 15' long concrete apron. Interior build out shall involve installation of self-standing shelving units, general task lighting, emergency/exit lighting, exhaust fan ventilation and ceiling fans.

B. Electrical power and telephone service will be made available in the immediate vicinity of the building. Water service shall be extended on site for one new fire hydrant.

C. Note: Design of pre-engineered metal building and concrete foundation will be signed and sealed by awarded Contractor's (PMB) supplier and structural engineer.

1.02 WORK BY OWNER

A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion.

1.03 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.04 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Arrange use of site and premises to allow:
   1. Work by Others.
   2. Work by Owner.

C. Provide access to and from site as required by law and by Owner:
   1. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Utility Outages and Shutdown:
   1. Prevent accidental disruption of utility services to other facilities.

1.05 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner.

1.06 SPECIFICATION SECTIONS APPLICABLE TO ALL CONTRACTS

A. Unless otherwise noted, all provisions of the sections listed below apply to all contracts. Specific items of work listed under individual contract descriptions constitute exceptions.

B. Section 01 30 00 - Administrative Requirements.

C. Section 01 32 16 - Construction Progress Schedule.

D. Section 01 35 53 - Security Procedures.

E. Section 01 40 00 - Quality Requirements.

F. Section 01 42 16 - Definitions.

G. Section 01 60 00 - Product Requirements.

H. Section 01 70 00 - Execution and Closeout Requirements.

I. Section 01 78 00 - Closeout Submittals.

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via an Internet-based submittal service.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. It is Contractor's responsibility to submit documents in allowable format.
   3. Paper document transmittals will not be reviewed.
   4. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's superintendent.
   5. Major subcontractors.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Maintenance of progress schedule.
   7. Corrective measures to regain projected schedules.
   8. Planned progress during succeeding work period.
   9. Coordination of projected progress.
   10. Maintenance of quality and work standards.
   11. Effect of proposed changes on progress schedule and coordination.

E. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit schedule .

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Submit updated schedule with each Application for Payment.

3.04 DAILY CONSTRUCTION REPORTS

A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.

B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
   1. Date.
   2. High and low temperatures, and general weather conditions.
   3. Safety, environmental, or industrial relations incidents.
   4. Meetings and significant decisions.
   5. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
   6. Testing and/or inspections performed.
   7. Signature of Contractor's authorized representative.

3.05 REQUESTS FOR INTERPRETATION (RFI)

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

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of the Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare in a format and with content acceptable to Owner.
   3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Contractor's signature attesting to good faith effort to determine from the Contract Documents information requiring interpretation.
   2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
      a. Approval of submittals (use procedures specified elsewhere in this section).
      b. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Official Project name and number.
   2. Owner's, Architect's, and Contractor's names.
   3. Discrete and consecutive RFI number, and descriptive subject/title.
   4. Issue date, and requested reply date.
   5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).

6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
2. Note dates of when each request is made, and when a response is received.

H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.06 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
1. Submit at the same time as the preliminary schedule specified in Section - 01 32 16 - Construction Progress Schedule.
2. Coordinate with Contractor's construction schedule and schedule of values.
3. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

3.07 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

3.08 SUBMITTAL PROCEDURES

A. General Requirements:
1. Use a single transmittal for related items.
2. Transmit using approved form.
a. Use Contractor's form, subject to prior approval by Architect.
3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.

5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
    a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
6. Schedule submittals to expedite the Project, and coordinate submission of related items.
    a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
    b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
8. Provide space for Contractor and Architect review stamps.
9. When revised for resubmission, identify all changes made since previous submission.
10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related work.
2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.09 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
    a. "Approved", or language with same legal meaning.
    b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
        1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
    c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
        1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
2. Not Authorizing fabrication, delivery, and installation:
    a. "Revise and Resubmit".
        1) Resubmit revised item, with review notations acknowledged and incorporated.
    b. "Rejected".

1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:
   1. Items for which no action was taken:
      a. "Received" - to notify the Contractor that the submittal has been received for record only.
   2. Items for which action was taken:
      a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SUBMITTALS

A. Within 10 days after date of Agreement, submit schedule .

B. Submit updated schedule with each Application for Payment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.04 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

3.05 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

END OF SECTION

SECTION 01 35 53

SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECURITY PROGRAM

A. Protect Work and Owner's operations from theft, vandalism, and unauthorized entry.

1.02 ENTRY CONTROL

A. Restrict entrance of persons and vehicles into Project site .

B. Owner will control entrance of persons and vehicles related to Owner's operations.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SUBMITTALS

A. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

B. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

E. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

F. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
   2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.02 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

1.03 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

D. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.04 TESTING AND INSPECTION AGENCIES AND SERVICES

A. As indicated in individual specification sections, Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 3 EXECUTION

2.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

2.02 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

2.03 TESTING AND INSPECTION

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.

E. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

2.04 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 42 16

DEFINITIONS

PART 1 GENERAL

1.01 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Provide: To furnish and install.

E. Supply: Same as Furnish.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 25 00 - Substitution Procedures.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

D. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Agrees to provide the same warranty for the substitution as for the specified product.

3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension that may subsequently become apparent.
5. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure (after contract award):
1. Submit pdf copies of request for substitution for consideration. Limit each request to one proposed substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
3. Architect will notify Contractor in writing of decision to accept or reject request.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. Provide off-site storage and protection when site does not permit on-site storage or protection.

F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer's warranty conditions, if any.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SUBMITTALS

A. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.

B. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.02 QUALIFICATIONS

A. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.03 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

H. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.04 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

PART 3 EXECUTION

3.01 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

D. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.03 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-conforming work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing.

D. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.04 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

3.05 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.06 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.07 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

C. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

D. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

F. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

G. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

END OF SECTION

SECTION 01 78 00

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Individual Product Sections: Specific requirements for operation and maintenance data.

C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

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

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 3 EXECUTION

2.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   2. Field changes of dimension and detail.
   3. Details not on original Contract drawings.

2.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

2.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

2.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Include test and balancing reports.

O. Additional Requirements: As specified in individual product specification sections.

2.05 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include photocopies of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

SECTION 02 22 00

SITE DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Demolition of structures, paving, and utilities.
   2. Filling voids created as a result of removals or demolition.

B. Related Requirements:
   1. Section 02 23 00 - Site Clearing: Clearing of trees and other plant vegetation
   2. Section 02 30 00 - Earthwork: Placement of fill material
   3. Section 02 37 00 - Erosion and Sedimentation Control (Including SWPPP): Erosion protection during demolition operations.

2.01 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. Occupational Safety and Health Administration (OSHA):
   1. OSHA 01926.1153 Respirable Crystalline Silica.

3.01 REGULATORY REQUIREMENTS

A. Conform to applicable State and local codes for demolition of structures, safety of adjacent structures, dust control, runoff control, and pollution prevention.

B. Obtain required permits and licenses from appropriate authorities. Pay associated fees including disposal charges.

C. Notify affected utility companies before starting work and comply with their requirements.

D. Do not close or obstruct public or private roadways, sidewalks, or fire hydrants without appropriate permits or written authorization.

E. If hazardous, contaminated materials or other environmental related conditions are discovered, stop work immediately and notify the Walmart Construction Manager for action to be taken. Do not resume work until specifically authorized by the Construction Manager.

F. Test soils around buried tanks for contamination. Coordinate notification for mobilization to site and required observation of tank removal with Walmart Civil Engineering Consultant.

4.01 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of capped utilities and subsurface obstructions that will remain after demolition. Submit record as part of closeout submittals.

5.01 PROJECT CONDITIONS

A. Structures to be demolished will be discontinued in use and vacated prior to start of work.

B. Owner assumes no responsibility for condition of structures to be demolished.

C. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as reasonably practical. Variations within structures may occur by Owner's removal and salvage operations prior to start of demolition work.

D. Unless otherwise indicated in Contract Documents or specified by the Owner, items of salvageable value to Contractor shall be removed from site and structures. Storage or sale of removed items on site will not be permitted and shall not interfere with other work specified.

E. Explosives shall not be brought to site or used without written consent of authorities having jurisdiction. Such written consent will not relieve Contractor of total responsibility for injury to persons or for damage to property due to blasting operations. Performance of required blasting shall comply with governing regulations.

PART 2 - PRODUCTS

1.01 FILL MATERIALS

A. Fill material shall be aggregate fill materials as specified in Section 02 30 00.

PART 3 - EXECUTION

1.01 PREPARATION

A. Provide, erect, and maintain erosion control devices, temporary barriers, and security devices at locations indicated on Construction Drawings.

B. Protect existing landscaping materials, appurtenances, and structures, which are not to be demolished. Repair damage to existing items to remain caused by demolition operations.

C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring as necessary.

D. Mark location of utilities. Protect and maintain in safe and operable condition utilities that are to remain. Prevent interruption of existing utility service to occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities as acceptable to governing authorities and Owner.

E. Notify adjacent property owners of work that may affect their property, potential noise, utility outages, or other disruptions. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon, or limit access to their property. Coordinate notice with Owner.

2.01 GENERAL DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with adjacent structures or pavements to remain.

B. Cease operations immediately if adjacent structures appear to be in danger. Notify authority having jurisdiction. Do not resume operations until directed by authority.

C. Conduct operations with minimum of interference to public or private access. Maintain ingress and egress at all times.

D. Sprinkle work with water to minimize dust. Provide hoses and water connections for this purpose.

E. Comply with governing regulations pertaining to environmental protection.

F. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

3.01 DEMOLITION

A. Demolish site improvements designated to be removed as shown on the drawings. Site improvements shall include but not be limited to structures, retaining walls, foundations, pavements, curbs and gutters, drainage structures, utilities, signage or landscaping.

B. Disconnect and cap or remove utilities to be abandoned as shown on the drawings.

C. Fill or remove underground tanks, piping, and appurtenances as shown.

D. Demolish buildings completely and remove from site using methods as required to complete work within limitations of governing regulations. Small structures may be removed intact when acceptable to Owner and authorities having jurisdiction.

E. Locate demolition equipment and remove materials to prevent excessive loading to supporting walls, floors, or framing.

F. Demolish concrete and masonry in small sections. Break up concrete slabs-on-grade that are 2-feet or more below proposed subgrade to permit moisture drainage. Remove slabs-on-grade and below grade construction within 2-feet of proposed subgrade. Use proper dust control methods to maintain dust emissions below the permissible level.

4.01 FILLING BASEMENTS AND VOIDS

A. Completely fill below grade areas and voids resulting from demolition or removal of structures, underground fuel storage tanks, wells, cisterns, etc., using aggregate fill materials consisting of stone, gravel, or sand free from debris, trash, frozen materials, roots, and other organic matter.

B. Areas to be filled shall be free of standing water, frost, frozen or unsuitable material, trash, and debris prior to fill placement.

C. Place fill materials in accordance with Section 02 30 00 unless subsequent excavation for new work is required.

D. Grade surface to match adjacent grades and to provide flow of surface drainage after fill placement and compaction.

5.01 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove from site debris, rubbish, and other materials resulting from demolition operations. Leave areas of work in clean condition.

B. No burning of any material, debris, or trash on-site or off-site will be allowed except when allowed by appropriate governing authority and Owner. If allowed as stated above, burning shall be performed in manner prescribed by governing authority. Attend burning materials until fires have burned out and have been completely extinguished.

C. Transport materials removed from demolished structures with appropriate vehicles and dispose off-site to areas that are approved for disposal by governing authorities and appropriate property owners.

END OF SECTION

SECTION 02 23 00

SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Cleaning site of debris, grass, trees, and other plant life in preparation for site or building earthwork.
   2. Protection of existing structures, trees, or vegetation indicated on the Construction Drawings to remain.

B. Related Requirements:
   1. Section 02 22 00 – Site Demolition: Demolition and removal of structures, paving, utilities and other improvements.
   2. Section 02 30 00 – Earthwork: Stripping and removal of topsoil.
   3. Section 02 37 00 - Erosion And Sedimentation Control (Including SWPPP)

2.01 ENVIRONMENTAL REQUIREMENTS

A. Construct temporary erosion and sediment control systems as shown on Construction Drawings and as directed by the "Storm Water Pollution Prevention Plan" (SWPPP) to protect adjacent properties and water resources from erosion and sedimentation.

B. In event that sitework on this project will disturb one or more acres, starting work shall be strictly governed by the sequence of construction as specified in Section 02 37 00 and SWPPP site maps. Contractor shall not begin construction without "National Pollution Discharge Elimination System" (NPDES) permit governing discharge of storm water from site for entire construction period. NPDES permit requires SWPPP to be in place during construction.

C. Clearing and grubbing shall commence in the proper sequence as stated in the Phase I of the Best Management Practice Sequence specified in Section 02 37 00 and on the SWPPP site map and subsequent to the halt in construction for performance of the inspection and certification of BMPs as stated.

D. Contractor shall conduct storm water management practices in accordance with the project SWPPP and applicable NPDES permit and shall enforce action taken or imposed by Federal or State agencies, including cost of fines, construction delays, and remedial actions resulting from Contractor's failure to comply with provisions of NPDES permit.

3.01 PROJECT CONDITIONS

A. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as reasonably practical.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

1.01 PREPARATION

A. Identify existing plant life that is to remain and verify clearing limits are clearly tagged, identified, and marked in such manner as to ensure their protection throughout construction operations.

2.01 PROTECTION

A. Locate, identify, and protect existing utilities that are to remain.

B. Protect trees, plant growth, and features designated to remain as part of final landscaping.

C. Conduct operations with minimum interference to public or private accesses and facilities. Maintain ingress and egress at all times and clean or sweep roadways daily as required by SWPPP or governing authority. Dust control shall be provided with sprinkling systems or equipment provided by Contractor.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by a licensed land surveyor and replaced, as necessary, in kind.

E. Provide traffic control as required, in accordance with the US Department of Transportation's "Manual on Uniform Traffic Control Devices" and applicable state highway department requirements.

3.01 EQUIPMENT

A. Material shall be transported to and from the project site using well-maintained and operating vehicles. Transporting vehicles operating on site shall stay on designated haul roads and shall not endanger improvements by rutting, overloading, or pumping.

4.01 CLEARING

A. Clear areas required for access to site and execution of work.

B. Unless otherwise indicated on Construction Drawings, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out stumps and roots. Depressions caused by clearing and grubbing operations shall be filled to subgrade elevation to avoid ponding of water. Satisfactory fill material shall be placed in accordance with Section 02 30 00.

C. Remove grass, trees, plant life, stumps, and other construction debris from site to dump site that is suitable for handling such material according to state laws and regulations.

D. Cut heavy growths of grass from areas before stripping and topsoil removal and remove cuttings with remainder of cleared vegetative material.

END OF SECTION

SECTION 02 30 00

EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Excavation, filling, and backfilling for structures, pavement, and outparcels.
   2. Trenching and backfilling for utilities.
   3. Dewatering.
   4. Boring under crossings.

B. Related Requirements:
   1. Section 02 37 00 - Erosion Control and Sedimentation. Temporary and permanent erosion control.

2.01 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM)
   1. ASTM D422 - Particle Size Analysis of Soil.
   2. ASTM D698 - Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN.m/m^3)).
   3. ASTM D2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   4. ASTM D2488 - Description and Identification of Soils (Visual-Manual Procedures).
   5. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
   6. ASTM D6938 – In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

C. American Association of State Highway and Transportation Officials (AASHTO)
   1. AASHTO T 88 - Particle Size Analysis of Soils.

D. State Department of Transportation (DOT):
   1. Standard Specifications for Construction and Materials.

E. National Fire Protection Association (NFPA)
   1. NFPA 70 - National Electrical Code.

F. American Water Works Association (AWWA)
   1. AWWA C200 - Standard for Steel Water Pipe - 6 In. (150 mm) and Larger.
   2. AWWA C206 - Field Welding Of Steel Water Pipe.

3.01 DEFINITIONS

A. Satisfactory Materials: ASTM D2487 soil classification groups GW, GP, GM, SW, SP, SM, ML, CL, [CH,] [MH,] [SC,][GC,] or a combination of these group symbols.

1. Fill material shall further conform to the plasticity index and liquid limits (PI and LL) specified in Paragraph FILLING hereinafter.
2. Satisfactory materials shall be free of rock or gravel larger than allowed for fill or backfill material as specified hereinafter or as shown on the drawings.
3. Satisfactory materials shall contain no debris, waste, frozen materials, vegetation, and other deleterious matter.
4. Unless specifically stated otherwise in "Foundation Subsurface Preparation" on the Drawings, the following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of satisfactory materials to be used as fill in specified areas:

Location	PI	LL
Building area (below upper four feet)	20	50
Building area (upper four feet)	12	40
Areas outside the building pad including outparcels		
(Below upper two feet)	20	50
(Upper two feet, except for depth to receive topsoil)	15	40

(References to depth are to proposed subgrade elevations)

B. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials are unsatisfactory.
1. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory materials which contains root and other organic matter or frozen material. The CTL shall be notified of any contaminated materials.
2. Unsatisfactory materials also include satisfactory materials not maintained within 2 percent of optimum moisture content at time of compaction.

4.01 SUBMITTALS

A. Submit 30-pound sample of each type of off-site fill material that is to be used at the site in airtight containers to the independent testing laboratory or submit gradation and certification of aggregate material that is to be used at the site to the independent testing laboratory for review.

B. Submit name of each material supplier and specific type and source of each material. Change in source throughout project requires approval of Owner.

C. Submit Dewatering Plans upon request by Owner.

D. Shop drawings or details pertaining to excavating and filling are not required unless otherwise shown on the Drawings or if contrary procedures to Construction Documents are proposed.

E. Shop drawings or details pertaining to site utilities are not required unless required by regulatory authorities or unless uses of materials, methods, equipment, or procedures that are contrary to The Drawings or Specifications are proposed. Do not perform work until Owner has accepted required shop drawings.

F. Contact utility companies and determine if additional easements will be required to complete project. Provide written confirmation of the status of all easements to Owner at time of Preconstruction Conference or no later than 90 days prior to project possession date.

PART 2 - PRODUCTS

1.01 SOIL AND ROCK MATERIALS

A. Fill and Backfill. Satisfactory materials excavated from the site.

B. Imported Fill Material: Satisfactory material provided from offsite borrow areas when sufficient satisfactory materials are not available from required excavations.

C. Trench Backfill: ASTM D2321 unless otherwise specified or shown on the drawings.

D. Building Subbase Material: Subbase for building and appurtenances slabs on ground is specified in Section 03 30 00.

E. Bedding: Aggregate Type as indicated on the plans or naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No.200 sieve.

F. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No.8 sieve.

G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No.4 sieve.

H. Topsoil: Topsoil shall consist of stripping material excavated from the site. Topsoil shall consist of organic surficial soil found in depth of not more than 6-inches.

2.01 APPURTENANT MATERIALS

A. Steel Casing Pipe: Comply with AWWA C200 minimum grade B, size, and wall thickness as indicated on The Drawings.

B. Trench Utility Locator Tape: Heavy duty 6" wide underground warning tape. Tape shall be made from polyethylene material, 3.5 mils thick, with a minimum tensile strength of 1,750 psi. Place the tape at one-half the minimum depth of cover for the utility line or a maximum of 3 feet, whichever is the less, but never above the top of subgrade. Color of tape shall be determined by as follows:

1. Natural Gas or Propane – Yellow.
2. Electric – Red.
3. Telephone – Orange.
4. Water – Blue.
5. Sanitary Sewer – Green.

3.01 EQUIPMENT

A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

4.01 SOURCE QUALITY CONTROL

A. Laboratory testing of materials proposed for use in the project shall be by the Contractor at no cost to Owner. The Contractor shall provide samples of material obtained off-site.

B. Perform California Bearing Ratio (CBR) tests in outparcels and areas to receive pavement for each type of material that is imported from off-site. CBR value shall be equal to or above pavement design subgrade CBR value indicated on Construction Drawings.

C. Following tests shall be performed on each type of on-site or imported soil material used as compacted fill:
   1. Moisture and Density Relationship: ASTM D698.
   2. Mechanical Analysis: AASHTO T88 or ASTM D422.
   3. Plasticity Index: ASTM D4318.

PART 3 - EXECUTION

1.01 PREPARATION

A. Identify required lines, levels, contours, datum, elevations, and grades necessary for construction as shown on the drawings.

B. Notify utility companies to remove or relocate public utilities that are in conflict with proposed improvements.

C. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs, unless otherwise noted on the drawings from excavating equipment and vehicular traffic.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

E. Remove from site, material encountered in grading operations that is unsatisfactory material or undesirable for backfilling, subgrade, or foundation purposes. Dispose of in manner satisfactory to Owner and local governing agencies. Backfill areas with layers of satisfactory material and compact as specified herein.

F. Prior to placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:
   1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain the same results.
   2. After drainage of low area is complete, remove muck, mud, debris, and other unsatisfactory material by using acceptable equipment and methods that will keep natural soils underlying low area dry and undisturbed.
   3. All muck, mud, and other materials removed from low areas shall be dried on-site by spreading in thin layers for observation. Material shall be inspected and, if found to be satisfactory for use as fill material, shall be incorporated into lowest elevation of site filling operation, but not under building subgrade or within 5'-0" of perimeter of building subgrade, paving or outparcel subgrade. If, after observation, material is found to be unsatisfactory, it shall be removed from site.

G. Locate and identify utilities that have previously been installed and protect from damage.

H. Locate and identify existing utilities that are to remain and protect from damage.

I. Maintain in operating condition existing utilities, previously installed utilities, and drainage systems encountered in utility installation. Repair surface or subsurface improvements shown on the Drawings.

J. Verify location, size, elevation, and other pertinent data required making connections to existing utilities and drainage systems as indicated on the Drawings.

K. Over excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems.

2.01 DEWATERING

A. General:
   1. Dewatering activities shall conform to applicable provisions in 02 37 00.
   2. Provide dewatering systems as required for excavations.
   3. Design and provide dewatering system using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom or sides. Design system to prevent differential hydrostatic head, which would result in floating out soil particles in a manner, termed as a “quick” or “boiling” condition. System shall not be dependent solely upon sumps or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation’s stability.
   4. Provide dewatering system of sufficient size and capacity to prevent ground and surface water flow into the excavation and to allow Work to be installed in a dry condition.
   5. Control, by acceptable means, all water regardless of source. Contractor shall be responsible for disposal of the water.
   6. Control groundwater in a manner that preserves strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary, lower water level in advance of excavation utilizing wells, wellpoints, jet educators, or similar positive methods. The water level as measured by piezometers shall be maintained a minimum of 3 feet below prevailing excavation level.
   7. Commence dewatering prior to any appearance of water in excavation and continue until Work is complete to the extent that no damage results from hydrostatic pressure, flotation, or other causes.
   8. Open pumping with sumps and ditches will be allowed provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes.
   9. Install wells or wellpoints, if required, with suitable screens and filters so that continuous pumping of fines does not occur. Arrange discharge to facilitate collection of samples by the Owner. During normal pumping and upon development of wells, levels of fine sand or silt in the discharge water shall not exceed 5 ppm. Install sand tester on discharge of each pump during testing to verify that levels are not exceeded.
   10. Control grading around excavations to prevent surface water from flowing into excavation areas.
   11. No additional payment will be made for any supplemental measures to control seepage, groundwater, or artesian head.

B. Design:
   1. Designate and obtain the services of a qualified dewatering specialist to provide dewatering plan as may be necessary to complete the Work.
   2. Contractor shall be responsible for the accuracy of the drawings, design data, and operational records required.
   3. Contractor shall be responsible for the design, installation, operation, maintenance, and any failure of any component of the system.

C. Damages:
   1. Contractor shall be responsible for and shall repair any damage to work in place, other contractor’s equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation. Contractor responsibility shall also include, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor’s negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.
   2. Remove subgrade materials rendered unsatisfactory by excessive wetting and replace with approved backfill material at no additional cost to the Owner.

D. Maintaining Excavation in Dewatering Condition:
   1. Dewatering shall be a continuous operation. Interruptions due to power outages or any other reason will not be permitted.

2. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of construction or backfill is completed to prevent damage of subgrade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance.
3. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to Owner.
4. System maintenance shall include but not be limited to 24-hour supervision by personnel skilled in the operation, maintenance, and replacement of system components and any other work required to maintain excavation in dewatered condition.

E. System Removal: Upon completion of the work, remove dewatering equipment from the site, including related temporary electrical service.

F. Wells shall be removed or cut off a minimum of 3 feet below final ground surface, capped, and abandoned in accordance with regulations by agencies having jurisdiction.

3.01 TOPSOIL EXCAVATION

A. Cut heavy growths of grass from areas before stripping and remove cuttings with remainder of cleared vegetative material.

B. Strip topsoil to a depth of not less than 6 inches from areas that are to be filled, excavated, landscaped, or re-graded to such depth that it prevents intermingling with underlying subsoil or questionable material.

C. Stockpile topsoil in storage piles in areas shown on The Drawings or where directed by Owner. Construct storage piles to freely drain surface water. Cover storage piles as required to prevent windblown dust. Dispose of unsuitable topsoil as specified for waste material, unless otherwise specified by Owner. Remove excess topsoil from site unless specifically noted otherwise on the Drawings.

4.01 GENERAL EXCAVATION

A. Classification of Excavation: The Contractor shall assure himself by site investigation or other necessary means that he is familiar with the type, quantity, quality, and character of excavation work to be performed. Excavation shall be considered unclassified excavation, except as indicated in the Contract Documents.

B. When performing grading operations during periods of wet weather, provide adequate dewatering, drainage and ground water management to control moisture of soils.

C. Shore, brace, and drain excavations as necessary to maintain excavation as safe, secure, and free of water at all times.

D. Excavate building areas to line and grade as shown on the Drawings being careful not to over excavate beyond elevations needed for building subgrades.

E. Place satisfactory excavated material into project fill areas.

F. Unsatisfactory excavated material shall be disposed of in manner and location that is acceptable to Owner and local governing agencies.

G. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and local governing agencies.

5.01 TRENCHING EXCAVATION FOR UTILITIES

A. Contact local utility companies before excavation begins. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks vertical, if possible, and remove stones from bottom of trench as necessary to avoid point-bearing. Over-excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding. Replace over-excavation with satisfactory material and dispose of unsatisfactory material.

B. Trench excavation sidewalls shall be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.

C. Perform trench excavation as indicated on the Drawings for specified depths. During excavation, stockpile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.

D. Remove excavated materials not required or not satisfactory as backfill or embankments and waste off-site or at on-site locations approved by the Owner and in accordance with governing regulations. Dispose of structures discovered during excavation as specified in Section 02 22 00.

E. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches and other excavations as specified.

F. Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill.

G. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.

H. Trench width below top of pipe shall not be less than 12 inches nor more than 18 inches wider than outside surface of pipe or conduit that is to be installed to designated elevations and grades. Other trench width for pipe, conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.

I. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances, whichever is more stringent:
   1. Water Mains: 30 inches to top of pipe barrel or 6 inches below frost line, established by local building official, whichever is deeper.
   2. Storm Sewer: Elevations and grades as indicated on the Drawings.
   3. Electrical Conduits: 24 inches minimum to top of conduit or as required by NEC 300-5, NEC 710-36 codes, or local utility company requirements, whichever is deeper.
   4. TV Conduits: 18 inches minimum to top of conduit or as required by local utility company, whichever is deeper.
   5. Telephone Conduits: 18 inches minimum to top of conduit, or as required by local utility company, whichever is deeper.
   6. Gas Mains and Service: 30 inches minimum to top of pipe, or as required by local utility company, whichever is deeper.

6.01 SUBGRADE PREPARATION

A. Scarification and Compaction: Areas exposed by excavation or stripping and on which subgrade preparations are to be performed shall be scarified to minimum depth of 8 inches and compacted as specified hereinafter.

B. Proofrolling: Subgrades shall be proofrolled to detect areas of insufficient compaction and soft pocket, or areas of excess yielding. Proofrolling shall be accomplished by making minimum of two complete passes with fully-loaded tandem-axle dump truck with a minimum weight of 20 tons, or approved equal, in each of two perpendicular directions. Limit vehicle speed to three mph. Areas of failure such as soft spots, unsatisfactory soils, and areas of excessive pumping or rutting shall be excavated and re-compacted as specified herein. Subgrade exposed longer than 48 hours or on which precipitation has occurred shall be re-proofrolled. Document proofrolling procedure, specific locations, deficiencies, and corrective measures for review by Owner or Owner's CTL upon request.

7.01 FILLING

A. Fill areas to contours and elevations shown on the Drawings with materials deemed satisfactory.

B. Place fills in continuous lifts specified herein.

C. Fill within proposed building subgrade, paving subgrade, and outparcel subgrades shall not contain rock or stone greater than 6 inches in any dimension.

D. Unless otherwise specified for rock fill, rock or stone less than 6-inches in largest dimension may be used in fill below structures, paving, outparcels, and graded areas, up to 24 inches below surface of proposed subgrade or finish grade of graded areas when mixed with satisfactory material. Rock or stone less than 2 inches in largest dimension may be used in fill within the upper 24 inches of proposed subgrade or finish grade of graded areas when mixed with satisfactory material.

E. Fill materials used in preparation of subgrade shall be placed in lifts or layers not to exceed 8 inches loose measure and compacted as specified hereinafter.

F. Material imported from off-site shall have CBR value equal to or above pavement design subgrade CBR value indicated on The Drawings.

G. Building area subgrade pad shall be that portion of site directly beneath and 5 feet beyond building and appurtenances, including limits of future building expansion areas as shown on the Drawings.

H. Prepare building area subgrade pad in strict accordance with "Foundation Subsurface Preparation" as shown on the Drawings. The Foundation Subsurface Preparation provisions shall take precedence over the provisions of this section whenever duplication or conflict occurs.

8.01 ROCK FILL

A. Rock fill may be utilized in fill up to 48 inches below top of subgrade or finish grade of graded areas outside the proposed building, paving, and outparcel areas. Rock fill shall consist of rock having a maximum dimension not greater than 12 inches in any dimension. Rock fill shall be placed in successive horizontal layers of loose material having a thickness of approximately the maximum size of the larger rock in the lift, but not greater than 12 inches. Each layer of material shall be spread uniformly, completely saturated, and compacted. Shot rock shall not be dumped into place, but shall be distributed in horizontal lifts by blading and dozing in such a manner as to ensure proper placement into final position in the embankment. Voids shall be filled with finer material including shot rock fines and limited soil fines during the spreading operation. Successive layers shall not be placed until all voids of the current lift are filled and the lift is compacted. Each successive layer of material shall adequately bond to the material on which it is placed. Compaction shall be accomplished with vibratory compactors, heavy rubber-tired rollers, or steel-wheeled rollers. Compaction shall be by uniform passes of compaction

equipment in sufficient number of passes, but not less than two passes, such that no further consolidation is evident.

9.01 PIPE BEDDING

A. Excavate trenches for pipe or conduit to 4 inches below bottom of pipe and to the width as specified herein. Place 4 inches of bedding material, compact in bottom of trench, and shape to conform to lower portion of pipe barrel.

10.01 TRENCH BACKFILLING

A. Materials used for trench backfill shall comply with requirements as specified herein.

B. Backfill and compact in accordance with fill and compaction requirements in ASTM D2321 unless otherwise shown on the drawings.

C. Do not backfill trenches until required tests are performed and utility systems comply with and are accepted by applicable governing authorities.

D. Backfill trenches to contours and elevations shown on the Drawings.

E. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

11.01 BORINGS AND CASINGS UNDER ROADS, HIGHWAYS, AND RAILROAD CROSSINGS

A. When indicated by the Drawings, street, road, highway, or railroad crossings for utility mains installed by jacking and boring method shall be in accordance with area specifications and governing authorities.

B. Excavation of approach pits and trenches within right-of-way of street, road, highway, or railroad shall be of sufficient distance from paving or railroad tracks to permit traffic to pass without interference. Tamp backfill for approach pits and trenches within right-of-way in layers not greater than 6-inches thick for entire length and depth of trench or pit. Compact backfill to 98 percent of maximum density in accordance with ASTM D698, (or 95 percent of maximum density, in accordance with ASTM D1557) obtained at optimum moisture as determined by AASHTO T180. Mechanical tampers may be used after cover of 6 inches has been obtained over top of barrel of pipe.

C. Accomplish boring operation using commercial type boring rig. Bore hole to proper alignment and grade. Bore hole shall be within 2 inches of same diameter as largest outside joint diameter of pipe installed. Install pipe in hole immediately after bore has been made and in no instance shall hole be left unattended while open.

D. In event subsurface operations result in failure or damage to pavement or railroad tracks within 1 year of construction, make necessary repairs to pavement or railroad tracks. If paving cracks on either side of pipe line or is otherwise disturbed or broken due to construction operations, repair or replace disturbed or broken area.

E. Clean, prime, and line interior and exterior of casing pipe with two coats of asphalt coating in accordance with and governing authorities.

F. Butt weld steel casing. Welds shall be full penetration single butt-welds in accordance with AWWA C206.

G. Install casing and utility pipe with end seals, vent pipe, and other special equipment in accordance with area specifications and governing authorities.

12.01 COMPACTION

A. Compact as follows:

Location	Percent of Maximum Laboratory Density ASTM D698
Subgrade & Fill below Structures, Pavement and Outparcels	98
Subgrade & Fill in All other Areas	95

B. Maintain moisture content of not less than 3 percent below and not more than 3 percent above optimum moisture content of fill materials to attain required compaction density.

C. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

D. Corrective Measures for Non-Complying Compaction: Remove and recompact deficient areas until proper compaction is obtained.

13.01 MAINTENANCE OF SUBGRADE

A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction, including concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material with CBR or LBR equal to or better than that specified on the drawings. Surface of subgrade after compaction shall be firm, uniform, smooth, stable, and true to grade and cross-section.

D. Construct temporary ditches and perform such grading as necessary to maintain positive drainage away from subgrade at all times.

14.01 BORROW AND SPOIL SITES

A. Comply with NPDES and local erosion control permitting requirements for any and all on-site and off-site, disturbed spoil and borrow areas. Upon completion of spoil or borrow operations, clean up spoil or borrow areas in a neat and reasonable manner to the satisfaction of Owner or off-site property owner, if applicable.

15.01 FINISH GRADING

A. Check grading of building subgrades by string line from grade stakes (blue tops) set at not more than 50-foot centers. Allowable tolerance shall be plus or minus 0.10 feet from plan grade. Provide engineering and field staking as necessary for verification of lines, grades, and elevations.

B. Grade areas where finish grade elevations or contours are indicated on the Drawings, other than paved areas, outparcels, and buildings, including excavated areas, filled and transition areas, and landscaped areas. Graded areas shall be uniform and smooth, free from rock, debris, or irregular surface changes. Ground surfaces shall vary uniformly between indicated elevations. Grade finished ditches to allow for proper drainage without ponding and in manner that will minimize erosion potential.

C. Correct settled and eroded areas within 1 year after date of completion at no additional expense to Owner. Bring grades to proper elevation.

16.01 FIELD QUALITY CONTROL

A. Except for specified mandatory testing, field quality control testing and inspection shall be at the discretion of the Contractor as necessary to assure compliance with Contract requirements. Owner T&I specified below shall not be considered a substitute for the Contractor's responsibility to perform similar routine, necessary, and customary testing and inspection of the methods and frequency suitable for the type of work involved.

END OF SECTION

SECTION 02 32 00

TRENCHING, BEDDING, AND BACKFILLING

PART 1 GENERAL

1.01 Section Includes

A. Trenching for piping and electrical work.

B. Excavation for manholes, junction boxes, meter vaults, and appurtenances.

C. Sheeting, shoring and bracing

D. Bedding, backfilling, and compaction.

1.02 Related Sections

A. Section 02 23 00 - Site Preparation

B. Section 02 37 00 - Erosion and Sedimentation Control

1.03 References

A. American Association of State Highway and Transportation Officials (AASHTO) latest edition:

1. AASHTO M145 - Classification of Soils and Soil Aggregate Mixtures
2. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb Rammer and 18-in Drop

B. American Society for Testing and Materials (ASTM) latest edition:

1. ASTM D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort
2. ASTM D2487 - Classification of Soils for Engineering Purposes

C. Occupational Safety and Health Administration (OSHA) Regulations, including:

1. Part 1926 Subpart P – Excavations

1.04 Definitions

A. Bedding - Area from bottom of trench to centerline of pipe

B. Backfill = material above the top of pipe to the topsoil, paving sub-grade, or foundation level.

C. Influence Area = the area within lines sloped downward at 45□ from the outer edges of paving, foundations, and utility lines. As a minimum, the influence area shall extend 5

feet beyond the edge of pavement (where there is no curb) or 5 feet beyond the back of curb.

1.05 Quality Assurance

A. Field density testing frequencies:

1. Two tests for each 300 linear feet of pipeline or fraction thereof per lift of general backfilling in the pipeline trench.
2. One test for each 100 square feet or fraction thereof of backfill around and under structures, with a minimum of two tests per lift.
3. One test per lift per each change in type of fill.

1.06 Preconstruction Requirements

Precondition surveys and vibration monitoring are required for those areas where residential structures are within 100 feet of the proposed construction.

PART 2 PRODUCTS

2.01 General

It is intended that previously excavated materials conforming to the following requirements be utilized wherever possible.

2.02 Materials

A. Acceptable materials (suitable material): AASHTO M145 classification A-1, A-3, A-2-4, A-2-6; ASTM D2487 classification GW, GP, GM, SM, SW, SP; unless otherwise disapproved within the Soil and Subsurface investigation reports. No more than 12 percent of acceptable materials shall pass the number 200 sieve.

B. Unacceptable materials (unsuitable material): AASHTO M145 classification A-2-5, A-2-7, A-4, A-5, A-6, A-7, A-8; ASTM D2487 classification GC, SC, ML, MH, CL, CH, OL, OH, PT; unless otherwise approved within the Soil and Subsurface investigation reports.

C. Controlled low strength material (“excavatable flowable fill”) shall meet the requirements of FDOT specification section 121, with a 28-day compressive strength of 80-100 psi.

2.03 Sheeting, Shoring, and Bracing

A. The structural strength and safety of all sheeting, shoring and bracing shall be the sole responsibility of the Contractor. Repair any damage resulting from failure to provide adequate supports.

B. Provide timber-work, shoring, bracing, sheeting, and sheet piling where necessary to retain banks of excavations, prevent cave-in of adjacent ground, prevent displacement of utilities and structures, and to protect public safety.

C. Contractor is solely responsible for the design, installation, and operation of dewatering systems and their safety and conformity with local codes and regulations.

PART 3 EXECUTION

3.01 General Construction Requirements

A. Provide suitable temporary drainage channels for any water that may flow along or across the work as specified hereafter.

B. Provide barriers, warning lights and other protective devices at all excavations.

C. Sidewalks, roads, streets, and pavements shall not be blocked or obstructed by excavated materials, except as authorized by the Engineer, in which case adequate temporary provisions must be made for satisfactory temporary passage of pedestrians, and vehicles. Minimize inconvenience to public travel or to tenants occupying adjoining property.

D. Where necessary to place excavated material adjacent to buildings, erect barriers to keep earth at least 4' from such buildings. Earth deposited on lawns shall be promptly and carefully removed to preserve the turf. All trees, shrubs, and landscaping shall be protected. Boring and jacking shall be used, if necessary, except where written permission is granted to remove trees and shrubs.

E. If open excavations cross existing rigid surfacing, the surfacing shall be removed for a width one foot beyond the anticipated edge of the excavation. The pavement break shall be sawed to insure a straight joint. Surface replacement shall match existing surfacing except as otherwise indicated on the Drawings. Where open excavation is allowed along or across public roadways, excavation, backfill, and surface replacement shall conform to the requirements of all permits applicable thereto. In no case shall surface replacement edges bear on less than 12 inches of undisturbed soil.

3.02 Preparation

A. Identify required lines, levels, contours, and datum.

B. Locate and identify existing utilities that are to remain and protect from damage.

C. Notify utility companies to remove or relocate utilities that are in conflict with proposed improvements.

D. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.03 Sheeting, Shoring, and Bracing

A. Furnish, install, and maintain, without additional compensation, sheeting, bracing, and shoring support required to keep excavations within the easement provided, to support the sides of the excavation, and to prevent any movement which may damage adjacent pavements or structures, damage or delay the work, or endanger life and health. Voids outside the supports shall be immediately filled and compacted.

B. Sheeting, where required, shall be driven below the bottom of excavation so the lowest set of wales and struts are above the bottom of the excavation to allow necessary working room.

C. The Engineer may direct in writing that supports in trenches be cut off at any specified elevation, in which case Contractor shall be paid for the supports left in place.

D. Contractor may leave in place, to be embedded in the backfill of the excavation, any or all supports for the purpose of preventing injury to persons or property, whether public or private. However, no supports which are within 4 feet of the ground or pavement surface may be left in place without written permission of the Engineer. No extra payment will be made for supports left in place at the Contractor's option.

E. All supports not left in place shall be removed in such manner as to avoid endangering the piping, structures, utilities or property, whether public or private. All voids left by the withdrawal of sheeting shall be immediately filled and compacted.

F. The right of the Engineer to order supports left in place shall not be construed as creating an obligation on his part to issue such orders. Failure by the Engineer to exercise this right shall not relieve the Contractor from total liability for damages to persons or property resulting from the failure of the Contractor to leave in place sufficient supports to prevent any caving or moving of the ground adjacent to the excavation.

3.04 Trenching

A. All excavations shall be made by open cut unless otherwise indicated. Sides of trenches shall be kept as nearly vertical as possible from the trench bottom to a level of one foot above the top of the pipe. Slope sides of trenches in accordance with OSHA requirements and the recommendations contained within the project geotechnical report.

B. Excavation of trenches shall not advance more than 50 feet ahead of completed pipe installation except as approved by the Engineer.

C. Excavate trenches to depth indicated or required for indicated flow lines and invert elevations. Over excavate trenches a minimum of 2 feet where excavations occur within unsuitable soils, and replace over excavated material with suitable soils.

D. Where rock is encountered, carry excavation 6 inches below scheduled elevation and backfill with a 6 inch layer of crushed stone or gravel prior to installation of pipe.

E. For pipes or conduit 5 inches or less, excavate to indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

F. For pipes or conduit 6 inches or larger, and other work indicated to receive subbase, excavate to subbase depth indicated, or, if not otherwise indicated, to 6 inches below bottom of work to be supported.

G. Except as otherwise indicated, excavate for pressure piping so top of piping is minimum 3 feet below finished grade.

H. Unsuitable excavated materials shall be removed from the site and disposed, unless otherwise indicated on the Drawings.

I. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

J. Trench bottoms shall be kept dry, compacted, and stable to a depth two feet below the bottom of the trench.

K. Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 9 -12 inch clearance on each side of pipe or conduit.

L. If more than one pipe is to be installed in a trench, the pipes shall be spaced a minimum of one foot apart for pipes 4 inches and larger.

M. If portions of the bottom of trenches consist of material unstable to such a degree that, in the opinion of the Engineer, it cannot adequately support the pipe or structure, the bottom shall be over excavated and stabilized with approved coarse granular stabilization material. Depth of stabilization shall be as directed by the Engineer. The initial 50 tons of stabilization shall be incidental to the Contract. Compensation will be allowed only for such additional quantities as the Engineer shall direct in writing to be placed.

N. Do not backfill trenches until tests and inspections have been made.

3.05 Trench Backfilling

A. Following placement of pipe and inspection of joints, install tamped bedding material. Place bedding fill materials in layers of 6 inch loose depth.

B. All bedding and backfill material shall be suitable soils or flowable fill. Backfill material within 1 foot of pipe and appurtenances shall not contain rock or stone larger than 2 inch diameter. If a sufficient quantity of suitable material is not available from the trench or other excavations within the site, provide additional suitable material or flowable fill.

C. After completion of bedding and preliminary approval of piping and testing, the pipe shall be covered to a point one foot above the top of the pipe for the full trench width, placed in layers of 8 inch loose depth.

D. Place backfill over pipe. Where trench is within the influence area of roadways, structures, foundations, or slabs, place backfill in layers of 8 inch loose depth. In all other areas, place backfill in layers of 12 inch loose depth.

E. Take necessary precautions not to cause settlement or damage to adjacent slabs, walls, structures, or foundations. Place backfill and fill materials evenly adjacent to structures, without wedging against structures or displacement of piping or conduit.

3.06 Minor Structural Excavation and Backfilling

A. Minor structures are defined as manholes, junction boxes, inlets, valve vaults, and meter vaults. Do not excavate for any structure until that structure is scheduled for construction. Excavate only to the depth and dimensions necessary for the construction.

B. The bottom of all excavations shall be undisturbed earth unless otherwise indicated, and shall be approved by the Engineer before any subsequent work is started. Over excavate a minimum of 2 feet where excavations occur within unsuitable soils, and replace over excavated material with suitable soils.

C. Excavations carried below depths indicated on the Drawings without the previous approval of the Engineer shall be filled with 2500 psi concrete or flowable fill at the Owner's discretion to the correct level at the expense of the Contractor.

D. Maintain excavations in good order. If the bearing capacity of the foundation soils is reduced because the excavation is allowed to remain open prior to commencing work, the weathered soil shall be removed and replaced with 2500 psi concrete or flowable fill at the Owner's discretion at the expense of the Contractor.

E. Do not backfill until new concrete has properly cured, coatings have been approved, and any required tests have been accepted.

F. Fill within the influence area of roadways, structures, foundations, or slabs, shall be placed in layers of 8 inch loose depth. In all other areas, place fill in layers of 12 inch loose depth.

G. Exercise care during backfilling operations to avoid any puncture, break or other damage to waterproofing systems, if any. Backfill adjacent to waterproofing in the presence of the Engineer.

H. Where backfilling is required on both sides of structures, backfill and compact simultaneously on opposite sides in even layers. Other backfilling sequences shall be as specifically noted.

3.07 Compaction

A. Unless otherwise indicated, the type of equipment and number of passes required to obtain the specified degree of compaction shall be determined at the site, subject to the approval of the Engineer.

B. Provide mechanical compaction for cohesive material and vibratory compaction for granular materials, unless otherwise approved by the Engineer. Vibratory compaction is not allowed within 100 feet of existing structures. In these areas, compaction shall be accomplished by static means only. If compaction difficulties arise, the Engineer shall be consulted to review and possibly modify compaction procedures.

C. Noncohesive soils shall be compacted with vibrating roller or equivalent; cohesive soils shall be compacted with sheeps-foot roller, pneumatic tamping, or approved equivalent, unless otherwise indicated.

D. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

3.08 Testing and Cleanup

A. Provide for testing and cleanup as soon as practicable, so these operations do not lag far behind pipe installation. Perform preliminary cleanup and grading operations immediately after backfilling.

B. All surplus excavated material shall be disposed of by the Contractor.

3.09 Field Quality Control

A. Minimum Density Requirement (ASTM D1557 or AASHTO T180):

1. Backfill placed under and within the influence area of roadways, structures, slabs, foundations = 98 percent
2. Backfill placed within pond and road embankment = 95 percent
3. Backfill placed within public road right-of-way and utility easements = 95 percent
4. Backfill placed within landscape areas = 85 percent
5. Backfill placed within all other areas = 90 percent

Where backfill is placed and differing density requirements are defined, the more stringent density requirement governs.

END OF SECTION

SECTION 02 37 00

EROSION AND SEDIMENTATION CONTROL (INCLUDING SWPPP)

PART 1 – GENERAL

1.01 SUMMARY

A. Includes
   1. Installation of temporary and permanent erosion and sedimentation control systems.
   2. Installation of temporary and permanent slope protection systems.
   3. Storm Water Pollution Prevention Plan (SWPPP).

B. Related Sections
   1. Section 02 23 30 – Site Clearing
   2. Section 02 30 00 – Earthwork

1.02 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent properties, any identified endangered or threatened species and/or critical habitat, any identified cultural or historic resources, and receiving water resources from erosion and sediment damage until final stabilization is achieved. All storm water controls and systems must be installed & functioning as designed and free of accumulated sediment and debris before final project approval.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All erosion control products sediment control devices or materials for non-storm water BMPs as specified herein and on the Construction Drawings.

B. Rolled erosion control products according to Erosion Control Technology Council (ECTC) standard specifications.

C. Temporary mulches such as loose straw, wood cellulose, or agricultural silage.

D. Temporary and permanent outfall structures as specified on the drawings.

PART 3 – EXECUTION

3.01 PREPARATION

A. Review the drawings and Storm Water Pollution Prevention Plan.

B. Revise SWPPP as necessary to address potential pollution from site identified after issuance of the SWPPP at no additional cost to owner.

3.02 EROSION AND SEDIMENTATION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Place erosion and sediment control systems in accordance with the drawings and Storm Water Pollution Prevention Plan or as may be dictated by site conditions in order to maintain the intent of the specifications and permits.

B. The Storm Water Pollution Prevention Plan and Site Maps shall be corrected or modified as site conditions change. Contractor must obtain approval from Owner's Engineer prior to modifying or substituting Best Management Practices. Changes during construction shall be noted in the Storm Water Pollution Prevention Plan and posted on the drawings (Site Maps).

C. Owner has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and to direct Contractor to provide immediate permanent or temporary pollution control measures.

D. Maintain erosion and sedimentation control systems as dictated by site conditions, indicated in the construction documents, or as directed by governing authorities or Owner to control sediment until final stabilization. Contractor shall respond to maintenance or additional work ordered by Owner or governing authorities immediately, but in no case, within not more than 48 hours at no additional cost to the Owner.

E. Contractor shall incorporate permanent erosion control features, paving, permanent slope stabilization, and vegetation into project at earliest practical time to minimize need for temporary controls.

F. Permanently seed and mulch cut and fill slopes as construction proceeds to extent considered desirable and practical.

G. Disturbed areas that will not be graded or actively worked for a period of 7 days or more, shall be temporarily stabilized as work progresses with vegetation or other acceptable means unless otherwise specified in the Contract Documents. In the event it is not practical to seed areas, slopes must be stabilized with mulch and tackifier, bonded fiber matrix, netting, blankets or other means to reduce the erosive potential of the area.

END OF SECTION

SECTION 02 51 00

WATER AND RECLAIMED WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.01 Section Includes

A. Piping and fittings for water, fire, and reclaimed water distribution systems

B. Valves and hydrants

C. Testing and disinfection

1.02 Related Sections

Section 02 32 00 - Trenching, Bedding and Backfilling

1.03 References

A. American Water Works Association (AWWA) and American National Standards Institute (ANSI) latest edition:

1. ANSI/AWWA C104/A21.4 - Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
2. ANSI/AWWA C105/A21.5 - Polyethylene Encasement for Ductile Iron Pipe Systems
3. ANSI/AWWA C110/A21.10 - Ductile Iron and Gray Iron Fittings, 3 Inch Through 48 Inch, for Water
4. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
5. ANSI/AWWA C115/A21.15 - Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Fittings
6. ANSI/AWWA C150/A21.50 - Thickness Design of Ductile Iron Pipe
7. ANSI/AWWA C151/A21.51 - Ductile Iron Pipe, Centrifugally Cast, for Water
8. ANSI/AWWA C153/A21.53 - Compact Ductile Iron Fittings for Water Service
9. AWWA C502 - Dry Barrel Fire Hydrants
10. AWWA C504 - Rubber Seated Butterfly Valves
11. AWWA C509 - Resilient Seated Gate Valves for Water Supply Service
12. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
13. AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants
14. AWWA C600 - Installation of Ductile Iron Water Mains and Their Appurtenances
15. AWWA C605 - Underground Installation of PVC Pipe and Fittings for Water
16. AWWA C651 - Disinfecting Water Mains
17. AWWA C800 - Underground Service Line Valves and Fittings
18. AWWA C900 - PVC Pressure Pipe, and Fabricated Fittings, 4 Inch Through 12 Inch, for Water Distribution

19. AWWA C901 - Polyethylene Pressure Pipe and Tubing, ½ Inch Through 3 Inch for Water Service
20. AWWA C905 - PVC Pressure Pipe and Fabricated Fittings, 14 Inch Through 48 Inch
21. AWWA C906 - Polyethylene Pressure Pipe and Fittings, 4 Inch Through 63 Inch for Water Distribution and Transmission
22. AWWA M23 - PVC Pipe Design and Installation Manual

B. American Society for Testing and Materials (ASTM) latest edition:

1. ASTM A307 - Carbon Steel Bolts and Studs
2. ASTM A536 - Ductile Iron Castings
3. ASTM D1784 - Rigid PVC Compounds and CPVC Compounds
4. ASTM D1785 - PVC Plastic Pipe, Schedules 40, 80 and 120
5. ASTM D2000 - Classification System for Rubber Products in Automotive Applications
6. ASTM F1674 - Test Method for Joint Restraint Products for Use with PVC Pipe
7. ASTM F2164 - Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure

1.04 Definitions

Reclaimed Water = Unrestricted public access reuse water as defined by FAC 17-610

1.05 Submittals

A. Detailed layout drawings for all pipelines 6 inches and larger.

B. Details of joints for all piping 6 inches and larger.

C. Product data for gaskets for all piping.

D. Product data for all pipe over 6 inches in diameter.

E. Piping specialties and installation details.

F. Product data and installation procedures for joint and pipe restraint

G. Certification of pipe and fittings coatings

1.06 Quality Assurance

The contractor installing the underground fire protection piping shall hold a class I, II, or V level certification as issued by the State of Florida, as required by FS 633.021(15).

1.07 Product Delivery, Storage, and Handling

Exercise care in transporting and handling pipe and fittings in order to avoid damage to materials or coatings. Lifting shall be by hoist or on skids when hand lifting is not feasible. Dropping shall not be permitted. Store pipe as recommended by the manufacturer. Damaged pipe and fittings shall be replaced.

PART 2 PRODUCTS

2.01 Ductile Iron Pipe

A. Buried pipe shall conform with ANSI/AWWA C150/A21.50 and C151/ A21.51, and shall have a minimum working pressure of 150 psi. Buried pipe shall comply with the following pressure class (PC) designations unless otherwise indicated on the Drawings:

1. 12 inch diameter and smaller = PC 350
2. 14 inch through 24 inch diameter = PC 250
3. 30 inch through 64 inch diameter = PC 200

B. Exposed pipe 4" and larger shall be flanged and shall conform with AWWA/ANSI C115/A21.15, and shall have a minimum working pressure of 150 psi. Flanged pipe shall comply with the following thickness class (TC) designations unless otherwise indicated on the Drawings:

1. 4 inch diameter = TC 54
2. 6 inch through 24 inch diameter = TC 53

C. All flanges shall be class 125, and shall be fully machine faced after being screwed tightly on the pipe. Bolts and nut shall conform to ASTM A307, Grade B.

2.02 Fittings for Ductile Iron and PVC Pipe

A. Fittings shall be manufactured of ductile iron, conforming to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53.

B. All full body (C110/A21.10) fittings shall be pressure rated to 250 psi, minimum. All compact fittings (C153/A21.53) shall be pressure rated to 350 psi, minimum.

C. Fitting joints shall be compatible with the type of pipe in use or specified, e.g., flange fittings for flange pipe and mechanical joint for mechanical joint pipe and push-on joint pipe.

2.03 Linings and Coatings for Ductile Iron Pipe and Fittings

A. Interior lining shall be standard thickness cement mortar lining and bituminous seal coat, conforming to ANSI/AWWA C104/A21.4.

B. Exterior coating for buried pipe and fittings shall be a petroleum asphaltic coating in accordance with ANSI/AWWA C110/A21.10.

C. Exterior coating of exposed pipe and fittings shall be factory applied rust inhibiting epoxy primer, minimum 3 mils dry film thickness. After installation, exterior surfaces shall be painted with two coats Tnemec Series 2 Tneme-Gloss, Glidden Life Master Pro High Performance Acrylic No. 6900 Series, or equal, at minimum 4 mils dry film thickness per coat. Paint color to be in accordance with local utility requirements.

2.04 Joints for Ductile Iron Pipe and Fittings

A. Mechanical and push-on joints shall be rubber gasketed, conforming to ANSI/AWWA C111/A21.11. Mechanical joint bolts and nuts shall conform to ASTM A307, Grade B. Ductile iron glands shall be provided with ductile iron pipe.

B. Lubricants other than that furnished by the pipe manufacturer with the pipe shall not be used.

2.05 Restrained Joints for Ductile Iron Pipe and Fittings

A. Restrained joints shall be in accordance with DIPRA, "thrust restraint designed for Ductile Iron Pipe," utilizing laying condition 3, a pressure of 150 psi or greater, the type soil encountered, and the depths of the cover shown on the drawings.

B. Restrained joints shall be American Fast Grip Gasket, Flex-ring, Field Flex Ring, Lok-Ring, US Pipe TR-Flex, EBAA Megalug, or equal.

C. Pipe joints shall be restrained upstream and downstream of fittings in accordance with the manufacturer's requirements or the table shown in the drawings, whichever is greater.

2.06 Schedule 40, 80 and 120 PVC Pipe and Fittings

A. Pipe shall be manufactured from PVC 1120 and shall conform to ASTM D1785. Nominal size of pipe shall be as indicated on the Drawings.

B. Joints may be either solvent weld type or push-on joints using gasket approved by the Engineer. The bell shall be integral with the pipe and of equal or greater pressure rating. The bell of pipe and fittings using push-on joints shall have an integral groove to retain the gasket in place.

C. Fittings shall be manufactured of the same material as the pipe and shall have the same type of joints. Schedule 40 fittings shall conform to ASTM D2466. Schedule 80 fittings shall conform to ASTM D2467.

D. Provide adapters as required to join PVC pipe-to-pipe, fitting, and equipment of other materials.

E. Solvent cement shall be as recommended by the pipe manufacturer and shall conform to ASTM D2564.

F. Pipe and fittings shall be NSF approved for the usage to which they will be applied.

2.07 PVC Pressure Pipe

A. Pipe 4 inch through 12 inch diameter shall conform to AWWA C900.

B. Pipe 14 inch through 36 inch diameter shall conform to AWWA C905.

C. Pipe shall conform to ASTM D1784, Type I, Grade I, 4000 psi design stress, and shall be National Sanitation Federation (NSF) approved.

D. Water main and reclaimed water main pipe shall be class 150 (DR18), fire mains shall be class 200 (DR 14). All pipe shall contain markings on each section showing conformance to the above specifications.

E. PVC pipes shall be color coded and stenciled (2 inch lettering on two sides of the pipe in at least three areas per pipe section) in accordance with the following:

1. PVC Water Main and Fire Main - Blue pipe, stenciled “Potable Water Main”.
2. PVC Reclaimed Water Main - Purple pipe, stenciled “Reclaimed Water Main”.

2.08 PVC Pressure Pipe Joints

A. Joints shall be rubber gasketed conforming to AWWA C900 or C905

B. The bell shall be integral with the pipe and of equal or greater pressure rating. The bell of pipe and fittings using push-on joints shall have an integral groove to retain the gasket in place.

C. Provide adapters as required to join PVC pipe to pipe, fittings and equipment of other materials.

2.09 Restrained Joints for PVC Pressure Pipe

A. Mechanical devices shall be full circumferential contact compression type consisting of two rings connected across the pipe joint with restraining rods and associated hardware.

B. The pipe bell ring shall be a single piece ductile iron retainer ring that slides over the pipe lain end up to the pipe bell. The pipe plain end ring shall be a two piece ductile iron restrainer with a serrated-face to contact the pipe.

C. The restrainer shall be assembled on the pipe with side clamping bolts and nuts. The design tolerances to which the restrainer is machined will prevent over-tightening which would weaken or damage the pipe.

D. Ductile iron rings shall be ASTM A536, Grade 65-45-12. Connecting bolts shall be in accordance with ANSI/AWWA C111/A21.11.

E. The restraining devices shall be rated for a working pressure equivalent to the pressure rating of the pipe and shall meet or exceed the requirements of ASTM F1674. The devices shall be Uni-Flange Block Buster Series 1350 or Engineer approved equal.

2.10 Polyethylene (PE) Pressure Pipe and Tubing, Joints and Fittings (½ Inch through 3 inch)

A. Polyethylene pipe ½ -3 inch diameter for main line piping shall be polyethylene pipe (not tubing) in accordance with AWWA C901, standard code designation PE 3408, DR 9 (outside diameter based dimension ratio), PC 200. Pipe and fittings shall be NSF approved for the usage to which they are to be applied.

B. Polyethylene tubing ½ -3 inch diameter for services shall be polyethylene tubing in accordance with AWWA C901, standard code designation PE 3408, DR 9 (outside diameter based dimension ratio), PC 200, and shall be NSF approved.

C. Joints in SDR-PR PE pipe shall be butt heat fusion or socket heat fusion type.

D. Fittings shall be manufactured of the same material as the pipe and shall be of the same DR.

E. Provide adapters as required to join PE pipe-to-pipe, fittings and equipment of other materials.

2.11 Polyethylene Pipe and Fittings (NA)

2.12 PVC Service Lines

All 2 inch and 2½ inch PVC service lines shall be ASTM D2241, SDR 21, class 200, and shall be National Sanitation Federation (NSF) approved.

2.13 Service Saddles

Ductile iron bodies in accordance with ASTM A536, with double stainless steel straps, bolts, washers and nuts. Stainless steel to be Type 304. Nuts to be Teflon coated. Ductile iron body to be fusion bonded nylon coating, minimum thickness 12 mils. Outlet of saddle to have NPT threads.

2.14 Polyethylene Encasement

A. Provide virgin polyethylene encasement in conformance with AWWA C105/A21.5. Polyethylene to be Type I, Grade E-1, 0.4 maximum flow rate, 1200 psi minimum tensile strength, 300 percent minimum elongation, 800 volt/mil thickness minimum dielectric strength.

B. Polyethylene material shall have a minimum nominal thickness of .008 inch (8 mils). The minus tolerance on thickness shall not exceed 10 percent of the nominal thickness.

2.15 General Valve Requirements

A. Unless otherwise indicated or specified, all valves two inches and smaller shall be all brass or bronze; valves over two inches shall be iron body, fully bronze or bronze mounted.

B. Where required for satisfactory operation of valves, provide valve operators, extension stems, stem guides, cast iron valve boxes, floor boxes, handwheels, operator stands, position indicators, and other valve appurtenances. Extension stems shall be complete with guide bearings, wrench nut, and tee handle wrench. All machinery stuffing boxes shall be packed with material selected for the service intended. Maintain all packing until final acceptance by the Owner.

C. Manufacturer's name, service, and pressure marking shall be cast into the body.

D. Valve operators shall be sized for operation at the pressure and flow conditions required for proper operation.

E. Manual operators for exterior buried valves shall conform to AWWA C504.

F. Valve shafts shall be one piece extended completely through the disc or stub shafts extending 1½ times the shaft diameter into the disc. Valve shaft diameter shall be as required by AWWA C504. Valve shafts shall be 304 or 316 stainless steel. Disc to stem connections or turned down portions of shafts shall be designed to transmit shaft torque equivalent to 75% of the required shaft diameter. Bushings shall be of reinforced Teflon, luberized bronze, or stainless steel. Seals may be preloaded by packing gland mechanism.

G. Manual valve operators shall be designed to hold the valve disc in any intermediate position between fully opened and fully closed without creeping or fluttering. The operator shall be capable of transmitting sufficient torque to open or close each valve under the most adverse operating conditions. An indicating arrow shall be provided to give full closed, full open, or intermediate disc position indicators.

H. Extension stems shall be provided for all valves in buried locations and in other locations where indicated on the Drawings.

I. Extension stems shall be fabricated from solid steel shafting not smaller in diameter than the stem of the valve or from galvanized steel pipe having an internal diameter not smaller than the diameter of the valve stem. Stem couplings shall be both threaded and keyed to the coupled stems and shall be of standard design and construction. Pipe couplings will not be acceptable.

J. Stems for buried valves shall extend to within 6 inches of the surface of the ground. Each extension stem shall be connected to the valve operator with a suitable universal joint type coupling. All connections shall be pinned. Each extension stem shall be provided with spacers which will center the stem in a valve box having an inside diameter of approximately 5 inches, and shall be equipped with a standard AWWA wrench nut as described in AWWA C500, except where handwheels are indicated.

2.16 Linings and Coatings for Valves

A. Valves 4 inches and larger and hydrants shall be lined and coated.

B. Buried and exposed valves shall be coated inside and out with a rust inhibiting epoxy primer, followed by an epoxy coating meeting the requirements of AWWA C550, applied at the factory.

C. After installation, exterior surfaces of exposed valves shall be painted with two coats Tnemec Series 2 Tneme-Gloss, Glidden Life Master Pro High Performance Acrylic No. 6900 Series, or equal, at 4 mils minimum dry film thickness per coat. Paint color to be in accordance with local utility requirements.

2.17 Gate Valves

A. Standard gate valves (pressure up to 75 psi) 2½ inches and smaller shall be Powell Fig. 500, Jenkins Fig. 62, or equal. Where pressure is 75 psi - 250 psi, gate valves 2½ inches and smaller shall be Powell Fig. 380, Jenkins Fig. 270, or equal.

B. Gate valves 3 inches and larger shall be resilient wedge gate valves, conforming to AWWA C509 or AWWA C515. The valves shall be iron body, cast iron fully encapsulated molded rubber wedge complying with ASTM D2000, non-rising stem with O-ring seals. Valves shall open counterclockwise. Valves shall be Mueller 2360 Series, American Series 2500, Clow F-1600 Series, or U.S. Pipe Metroseal 250.

C. Tapping valves and sleeves shall be approved AWWA type of the size required. Valves shall conform to the requirements of AWWA C509.

2.18 Air Release Valves

A. Valves shall have heavy duty compound lever operating mechanism, 316 stainless steel pivot pins and retaining rings. Valves shall be cast iron ASTM A48, class 35, 316 stainless steel trim and float. Valves shall have adjustable orifice button, 316 stainless steel, with Buna-n seating. Provide ½" threaded outlet and stainless steel plug for top cover and body drain. Valves shall be capable of withstanding operating pressures of 150 psi.

B. Valves shall be Valmatic 202C or Empire 940.

2.19 Butterfly Valves

A. Butterfly valves shall meet or exceed the design strength, testing and performance requirements of AWWA C504, Class 150.

B. Valve body shall be mechanical joint end type valve constructed of cast iron or ductile iron.

C. Disc shall be one piece cast design with no external ribs transverse to flow. Disc shall be cast iron or ductile iron.

D. The resilient seat shall mate with a 304 or 316 stainless steel surface.

E. Valve seats for valves 14 inch diameter and larger shall be mechanically retained, and may be installed on either the body or disc. O-ring seats on valve discs are unacceptable. Seats for valves 14 inch diameter and larger shall be fully field replaceable without the use of special tools.

F. Operators of the enclosed traveling-nut type shall be provided unless otherwise indicated.

G. Valves shall be Mueller Lineseal B-3211, Kennedy BFV-84, Clow 1450, or DeZurik AWWA Series.

2.20 Corporation Stops

Corporation stops shall be 1 inch, 1½ inch or 2 inch brass, equipped with connections suitable for service piping. Conformance with AWWA C800 and C901 is required.

2.21 Curb Stops

Curb stops shall be manufactured of 85-5-5-5 bronze conforming to ASTM B62. Curb stops shall be sized to match the meter size. Conformance with AWWA C800 and C901 required.

2.22 Valve Boxes

A. All buried valves shall be provided with adjustable valve boxes approximately 5 inches in diameter with a minimum thickness of 3/16 inch and constructed so that the removable cover will not be thrown out by travel over it. Valve boxes shall be of sound, close grained cast iron, free from flaws and defects, built strong and rugged enough to withstand the shock of street traffic.

B. Valve boxes shall be of sufficient length to operate all valves buried in the ground. Valve boxes shall consist of base, center section, and top section with cover.

C. Valve boxes located in unpaved areas shall be Slip Type design to permit movement of the top section without transmitting forces onto the valve body.

D. Valve boxes shall have valve box covers with the inscription "WATER" or “RECLAIMED WATER” cast thereon.

E. All valve box covers shall be painted in an approved manner with the primer paint being Kopper's "Glamortex" no. 622 rust primer and the finish paint shall be two coats of enamel to color as required by the utility company.

2.23 Curb Boxes

Boxes for curb stops shall be manufactured of heavy cast iron and shall be of the telescopic type with a tar base enamel coating inside and outside. Base of curb boxes shall be Minneapolis type. Covers for curb boxes shall be marked "Water" or “Reclaimed Water”.

2.24 Hydrants

A. Hydrants shall conform to AWWA C502 and shall be furnished complete with wrench and other appurtenances. Manufacturer's certification of compliance with AWWA C502 and tests listed therein will be required.

B. All hydrants shall be of breakable type, with the breakable section located slightly above the finish ground line. Hydrants shall contain two 2½ inch hose connections and one 4½ inch steamer connections with national standard fire hose coupling screw threads, 5¼ inch valve opening, 6 inch diameter mechanical joint inlet, 1½ inch pentagon operating nut. The hydrants shall open counterclockwise.

C. All hydrants shall be painted in an approved manner with the primer paint being Kopper's "Glamortex" no. 622 rust primer and the finish paint shall be two coats of enamel or special coating to color as required by the utility company.

D. Hydrants shall be Mueller Centurion (Traffic model A-423), American-Darling B-84-B, Kennedy K-81A, or Clow Medallion F-2545.

2.25 Pipeline Identification Tape

A. Identification tape shall be an inert plastic film specifically formulated for prolonged underground use. Minimum thickness 4 mils, width 6 inches, letter size 1 inch. Lettering shall be continuous.

B. Tape shall be the standard product of a manufacturer regularly engaged in the supply of this tape. Provide tape with adhesive backing for attachment to pipe.

C. Identification tape color and lettering shall be:

1. Potable Water Mains and Fire Mains - "POTABLE WATER MAIN", black printing on blue background
2. Reclaimed Water Mains - “RECLAIMED WATER MAIN”, black printing on purple background

2.26 Pipeline Warning Tape

A. Warning tape shall be 6 inch wide vinyl continuous tape, for identification and warning purposes. It shall be color coded and worded as follows:

1. Potable Water Main and Fire Main - Blue with black lettering, “CAUTION: WATER MAIN BURIED BELOW”.
2. Reclaimed Water Main - Purple with black lettering, “CAUTION: RECLAIMED WATER MAIN BURIED BELOW”

2.27 Locating Wire

Locating wire shall be color-coded 12 gage continuous insulated wire. Color coding shall be similar to warning tape colors.

PART 3 EXECUTION

3.01 General Installation Requirements

A. All lengths of pipe shall be dimensioned accurately to measurements established at the site, and shall be worked into place without springing or forcing.

B. Cut all pipe and drill all holes that may be necessary. Cut sections of pipe shall be reamed or filed to remove all burrs. The pipe interior and joints shall be thoroughly cleaned before being installed and kept clean during construction.

C. All changes in direction shall be made with fittings or approved joint deflection. Bending of pipe, except copper and polyethylene, is prohibited. Joint deflection shall not exceed 75 percent of the manufacturer's recommended maximum deflection.

D. Any transition from one pipe size to another shall be made with a reducing fitting. Reducing bushings are prohibited except where specifically indicated on the Drawings or approved by the Engineer.

E. Make adequate provision for expansion and contraction of piping.

F. Trenching, bedding and backfilling shall be in accordance with Section 02 32 00.

G. Valves shall be installed in all pipe ahead of appliances and equipment not furnished with stops, and elsewhere as required for proper control and isolation of sections of systems for maintenance purposes.

H. Minimum cover over pipe shall be 36 inches.

3.02 Concrete Cradles and Encasement

Concrete cradles and encasement shall be as indicated on the drawings, or as directed by the Engineer. All concrete cradles and anchors shall be of Class B concrete.

3.03 Separation of Non-Potable and Potable Water Lines

A. The horizontal separation between water mains and sanitary sewer, storm sewer, wastewater force mains, stormwater force mains, reclaimed water mains and onsite sewage treatment and disposal systems shall be in accordance with the following:

1. The outside of water mains shall be a minimum of three feet from the outside of any existing or proposed storm sewer, stormwater force main, vacuum type sanitary sewer and reclaimed water main.
2. The outside of water mains shall be a minimum of six feet from the outside of any existing or proposed gravity sanitary sewer and wastewater force main. The minimum horizontal separation distance between the outside of water mains and the outside of gravity sanitary sewers can be reduced to three feet where the bottom of the water main is at least six inches above the top of the sewer.
3. The outside of water mains shall be a minimum of ten feet from all parts of any existing or proposed onsite sewage treatment and disposal system such as septic tanks, drainfields, and grease traps. Onsite sewage treatment and disposal systems do not include package sewage treatment facilities and public wastewater treatment facilities.

B. The vertical separation between water mains and sanitary and storm sewer, wastewater or stormwater force mains, and reclaimed water mains shall be in accordance with the following:

1. Wherever possible, water mains shall cross over existing or proposed gravity sanitary sewer, vacuum type sanitary sewer, and storm sewer, so the outside of the water main is at least six inches above the outside of the sewer. Where it is not possible for the water main to cross over existing or proposed gravity sanitary sewer, vacuum type sanitary sewer, and storm sewer, then the water main can cross under these types of pipeline systems provided the outside of the water main is at least 12 inches below the outside of the pipeline. At the crossing, the proposed pipe joints shall be arranged so that all water main joints are at least three feet from vacuum type sanitary sewer or storm sewer joints, and at least six feet from gravity sanitary sewer joints.
2. Wherever possible, water mains shall cross over existing or proposed reclaimed water mains, wastewater force mains and stormwater force mains. Whether the water main crosses over or under these types of pipeline systems, the outside of the water main shall be at least 12 inches from the outside of the existing or proposed reclaimed water main, wastewater force main and stormwater force main. At the crossing, the proposed pipe joints shall be arranged so that all water main joints are at least three feet from reclaimed water main joints and stormwater force main joints, and at least six feet from the joints of wastewater force mains.

C. No water main shall pass through or come in contact with any part of a sanitary sewer manhole.

D. The following are acceptable alternative construction variances where it is not possible to meet the separation requirements, and are only to be implemented upon receipt of expressed written consent from the Engineer and approval from FDEP. Implementation of these measures without the expressed written consent of the Engineer and approval by FDEP could result in the requirement that the installed unapproved measures be removed and replaced at no cost.

1. Where a water main is less than the required minimum horizontal distance from another pipeline and or where a water main crosses another pipeline and joints in the water main are less than the minimum required distance between the joints in the other pipeline:

   a. Use of pressure rated pipe conforming to AWWA standards for a gravity or vacuum type pipeline.
   b. Use of welded, fused, or otherwise restrained joints for either pipeline.
   c. Use of watertight casing pipe or concrete encasement at least four inches thick for either pipe.

2. Where a water main is less than three feet horizontally from another pipeline and or where a water main crosses another pipeline less than the required minimum separation:

   a. Use of pipe or casing pipe, having high impact strength (at least equal to 0.25 inch thick ductile iron pipe), or concrete encasement at least four inches thick for the water main and for the other pipeline if the other pipeline coveys wastewater or reclaimed water.

3.04 Plugs

A. Installed piping systems shall be temporarily plugged at the end of each day's work, or other interruption to progress on a given line. Plugging shall be adequate to prevent entry of small animals or persons into the pipe or the entrance or insertion of deleterious materials.

B. Standard plugs shall be inserted into all dead-end pipes, tees, or crosses; spigot ends shall be capped; flanged and mechanical joint ends shall have blind flanges of metal.

C. Plugs installed for pressure testing shall be blind flanges fully secured and blocked to withstand the test pressure.

D. Where plugging is required because of contract division or phasing for later connection, the ends of such lines shall be equipped with a permanent type plug or blind flange. Installation or removal of such plugging shall be considered incidental to the work.

3.05 Ductile Iron Pipe

A. Mechanical joints: install according to the manufacturer's specifications. Socket and gasket shall be clean and gasket shall be properly centered before joint is made.

B. Push-On Type Joints: Remove any foreign matter in the gasket seat, wipe gasket clean, flex and place in socket. Apply thin film of lubricant to inside surface of gasket. Complete joint assembly by forcing the plain end of the entering pipe past the gasket until it makes contact with the bottom of the socket.

C. Flanged Joints: Bolt flanged joints with care so there is no restraint on the opposite end of the piece, which would prevent pressure from being evenly and uniformly applied upon the gasket. The pipe or fitting must be free to move in any direction while bolting. Gradually tighten bolts, each in turn, at a uniform rate of gasket compression around the entire flange.

3.06 O-Ring Type Push-On Joints for PVC Pipe

A. Clean the pipe end and the bell thoroughly. Insert O-Ring gasket, making certain it is properly oriented. Lubricate the spigot well with an approved lubricant; do not lubricate the bell or O-ring. Insert the spigot end of the pipe carefully into the bell until the reference mark on the spigot is flush with the bell.

B. Field cut pipe shall be beveled, have all burrs removed, and shall have a reference mark applied the correct distance from the end.

3.07 Solvent Cement Joints for Plastic Pipe

A. Bevel the pipe end and remove all burrs before making joint. Clean both pipe and fittings thoroughly. Do not attempt to make solvent cement joints if temperature is below 40 degrees F nor in wet conditions.

B. Apply a complete coating of primer to the outside surface of the pipe end and to the mating inside surface of the socket. Apply a liberal coat of solvent cement to the pipe and socket. Immediately after application of cement, insert the pipe to the full depth of the socket while rotating the pipe or fitting 1/4 turn to evenly spread the cement. Hold joint together for a minimum of 10 to 15 seconds to insure pipe does not back out of socket. Immediately after joining, wipe all excess cement from the pipe and fittings leaving only a small bead of cement around the circumference of the joint. The joint shall be allowed to set for a minimum one half hour before handling.

C. Due to the explosive hazard, the following safety precautions shall be observed in conjunction with the use of solvent weld plastic pipe:

1. Air shall be permitted to circulate through the pipeline to permit solvent vapor to escape.
2. When flushing or filling pipelines, admit water slowly to prevent compression of the gases within pipe.

3.08 Butt Heat Fusion Joints for PE (Polyethylene) Pipe

A. Equipment for butt heat fusion joints shall be as recommended by the pipe manufacturer.

B. Carefully face pipe ends and check for squareness prior to heating ends. Apply clamps as necessary to match outside pipe end diameters. Follow the pipe manufacturer's recommendations concerning temperature, melt time, heat soak times, and joining time. Maintain joining pressure until pipe has cooled to a temperature of 150-160 degrees F.

Handle pipe carefully until joint has returned to ambient temperature. Inspect all joints carefully for any irregularities; cut out and re-do all defective joints.

3.09 Socket Heat Fusion for PE (Polyethylene) Pipe

A. Equipment for socket heat fusion shall be as recommended by the pipe manufacturer.

B. Bevel the pipe end and remove burrs before making joint. Clean heating tool thoroughly and, if tool is not Teflon coated, spray with a silicone release solution. Heat tool to the temperature recommended by the pipe manufacturer. Place both pipe and fitting on the tool until the correct degree of melt is achieved. Remove pipe and fitting from the tool simultaneously and insert the pipe squarely into the fitting; do not turn pipe or fitting during insertion. Avoid any movement of the joint for 10 to 15 seconds. Handle pipe carefully until the joint has returned to ambient temperature.

3.10 Polyethylene Pipe Joining (NA)

3.11 Polyethylene Encasement Installation

A. Install polyethylene encasement in accordance with ANSI/AWWA C105/A21.5.

B. Polyethylene encasement in to be installed on all ductile iron pipe and fittings within 10 feet of gas mains.

C. Cut polyethylene to a length approximately two feet longer than the length of the pipe section. Slip around the pipe, centering it to provide a one-foot overlap and 1 foot overlay on each adjacent pipe section, bunching it accordion fashion lengthwise until it clears the pipe ends. Place a six-inch length of pressure sensitive waterproof tape at approximately three-foot intervals along the pipe length, securing the cut edge of polyethylene sheet.

D. After assembling the pipe joint, make the overlap of the polyethylene tube. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe and secure in place. Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width to make a snug, but not tight, fit along the barrel of the pipe, securing a fold at quarter points.

E. Repair any rips, punctures, or other damage to the polyethylene with pressure sensitive waterproof tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured in place. Proceed with installation of the next section of pipe in the same manner.

F. Where polyethylene wrapped pipe joins a pipe that is not wrapped, extend the polyethylene tube to cover the unwrapped pipe a distance of at least two feet. Secure the end with circumferential turns of tape.

3.12 Buried and Exposed Valves

A. Buried valves 6 inch diameter and larger shall be set on a foundation of solid concrete or stone not less than 8 inches thick nor less than one cubic foot in volume. Foundations shall be set on firmly compacted ground.

B. The height of the valve and its supporting foundation shall conform to the height of the connecting pipe. Valves shall be set in a vertical position unless otherwise indicated on the Drawings.

C. Exposed valves shall be installed in a vertical position wherever possible. Unless otherwise indicated or directed by the Engineer, valve stems shall never be below a horizontal position.

D. Open and close each valve observing full operation prior to installing successive lengths of pipe.

3.13 Air Release Valves

Air release valves shall be placed at high points of the pipeline to permit escape of trapped air. The valve size, location and method of installation shall be indicated on the Drawings or as directed by the Engineer.

3.14 Valve Boxes and Curb Boxes

A. Boxes shall rest on the valve and shall be adjusted so that the cover may be set flush with paving; in areas without paving, set the cover as directed by the Engineer. Boxes shall be set to allow equal movement above and below finish grade.

B. The base of the box shall be centered over the valve, and the top of the base section shall be approximately on line with the nut on top of the valve stem. The entire assembly shall be plumb.

3.15 Hydrants

A. Blue pavement reflectors (cat eyes) shall be placed in the centerline of the driving lane directly in front of the fire hydrant.

B. All hydrants shall be inspected in the field upon delivery to the job to insure proper operation before installation.

C. There shall be no trees, shrubs, or landscaping planted around the fire hydrants or in areas designated as fire lanes.

D. Final field location of all hydrants shall be as approved by the utility. All hydrants shall be located no less than three feet (3') and no more than eight feet (8') from back of curb of the adjacent roadway, or seven (7) feet from the edge of pavement, and no less than five (5) feet from any physical feature which may obstruct access or view of any hydrant unless otherwise approved by the utility.

E. Hydrants shall be plumb and shall be set so that the lowest hose connection is, at least, eighteen (18) inches above the surrounding finished grade.

F. Combustible construction cannot occur until proper documentation has been submitted to the local fire marshal. Documentation shall show that hydrants have been installed, tested, and are in proper working order.

G. New or relocated fire hydrants shall be located such that the underground drain (weep hole) is at least:

1. Three feet from any existing or proposed storm sewer, stormwater force main, reclaimed water main, or vacuum type sanitary sewer.
2. Six feet from any existing or proposed gravity sanitary sewer and wastewater force main.
3. Ten feet from any onsite sewage treatment and disposal system such as septic tanks, drainfields, and grease traps. Onsite sewage treatment and disposal systems do not include package sewage treatment facilities and public wastewater treatment facilities.

3.16 Installation of Identification and Warning Tape

A. Install identification tape on all pipelines. Place tape as follows:

1. 2 inch through 8 inch diameter pipe - center along top half of pipe
2. 10 inch through 18 inch diameter pipe - place along both sides of the top half of pipe
3. 20 inch diameter and larger pipe - place on both sides of top half of pipe with a third strip centered along top half of pipe

B. Place tape from joint to joint on every section of pipe.

C. Install warning tape along all pipelines. Install 2 feet above pipe, minimum of 1 foot below grade.

3.17 Locator Wire

A. Install locator wire along all pressurized pipelines 2 inch diameter and larger. Loop wire into all valve boxes.

B. Test the locate wire for continuity and submit report documenting the continuity testing. Repair or replace locate wire at failed test locations as directed by Owner.

3.18 Testing General Requirements

A. Test procedures and method of disposal of water shall be approved by the Engineer. All tests shall be made in the presence of the Engineer and utility. Preliminary tests made by the Contractor without being observed by the Engineer will not be accepted. Notify the Engineer and the utility companies at least 48 hours before any work is to be inspected or tested.

B. All defects in piping systems shall be repaired and/or replaced and retested until acceptable. Repairs shall be made to the standard of quality specified for the entire system.

C. Sections of the system may be tested separately, but any defect which may develop in a section previously tested and accepted shall be promptly corrected and retested. Pressure tests shall be made between valves to demonstrate ability of valves to sustain pressure.

D. Provide all necessary test equipment. Increments on gages used for pressure pipe testing shall be of scaled to the nearest 1 psi. Gages, pumps, and hoses shall be in good working order with no noticeable leaks.

E. Tests for any exposed piping shall be made before covering and insulation is placed.

F. The pressure and leakage test for buried piping shall be made after all jointing operations are completed and restraints have been in place at least seven days. Lines tested before backfill is in place shall be retested after compacted backfill is placed.

G. All service connections to water and reclaimed water mains shall be completed prior to testing.

H. Sections of piping between valves and other short sections of line may be isolated for testing. If shorter sections are tested, test plugs or bulkheads required at the ends of the test section shall be furnished and installed by Contractor, together with all anchors, braces, and other devices required to withstand the hydrostatic pressure without imposing any thrust on the pipe line. Contractor shall be solely responsible for any damage that results from the failure of test plugs or supports.

I. All items including valves and controls shall be given a thorough test. The entire system shall be operated for two days to prove compatibility of equipment and to achieve proper adjustment for operation. Valves, pipes, tanks, and other items that are non-operating or occasional-operating shall be tested for ability to meet design criteria.

3.19 Pressure and Leakage Testing (PVC and DI Mains)

A. Piping shall be slowly filled with water and all air expelled. Care shall be taken that all air valves are installed and open in the section being filled, and that the rate of filling does not exceed the venting capacity of the air valves.

B. Apply hydrostatic test pressure of 150 psi (water mains and reclaimed water mains), or 200 psi (fire mains) for 10 minutes and for such additional period necessary for the Engineer to complete the inspection of the line under test. Do not exceed pipe manufacturer's suggested time duration at the test pressure. If defects are noted, repairs shall be made and the test repeated until all parts of the line withstand the test pressure.

C. Apply leakage test pressure of 150 psi (water mains and reclaimed water mains), or 200 psi (fire mains). Maintain pressure at a maximum variation of 5 percent during the entire leakage test. The duration of the leakage test shall be two hours minimum, and for such additional time necessary for the Engineer to complete inspection of the section of line under test. Leakage measurements shall not be started until a constant test pressure has been established. The line leakage shall be measured by means of a water meter installed on the supply side of the pressure pump.

D. No leakage is allowed in exposed piping, buried piping with flanged, threaded, or welded joints or buried non-potable piping in conflict with potable water lines.

E. Tested sections of buried piping with slip type or mechanical joints will not be accepted if it has a leakage rate in excess of that rate determined by the formula:

AWWA C-600 Ductile Iron Mains $L = \frac{SD\sqrt{P}}{133200}$

AWWA C-605 PVC Mains $L = \frac{ND\sqrt{P}}{7400}$

L = Maximum permissible leakage rate, in gallons per hour, throughout the entire length of line being tested.

S = Length of line tested (in feet).

D = Nominal internal diameter (in inches) of the pipe.

$\sqrt{P}$ = The square root of the actual pressure in psig on all joints in the tested portion of the line. This actual pressure shall be determined by finding the difference between the average elevation of all tested pipe joints and the elevation of the pressure gauge and adding the difference in elevation head to the authorized test pressure.

N = Number of joints along pipeline being tested.

F. All apparent leaks discovered within one year from the date of final acceptance of the work by the Owner shall be located and repaired by Contractor, regardless of the total line leakage rate.

3.20 Pressure and Leakage Testing (NA)

3.21 Fire Hydrant Testing

The Contractor shall provide a post-construction fire flow test witnessed and approved by the Engineer and the Utility. Hydrants shall deliver a minimum of 1250 gpm with a residual pressure of 20 psi.

3.22 Disinfection

A. Disinfect all potable water lines, fire mains, valves, fittings, hydrants

B. All disinfection work shall be acceptable to the State health authority. If any requirements of this Section are in conflict with requirements of the authority for disinfection, those of the authority shall govern. The water main disinfection and bacteriological sampling and methods of disinfection for all water containment devices and piping systems shall conform to AWWA C651.

C. All equipment used in disinfection work shall be in proper working condition, and shall be adequate for the specified work.

D. Prior to starting any disinfection work, furnish for the Engineer's approval, a detailed outline of the proposed sequence of operation, manner of filling and flushing units, source

and quality of water to be used, and disposal of wasted water. Admission of contaminated water into previously disinfected units must be prevented.

E. Chlorine gas-water solution or direct chlorine feed is preferred for disinfection. Use of high-test calcium hypochlorite or the tablet method of disinfection must be approved by the Engineer and must be in accordance with AWWA procedures. Tablet form calcium hypochlorite may be used only for water lines up to 12" in diameter and less than 2,500 feet in length.

F. The Contractor shall be liable for all damages arising from direct contact of granular calcium hypochlorite with solvent welding materials used to join PVC pipe, if any.

G. A chlorine gas-water solution shall be applied by means of a solution feed chlorinating device, or, if approved by the Engineer, the dry gas may be fed directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the unit being treated. Chlorinating devices for feeding solutions of the chlorine gas shall provide means to prevent the backflow of water into the chlorine cylinder.

H. Granular calcium hypochlorite shall be prepared as a water mixture before introduction into the unit. The dry powder shall first be made into a paste and then thinned to approximately a one percent chlorine solution. To prepare a one percent chlorine solution, add one pound of calcium hypochlorite (65-70 percent available Cl_2) to 7½ gallons of water.

I. Chlorinating agent shall be applied at the supply end of the unit being disinfected. For pipes, disinfectant shall be applied through a corporation cock installed in the top of the pipe.

J. Water shall be introduced at a controlled rate in order to regulate the chlorine dosage. The rate of chlorine mixture flow shall be proportioned to the rate of water entering the unit so the chlorine dose applied shall produce at least 25 mg/l chlorine residual after a period of 24 hours.

K. All valves and appurtenances shall be operated while the line or unit is being disinfected to insure that all surfaces of the valves are disinfected. Valves shall be manipulated to keep the strong chlorine solution and/or contaminated water from flowing into units that have been previously chlorinated and/or flushed.

END OF SECTION

SECTION 02 71 50

BASE COURSE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Aggregate base for asphaltic concrete including sand/shell base and hot-mix sand asphalt base.

B. Related Requirements:
   1. Section 02 30 00 – Earthwork: Excavation, Backfill, and Compaction for Pavement subgrade.

2.01 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
   1. ASTM D1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbs/ft^3 (2,700 kN-m/m^3)).

C. Asphalt Institute.

D. State Highway Department Standard Specifications.

3.01 SUBMITTALS

A. Submit materials certificate to the Owner's Civil Engineering Consultant and the Owner's Construction Testing Laboratory, signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein or on the Construction Drawings.

B. Submit certification of base course materials and placement as specified in Parts 2 and 3 hereinafter.

4.01 WEATHER LIMITATIONS

A. Do not place aggregate when base surface temperature is less than 40 degrees F, nor when air temperature is below 45 degrees F. Do not place aggregate when surface is wet or frozen. Do not place aggregate when weather conditions are unfavorable otherwise.

PART 2 - PRODUCTS

1.01 BASE COURSE MATERIAL

A. Aggregate Base Course: Aggregate base course shall consist of a well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction. Base course may consist of a granular base (crushed slag, stone, or gravel, etc), sand/shell base material, or a hot-mix sand asphalt base.

B. Base course shall be as shown on the drawings, or when not shown, shall be as specified herein.

C. Aggregate base material requirements from State or other local highway agency specifications may be used for aggregate base course for roads, streets, or similar use pavements if the following conditions are met:
   1. Percentage of material by weight passing the No. 200 sieve will not exceed 10.

2. Portion of the material passing the No. 40 sieve must have a liquid limit not greater than 25 and a plasticity index not greater than 5.

D. Aggregate shall consist of clean, sound, durable particles of crushed stone, crushed slag, crushed gravel, angular sand, or other approved material. Aggregate shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.
   1. Coarse aggregates shall be angular particles of uniform density.
   2. Fine aggregates shall be angular particles of uniform density. Fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

E. Gradation: The specified gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of 2 inches and shall be continuously well graded within the following limits:

GRADATION OF AGGREGATES
Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
2 inch	100	----	----
1-1/2 inch	70-100	100	----
1 inch	45-80	60-100	100
1/2 inch	30-60	30-65	40-70
No. 4	20-50	20-50	20-50
No. 10	15-40	15-40	15-40
No. 40	5-25	5-25	5-25
No. 200	0-10	0-10	0-10

NOTE: Particles having diameters less than 0.0008 inch shall not be in excess of 3 percent by weight of the total sample tested.

F. Hot-mix Sand Asphalt Bases: Asphalt Institute Type VI, VII, or VIII Mixes for Hot-mix Sand Asphalt Bases. Hot-Mix base shall be used only under asphaltic concrete surfaces.

PART 3 - EXECUTION

1.01 EXAMINATION

A. Contractor shall verify to the Owner in writing that the subgrade has been inspected, tested, and gradients and elevations are correct, dry, and properly prepared in accordance with Section 02 30 00.

2.01 CONSTRUCTION

A. Perform base course construction in accordance with the applicable State standard specifications or as shown or specified.

B. Perform base course construction in a manner that will drain the surface properly and prevent runoff from adjacent areas from draining onto base course construction.

C. Compact base material to not less than 98 percent of optimum density, as determined by ASTM D1557 unless otherwise indicated on the Drawings.

D. Construct to thickness indicated on Construction Drawings. The minimum base thickness as shown on drawings shall be achieved throughout all pavement areas.

1. Granular Base: Apply in lifts or layers not exceeding 8-inches, measured loose.
2. Sand/Shell Base: Apply in lifts or layers not exceeding 4-inches, measured loose.
3. Hot-mix Sand Asphalt Bases: Apply in lifts or layers not exceeding 3-inches, measured loose.

3.01 FIELD QUALITY CONTROL

A. Field quality control testing and inspection shall be at the discretion of the Contractor (except for specified mandatory testing listed below) as necessary to assure compliance with Contract requirements. Owner T&I shall not be considered a substitute for the Contractor's responsibility to perform similar routine, necessary, and customary testing and inspection of the methods and frequency suitable for the type of work involved.

B. Mandatory Testing and Inspection:
1. Measure base course tolerances no more than 25 ft. on center with a rod and level or stringline.
2. Certify in writing to the Owner that base course placement is in accordance with Contract Document requirements prior to subsequent work thereon.

4.01 OWNER TESTING AND INSPECTION (T&I) AND OBSERVATION

A. The general contractor will perform testing and inspection (T & I) as specified in Section 01 40 00.

END OF SECTION

SECTION 02 74 00

ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Asphalt concrete binder and surface course.

B. Related Requirements:

1. Section 02 30 00 - Earthwork.
2. Section 02 71 50 - Base Course.

2.01 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. The Asphalt Institute (AI):
1. MS-2 - Mix Design Methods For Asphalt Concrete And Other Hot-Mix Types.

C. State Highway Department Standard Specifications
1. Standard Specifications for Construction and Materials – Local in the state where project is located.

D. ASTM International (ASTM):
1. ASTM D1188 - Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
2. ASTM D2041 - Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
3. ASTM D2950 - Density of Bituminous Concrete in Place by the Nuclear Methods.
4. ASTM D2726 - Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixture.
5. ASTM D5444 - Mechanical Size Analysis of Extracted Aggregate.

E. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO M017 - Mineral Filler for Bituminous Paving Mixtures.
2. AASHTO M140 - Emulsified Asphalt.
3. AASHTO M208 - Cationic Emulsified Asphalt.
4. AASHTO M320 - Performance-Graded Asphalt Binder
5. AASHTO M323 - Superpave Volumetric Mix Design
6. AASHTO T164 - Quantitative Extraction of Asphalt Binder from Hot-Mix Asphalt (HMA)
7. AASHTO T166 - Bulk Specific Gravity of Compacted Hot-Mix Asphalt Mixtures Using Saturated Surface-Dry Specimens
8. AASHTO T209 – Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt (HMA)
9. AASHTO T245 - Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
10. AASHTO T275 - Bulk Specific Gravity of Compacted Hot-Mix Asphalt Mixtures Using Paraffin-Coated Specimens
11. AASHTO T308 - Asphalt Content of Hot-Mix Asphalt (HMA) by the Ignition Method.
12. AASHTOT312 - Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor.

13. AASHTO T331 - Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method

F. National Asphalt Pavement Association (NAPA):
1. IS 123 – Recycling Hot-Mix Asphalt Pavements
2. IS 128 - HMA Pavement Mix Type Selection Guide

A. Occupational Safety and Health Administration (OSHA):
3. OSHA 01926.1153 Respirable Crystalline Silica.

3.01 QUALITY ASSURANCE

A. Pre-installation Meeting: Convene a pre-installation meeting at the site at least two weeks prior to commencing work of this Section. Require attendance of parties directly affecting work of this Section, including, but not limited to, the Owner's representative, CTL's representative and inspector, Contractor, paving sub-contractor and job foreman.
1. Contact Owner three weeks prior to pre-installation conference to confirm schedule.
2. Record discussions of meeting and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. Review foreseeable methods and procedures related to paving work, including the following:
a. Review preparation and installation procedures and coordinating and scheduling required with related work.
b. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
c. Tour, inspect and discuss condition of subgrade, drainage structures, and other preparatory work.
d. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
e. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
f. Review paving requirements (drawings, specifications and other contract documents).
g. Review required submittals, both completed and yet to be completed.
h. Review required inspections, testing procedures.
i. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
j. Review safety precautions relating to placement of paving.

4.01 SUBMITTALS

A. Submit mix designs to the Civil Engineering Consultant of Record at least 30 days prior to beginning asphalt paving operations. Mix designs over one year old will not be accepted by Owner. Mix design submittal shall follow the format as recommended by Asphalt Institutes Manual MS-2 and include the following:
1. Type and Name of mix.
2. Gradation Analysis.
3. Optimum asphalt content.
4. Grade of asphalt binder.
5. Volumetric properties.
6. References to local State Highway Department Specification for each material when applicable.

B. Submit approved mix designs and laboratory test results to CTL signed by the materials producer and Contractor certifying materials and mix ratios conform to the requirements specified herein.

C. Submit certification of asphalt placement as specified in Field Quality Control.

5.01 ENVIRONMENTAL REQUIREMENTS

A. Minimize dust emissions or provide equipment that suppresses dust.

6.01 PROJECT CONDITIONS

A. Weather Limitations:
   1. Apply tack coat when ambient or base surface temperature is above 40 F, and when temperature has been above 35 F for 12 hours immediately prior to application. Do not apply when base is wet, contains excess moisture, during rain, or when frozen.
   2. Construct asphalt concrete paving when ambient temperature is above 40 F.

B. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

1.01 MATERIALS

A. Aggregate: Use locally available materials and gradations that meet local State Highway Department Specifications and exhibit satisfactory records of previous installations. All aggregate requirements, including those for quality, shall meet those in AASHTO M323 for the specified traffic level.

B. Asphalt Binder: Asphalt binder shall be a performance-graded (PG) binder, meeting the requirements of M 320, which is appropriate for the climate and traffic-loading conditions at the site of the paving project and in compliance with the local State Highway Department Specifications for that location, or as specified by the contract documents.
   1. Design reliability shall be 85% for the high- and low-temperature performance.
   2. The minimum required PG binder shall be that which satisfies the required design reliability using the pavement temperature data determined.
   3. The high-temperature grade shall be increased by one grade equivalent to accommodate low traffic speeds.

C. Tack Coat: Emulsified asphalt; AASHTO M140 or AASHTO M208, SS-1h, CSS-1, or CSS-1h, may be diluted with up to 1 part water to 1 part asphalt.

D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M17, if recommended by local State Highway Department Specifications.

E. Reclaimed Asphalt Pavement (RAP): RAP may be used in amounts not to exceed 20% by wt. The mix design shall contain the percentage of RAP that is to be used in the production. Production procedures using RAP material shall conform to NAPA IS 123. Additional RAP provisions shall be as follows:
   1. Material-handling machinery shall not drive on the RAP stockpiles.
   2. RAP maximum top size aggregate introduced into the mix shall be 1-1/2 inches.
   3. Dust (fines) in the RAP, when added to the virgin aggregate, shall not exceed the requirements of the virgin mix design.
   4. Moisture content shall be monitored to assure that the material can be thoroughly dried as it is processed.
   5. Stockpiles shall be left uncovered or stored under the roof of an open-sided building.
   6. Material handling front-end loader operators shall be experienced in handing RAP materials.
   7. RAP shall be loaded in the cold feed bins in small consistent quantities without causing the material to compact in the bin.
   8. RAP shall not be held in the bin for extended periods of time, especially on hot, humid days.
   9. During production, RAP material shall not be allowed to contact open flame.

2.01 AGGREGATE SIZE REQUIREMENTS - SUPERPAVE MIX

A. Nominal Maximum Size The combined aggregate shall have a nominal maximum aggregate size of

4.75 to 19.0 mm for surface courses and no larger than 25 mm for subsurface courses in accordance with Table 3 of AASHTO M323. Selection of the appropriate nominal maximum aggregate size mixture shall be in accordance with NAPA IS 128.

B. Gradation Classification The combined aggregate gradation shall be classified as coarse-graded when it passes below the Primary Control Sieve (PCS) control point as defined in Table 4 of AASHTO M323. All other gradations shall be classified as fine-graded.

3.01 ASPHALT-AGGREGATE MIXTURE

A. Superpave Mix:
1. The initial, design, and maximum number of gyrations shall conform to the following:

Superpave Gyratory Compaction Effort

Design ESALs (Million)	Compaction Parameters		
	$N_{initial}$	N_{design}	N_{max}
< 0.3	6	50	75
0.3 < 3	7	75	115

2. The design, when compacted in accordance with T 312, shall meet the relative density, VMA, VFA, and dust-to-binder ratio requirements specified in the following table. Air voids at N (design) shall be 4.0 percent.

Superpave HMA Design Requirements

Design ESALs[a] (Million)	Required Relative Density, Percent of Theoretical Maximum Specific Gravity			Voids in the Mineral Aggregate (VMA) Percent Minimum				VFA Range, Percent	Dust-to-Binder Ratio Range[b]
				Nominal Maximum Aggregate Size, mm					
	$N_{initial}$	N_{design}	N_{max}	25.0	12.5	9.5	4.75		
<0.3	≤91.5	96.0	≤98.0	12.0	14.0	15.0	16.0	70-80[c]	0.6-1.2
0.3 to <3	≤90.5	96.0	≤98.0	12.0	14.0	15.0	16.0	65-78	0.6-1.2

[a] Design ESALs are the anticipated project traffic level expected on the design project over a 20-year period. Regardless of the actual design life of the project, determine the design ESALs for 20 years.

[b] For the 4.75-mm nominal maximum size mixtures, the dust-to-binder ratio shall be 0.9 to 2.0.

[c] For the 25.0-mm nominal maximum size mixtures, the specified lower limit of the VFA range shall be 67 percent for design traffic levels < 0.3 million ESALs.

3. Aggregate gradation and asphalt content tolerances for acceptance of plant produced mix shall be as follows:

Property	Maximum tolerance for any one sample	Average of samples for given mix for four or more samples
3/4" (19mm)	±7.0	±4.0
1/2" (12.5 mm)	±7.0	±4.0
#4 (4.75mm)	±6.0	±3.5
#8 (2.36mm)	±6.0	±3.5
#50 (0.3mm)	±4.0	±2.3
#200 (0.075mm)	±2.0	±1.2
Asphalt Content	±0.4	±0.3
Air Voids	±2.0	±1.2
VMA	> Min.	> Min.

B. Marshall Mix:

1. The design shall meet the requirements specified in the following table.

Marshall HMA Design Requirements

Design ESALs[a] (Million)	Compaction Effort[b] (Blows)	Design Air Voids, Percent	Voids in Mineral Aggregate (VMA), Percent Minimum				VFA Range, Percent	Minimum Stability, pounds	Flow, inches
			1 in	3/4 in.	1/2 in.	3/8 in.			
< 0.3	50	3-5	12.0	13.0	14.0	15.0	70-82	1000	0.08 – 0.16
0.3 < 3	75	3-5	12.0	13.0	14.0	15.0	20-82	1500	0.08 – 0.16

[a] Design ESALs are the anticipated project traffic level expected on the design project over a 20-year period. Regardless of the actual design life of the project, determine the design ESALs for 20 years.
[b]Flat-foot, static base hammer.

2. Aggregate gradation and asphalt content tolerances for acceptance of plant produced mix shall be as follows:

Property	Maximum tolerance for any one sample	Average of samples for given mix for four or more samples
3/4" (19mm)	±7.0	±4.0
1/2" (12.5 mm)	±7.0	±4.0
#4 (4.75mm)	±6.0	±3.5
#8 (2.36mm)	±6.0	±3.5
#50 (0.3mm)	±4.0	±2.3
#200 (0.075mm)	±2.0	±1.2
Asphalt Content	±0.4	±0.3
Air Voids	±2.0	±1.2
VMA	> Min.	> Min.

PART 3 - EXECUTION

1.01 EXAMINATION

A. Verify that the prepared base material has been inspected, tested, and gradients and elevations are correct, dry, and properly prepared in accordance with Section 02 71 50.

2.01 PREPARATION

A. Proof roll prepared base material surface to check for unstable areas in accordance with Section 02 30 00 including documentation and re-proof rolling as required. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.

B. Establish and maintain required lines and elevations.

C. Cover the surfaces of curbs, gutters, manholes and other structures on which the asphalt concrete mixture will be placed, with a thin, uniform coat of liquid asphalt. Where the asphalt concrete mixture will be placed against the vertical face of an existing pavement, clean the vertical face to remove foreign substances and apply a coating of liquid asphalt at a rate of approximately 0.25 gallons per square yard.

D. Density Control Strips.
   1. Prior to beginning placement of asphalt, construct asphalt concrete density control strips.
   2. Source and type of material, material requirements, and laydown and compaction equipment used for compaction shall be the same as that to be used in the project.
   3. The subgrade or pavement layer upon which the control strip is constructed shall tested prior to construction of the control strip.
   4. The control strip shall be a minimum of 250 linear feet long and one paver width wide.
   5. Rolling the control strip shall continue until no appreciable increase in density is obtained by additional coverages.
   6. Upon completion of rolling, the Contractor shall use a nuclear testing device to establish the mean density of the control strip. The mean density will be based on 10 tests taken at randomly selected sites within the control strip area. The nuclear gauge will be calibrated with the average of 3 cores taken from the same area. The average of the cores shall meet the specified density requirements. The calibration factor between the average nuclear density and average core density shall be applied to the Contractor's nuclear gauge for Contractor's density monitoring.

E. Equipment:
   1. Equipment necessary for the paving of asphalt concrete shall be on the project prior to beginning paving operations.
   2. Maintain equipment in satisfactory operating condition and correct breakdowns in manner that will not delay or be detrimental to the schedule of paving operations.

3.01 APPLICATION

A. Tack Coat:
   1. Apply to contact surfaces of previously constructed asphalt concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphalt concrete or into asphalt concrete pavement.
   2. Apply tack coat to asphalt concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat between each lift or layer of full depth asphalt concrete and sand asphalt bases and on surface of bases where asphalt concrete paving will be constructed.
   3. Apply at rate which produces a residual of asphalt cement between 0.04 and 0.06 gal per sq. yd of surface.
   4. Allow drying until at proper condition to receive paving.

4.01 ASPHALT CONCRETE PLACEMENT

A. Place asphalt concrete mixture on completed, compacted underlying surface, spread, and strike off. Spread mixture at the minimum ambient temperature that will allow the required density to be achieved.

B. Whenever possible, spread pavement by finishing machine; however, inaccessible or irregular areas may be placed by hand methods. Spread hot mixture uniformly to required depth with hot shovels and rakes. After spreading, carefully smooth hot mixture to remove segregated course aggregate and rake marks. Rakes and lutes used for hand spreading shall be type designed for use on asphalt mixtures. Do not dump loads faster that they can be properly spread. Workers shall not stand on loose mixture while spreading.

C. Placement and routing of hauling and placing equipment shall be conducted in a manner to avoid tire tracking of bituminous material onto existing paved surfaces.

D. Paving Machine Placement: Apply successive lifts of asphalt concrete in transverse directions except when placing within small areas, parallel lifts may be placed when considered more practical. Joints of successive parallel lifts shall be offset a minimum of 2 feet. Place surface course parallel to flow of traffic. Place asphalt paving in typical strips not less than 10'-0" wide. Asphalt concrete pavement, including base and surface course, shall be placed in two or more lifts as indicated on drawings. Pavement thicknesses shall be thickness shown on the drawings for each course but not less than 1-1/2 inch nor more than 3 inches for each lift.

5.01 ROLLING AND COMPACTION

A. After being spread, mixture shall be compacted by rolling as soon as it will bear the weight of rollers without undue displacement. Number, weight, types of rollers, and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in workable condition.

B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. Breakdown Rolling: Perform breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling and repair displaced areas by loosening and filling with hot material.

D. Intermediate Rolling: Follow breakdown rolling as soon as possible while mixture is hot. Continue second rolling until mixture has been thoroughly compacted as follows:
   1. Minimum Average Density: 93 percent of theoretical maximum density according to AASHTO T209 or ASTM D2041, with no individual test less than 91 percent nor greater than 97 percent.

E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked. Any masked or marred finish surfaces shall be repaired or smoothed.

H. Compaction at Unsupported Edges of Pavements: Start the first roller pass 12-15 inches from the unsupported edge. Allow the uncompacted asphalt to act as a dike to hold the mat in place. The final pass over the uncompacted dike should not slough off if the roller is supported on the compacted mat.

6.01 JOINTS

A. General: Place each asphalt paving layer as continuous as possible to keep the number of joints to a minimum. Create joints between old and new pavement, between successive days work, and where the mixture has become cold (less than 140 degrees F). Make these joints in such a manner as to create a continuous bond between the old and new pavement construction courses.

B. Construction joints shall have same texture, density, and smoothness as other sections of asphalt concrete course.

C. Transverse Joints: If placing of material is discontinued or if material in place becomes cold, make a joint running perpendicular to the direction traveled by the paver. Before placement continues, trim the edge of the previously placed pavement to a straight line perpendicular to the paver and cut back to expose an even vertical surface for the full thickness of the course. When placement continues, position the paver on the transverse joint so that sufficient hot mixture will be spread in order to create a joint after rolling that conforms to the required smoothness. If the temperature of the previously placed pavement material drops below 140 degrees F before paving is resumed, give the exposed vertical face a thin coat of liquid asphalt just before paving is continued.

D. Longitudinal Joints: Coat longitudinal joints that are not completed before the previously laid mixture has cooled to a temperature below 140 degrees F, with liquid asphalt just before paving is continued.

7.01 FIELD QUALITY CONTROL

A. Field quality control testing and inspection shall be at the discretion of the Contractor (except for specified mandatory testing listed below) as necessary to assure compliance with Contract requirements. Owner T&I shall not be considered a substitute for the Contractor's responsibility to perform similar routine, necessary, and customary testing and inspection of the methods and frequency suitable for the type of work involved.

B. Mandatory Testing:
   1. Pavement Thickness: Measure pavement thickness behind the paver at the beginning of and during pavement placing operations to assure proper thickness.
   2. Field Density Test For In-Place Materials: In-place density tests by nuclear method in accordance with ASTM D2950. Nuclear density shall be correlated with ASTM D1188 or D2726 or AASHTO T166, T275, T331 as applicable.
      a. Density tests on subgrades and aggregate base courses to be overlaid by pavements shall be performed within 48 hours prior to placement of the pavement lift. If inclement weather occurs after testing, retest prior to placement of next lift. Testing frequencies shall be as specified in Sections 02 30 00 and 02 71 50 respectively.

C. Coring holes remaining from cores taken by the CTL shall be immediately filled by the Contractor with full depth, hot-mix asphalt concrete or non-shrink grout tinted to match the surrounding pavement.

D. Obtain test samples for volumetric testing from the truck at the asphalt plant. Mixture samples shall be taken at least 2 times for every 8 hour day. Deliver samples to the CTL for testing by the CTL:

E. Areas of deficient paving, including compaction, smoothness, thickness, and asphalt mixture, shall be delineated, removed, and replaced in compliance with specifications requirements. Alternative remedial or corrective measures for repair of deficient paving may be allowed provided a plan of corrective action is submitted in the form of a Request For Information (RFI) and the plan is approved by the CEC.

F. Provide certification in writing that asphalt placement is in accordance with specification requirements.

G. Provide documentation to the CTL of proof rolling and of subgrade and aggregate base compaction testing prior to pavement placement each day in the areas to be paved including the density control strip.

END OF SECTION

SECTION 02 75 10

CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Preparation and placement of Portland cement concrete parking areas.
2. Preparation and placement of Portland cement concrete roads and entrances.
3. Aggregate base below slab.
4. Exterior light pole bases.

B. Related Requirements:
1. Section 02 30 00 - Earthwork: Excavation, backfill, compaction for subgrades.

2.01 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Concrete Institute (ACI):
1. ACI 117 - Tolerances for Concrete Construction and Materials and Commentary.
2. ACI 301 - Structural Concrete.
3. ACI 305.1- Hot Weather Concreting.
4. ACI 306.1- Cold Weather Concreting.
5. ACI 308.1 - Curing Concrete.
6. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary.

C. American Society for Testing and Materials (ASTM):
1. ASTM A 36 - Structural Steel.
2. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
3. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
4. ASTM C31 - Making and Curing Concrete Test Specimens in the Field.
5. ASTM C33 - Concrete Aggregates.
6. ASTM C 39 - Comprehensive Strength of Cylindrical Concrete Specimens.
7. ASTM C42 - Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
8. ASTM C94 - Ready-Mixed Concrete.
9. ASTM C138 - Unit Weight, Yield, and Air Content (Gravemetric) of Concrete.
10. ASTM C143 - Slump of Hydraulic Cement Concrete.
11. ASTM C150 - Portland Cement.
12. ASTM C172 - Sampling Freshly Mixed Concrete.
13. ASTM C231 - Air-Content of Freshly Mixed Concrete by the Pressure Method.
14. ASTM C260 - Air-Entraining Admixtures for Concrete.
15. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
16. ASTM C403 - Time of Setting of Concrete Mixtures by Penetration Resistance
17. ASTM C618 - Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.
18. ASTM C920 - Elastomeric Joint Sealants.
19. ASTM C989 - Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
20. ASTM C1064 - Temperature of Freshly Mixed Portland Concrete Cement.

21. ASTM C1218 - Water-Soluble Chloride in Mortar and Concrete.
22. ASTM C1602 - Mixing Water used in the Production of Hydraulic Cement Concrete.
23. ASTM D98 - Calcium Chloride
24. ASTM D 698 - Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. (2.49 Kg) Hammerand 12-in (305 mm) Drop.
25. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous).
26. ASTM D1241 - Materials for Soil-Aggregate Subbase, Base and Surface Courses
27. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
28. ASTM D1752: Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
29. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
30. ASTM D3575: Standard Test Methods for Flexible Cellular Materials Made From Olefin Polymers.

D. Federal Specifications (FS):
   1. FS HH-F-341 - Fillers, Expansion Joint: Bituminous (Asphalt & Tar)

E. International Code Council, Inc.:
   1. International Building Code (IBC).

F. State Highway Department Standard Specifications.

G. National Ready-Mixed Concrete Association:
   1. NRMCA Inspection Standards

3.01 SUBMITTALS

A. Submittal Procedures: Unless otherwise specified herein, submit in accordance with procedures specified in Section 01 30 00.

B. Obtain CEC approval for Mix Design and Pavement Joint and Placement Plan prior to commencement of work.

C. Submit submittal items required within this section in a single submittal. Identify submittals explicitly in accordance with Procedures paragraphs in Section 01 30 00.

D. Sieve Analysis for Aggregate Base: Submit current sieve analysis report, sampled and tested within the last 60 days of submittal date, for aggregate base and choker material.

E. Concrete Batch Plant Certifications: Submit name and address of the concrete supplier's batch plant and plant certification(s) by National Ready-Mix Concrete Association and/or State Department of Transportation.

F. Mix Design:
   1. Fill out and submit attached Concrete Mix Design Submittal Form.
   2. Submit three copies of each proposed mix.
   3. Submit separate mix design for concrete to be placed by pumping in addition to the mix design for concrete to be placed directly from the truck chute.
   4. Submit mix design to the Civil Engineering Consultant of Record, the Owner's Construction Testing Laboratory, and the Owner's Assigned Concrete Sub-Consultant.
   5. Include applicable information shown on the Mix Design Submittal Form and the following:
      a. Proportions of cementitious materials, fine and coarse aggregate, and water.

b. Water-cementitious material ratio, 28-day compressive design strength, slump, and air content.
c. Type of cement, fly ash, slag and aggregate.
d. Aggregate gradation.
e. Type and dosage of admixtures.
f. Special requirements for pumping.
g. Range of ambient temperature and humidity for which design is valid.
h. Special characteristics of mix which require precautions in mixing, placing, or finishing techniques to achieve finished product specified.

6. Materials and methods for curing concrete.

G. Attachments to Concrete Mix Design: Submit the following as attachments to be included with the Concrete Mix Design:
1. Cementitious materials mill test reports for the following:
a. Portland cement
b. Fly ash
c. Slag
2. Designation, type, quality, and source (natural or manufactured) of coarse and fine aggregate materials.
3. Sieve Analysis Reports: Provide separate sieve analysis of percentages passing for coarse and fine aggregate. Show values for each sieve size shown on the mix design form. Do not leave any line blank. Sieve analysis sampling and testing for each aggregate source shall be conducted within 60 days of concrete submittal date.
4. Aggregate Supplier Statement:
a. Stating if aggregate is possibly alkali-reactive based on tests or past service.
b. Stating if aggregate can possibly cause pop-outs, “D” cracking, or other disruptions due to moisture gain, freezing, or other mechanisms, based on tests or past service.
5. Product data for the following concrete materials admixtures:
a. Water reducing
b. Set retarding
c. Set accelerating
d. Data indicating chloride ion content information for each admixture
6. Concrete compressive strength data as required by ACI 318.
7. Concrete supplier approval of mix design.
8. Chloride-Ion Content: Measured water-soluble chloride-ion content (percent by weight of cementitious materials) in accordance with ASTM C1218.
9. Time of Initial Setting: Initial setting time in accordance with ASTM C403.

H. Product Data: Submit certified laboratory test data or manufacturer’s certificates and data for the items listed below certifying that materials are in conformance requirements specified herein. Submit to the Civil Engineering Consultant of Record and the Construction Testing Laboratory for review and approval and within 7 calendar days after receipt of Notice-to-Proceed.
1. Portland cement concrete mix design(s)
2. Type and source of Portland cement, fly ash, and slag
3. Aggregate gradations
4. Joint back-up material
5. Soft preformed joint filler
6. Pavement joint sealant
7. Dowel bars
8. Tie bars
9. Reinforcing steel bars
10. Welded wire fabric
11. Air entraining admixtures

12. Water-reducing, set-retarding, and set-accelerating admixtures (if used)

I. Pavement Joint and Placement Plan: For projects with all-concrete parking lots, provide a placement plan identifying the items listed below.
   1. Concrete truck access location.
   2. Extent of placements including width, length, slab placement area and volume.
   3. Locations of construction joints.
   4. Location of sawn contraction joints if different from those shown on the civil drawings.

J. Pre-Slab Installation Meeting:
   1. Provide record of notification of pre-slab meeting including company name, persons contacted, and date and method of contact.
   2. Provide meeting minutes to all participants.

K. Delivery Tickets:
   1. Copies of delivery tickets for each load of concrete delivered to site.
   2. Indicate information required by ASTM C 94 on each ticket including additional information required for slabs.
   3. Information on ticket shall include quantities of material batched including the amount of free water in the aggregate and the quantity of water that can be added at the site without exceeding the maximum water cementitious ratio of the approved mix design. Aggregate moisture corrections shall be based on ASTM definitions of aggregate moisture content and absorption.
   4. Mix identification number on ticket shall match number on submitted and approved mix design.

L. Installation Certification: Submit certification in writing that final placement is in accordance with specification requirements.

M. Statement of Approval of Concrete Supplier: Submit statement with information specified in Quality Assurance paragraph below.

4.01 QUALITY ASSURANCE

A. Concrete Truck Inspection:
   1. Conform to ASTM C94, NRMCA, and Department of Transportation standards in state where project is located.
   2. Perform inspections immediately before starting concreting operations.
   3. Record acceptable truck numbers.
   4. Record the identification numbers of those trucks found to be acceptable on the basis of inspections.
   5. Do not bring on site for concreting operations, any truck whose identification numbers are not recorded as acceptable.

B. Tolerances:
   1. Conform to most stringent requirements of ACI 117 and ACI 301 except as specified herein.
   2. Conform to ACI 117 thickness tolerances for slabs-on-ground.

C. Concrete Supplier Approval:
   1. The concrete supplier shall be fully approved and acceptable by the concrete subcontractor as the producer of concrete for which the subcontractor is to place and finish. Prepare Statement of Approval of Concrete Supplier stating project name, name of concrete supplier, along with the statement of approval and the signatures of the Contractor and concrete pavement subcontractor.

D. Pre-installation Meeting: Convene a pre-installation meeting at the site at least two weeks prior to commencing work of this Section. Require attendance of parties directly affecting work of this Section, including, but not limited to, the Owner's representative, CTL's representative and inspector, Contractor, concrete sub-contractor and job foreman, concrete supplier, and base fine grading contractor.
   1. Contact Owner Thirty days prior to pre-installation conference to confirm schedule.
   2. Record discussions of meeting and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. Review foreseeable methods and procedures related to paving work, including the following:
   3. CTL's testing and inspection procedures.
   4. Concrete finishes and finishing.
   5. Cold- and hot-weather concreting procedures.
   6. Curing procedures.
   7. Concrete design mixture and examine procedures for ensuring quality of concrete materials.
   8. Proposed sources of concrete materials, including capabilities and location of plant that will manufacture concrete.
   9. Tour, inspect and discuss condition of subgrade, drainage structures, and other preparatory work.
   10. Requirements for protecting concrete work, including restriction of traffic during installation period and for remainder of construction period.
   11. Review and finalize construction schedule and verify availability of materials.
   12. Concrete paving requirements (drawings, specifications and other contract documents).
   13. Required submittals, both completed and yet to be completed.
   14. Weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
   15. Safety precautions relating to placement of concrete.

5.01 ENVIRONMENTAL REQUIREMENTS

A. Concreting in Hot, Dry, or Windy Weather:
   1. Employ precautions to avoid cracking when the concrete rate of evaporation exceeds 0.1 pounds per square foot per hour or when any combination of concrete materials and weather conditions are favorable for the formation of plastic shrinkage cracks.
   2. Maintain an accurate reading thermometer at the job site to check temperature of concrete.
   3. Reject concrete if more than one slump adjustment, as defined in ASTM C 94, is required.
   4. Do not place concrete when forms, subgrade, aggregate base, or reinforcing bars are more than 120 F or the temperature differential between the forms, aggregate base, or reinforcing bars and concrete will create conditions favorable for settlement cracks or thermal cracking.

B. Concreting in Cold Weather:
   1. Conform to ACI 306.1 when temperature and other environmental conditions are as noted therein.
   2. Subgrade shall be thawed to depth of 12 inches immediately before placing concrete.
   3. Measure and record concrete temperature during protection period in each placement at regular time intervals, but not less than 3 times per 24 hour period.
   4. Do not place slabs on subgrade or base that is more than 20°F cooler than concrete. Warm subgrade or base to decrease temperature differential to 20 F or less

6.01 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

1.01 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Coat forms with nonstaining type of coating that will not discolor or deface surface of concrete.

B. Aggregate Base and Choker Materials:
   1. Aggregate Base Material:
      a. Gradation: Conform to gradation shown on the Civil Drawings.
      b. Equivalent Gradation: Equivalent gradations may be used upon approval of the Civil Engineer of Record. Submit proposed equivalent gradation to the Architect for approval within 30 days after the award of contract. Equivalent gradation shall be one of the following.
         1) Any state DOT approved road base material meeting the following gradation:

Std. Sieve Size	% Passing
No. 1-1/2	100
No. 4	15-55
No. 200	5-12

         2) Material conforming to the General Requirements and of the Gradation “A”, ”C”, or “D” requirements (with the modified allowance of 5% to 12% passing the No. 200 sieve) as defined by ASTM D1241
   2. Aggregate Choker Material: Clean granular fill with less than 3% clay and/or friable particles. Use one of the following gradations:
      a. ASTM 448 No. 10 with 6% to 12% passing No. 200 sieve.
      b. Material meeting the following gradation:

Std. Sieve Size	% Passing
No. 4	85-100
No. 8	75-95
No. 16	55-75
No. 50	22-45
No. 100	10-30
No. 200	6-12

C. Reinforcement:
   1. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A185. Furnish in flat sheets.
   2. Reinforcing Bars: Deformed steel bars, ASTM A615, Grade 60.
   3. Joint Dowel Bars: ASTM A615, grade 40 minimum, smooth round plain steel bars, or ASTM A36, smooth round or square plain steel bars, cut bars true to length with ends square and free of burrs. Epoxy coat per State Highway Department Standard Specifications.

D. Cementitious Materials:
   1. Portland Cement: ASTM C150, Type I, Use only one brand throughout project.
   2. Fly Ash: ASTM C 618, Class C or F. Use only one type and source throughout project.
   3. Slag: ASTM C989, Grade 100 or 120. Use only one type and source throughout project.

E. Pavement Joint Materials:
   1. Joint Back-up Material: Polyethylene foam, 100% closed cell
   2. Soft Preformed Joint Filler: Flexible closed-cell non-extruding synthetic foam expansion joint strips.
      a. Ceramar Flexibe Foam Expansion Joint, by W.R. Meadows.

b. Deck-O-Foam Expansion Joint Filler, by W.R. Meadows

3. Sealant:
   a. Dow 888, by Dow Corning.
   b. 301 NS by Pecora.
   c. Spectrum 800 by Tremco.

F. Concrete Aggregate:
1. Conform to ASTM C33.
2. Aggregate shall contain no coal or lignite in concrete that will not be covered by soil.
3. Fine Aggregate:
   a. Conform to fine aggregate grading requirements as defined in section 6.1 of ASTM C 33 unless approved by the Civil Engineer.
   b. If manufactured sand is used, blend with minimum 25% natural sand unless otherwise approved by Civil Engineer.
4. Coarse Aggregate:
   a. Nominal maximum coarse aggregate size shall be 1 inch for slabs ≤ 5-1/2 inch thick.
   b. The nominal maximum size of an aggregate is the smallest sieve size through which the major portion of the aggregate must pass, with a minimal amount retained on the maximum sieve size. Maximum 4% shall be retained on the nominal maximum size sieve.
5. Adjust proportions of combined coarse, intermediate, and fine aggregates to provide the following particle size distribution characteristics, unless otherwise approved:
   a. Coarseness Factor of 60 to 75%.
      1) The Coarseness Factor (CF) is the percent of combined aggregate retained on the #8 sieve that is also retained on the 3/8" sieve.
      2) The Coarseness Factor is calculated as follows:
         a) CF = Aggregate retained on 3/8" sieve / Aggregate retained on #8 sieve.
   b. Adjusted Workability Factor
      1) The Workability Factor (WF) is the percent of combined aggregate that passes the #8 sieve.
      2) The Adjusted Workability Factor (Adj-WF) is calculated as follows:
         a) Adj-WF = WF+[(Cementitious Material -564 lbs.)/37.6]
      3) The range of accepted Adj-WF for a given CF is as follows:
         a) Adj-WF = [(11.25 - .15 CF) + 33] ± 2.5
      4) Combined percent retained on any given sieve size shall not exceed 24%.
   c. Gradation requirement of ASTM C33 may be waived in order to meet ranges specified.

G. Water: ASTM C 1602.

H. Air Entrainment: ASTM C260.
1. Air-Mix or AEA-92, by Euclid.
2. MasterAir VR 10, MasterAir AE 90, or MasterAir E 200 by BASF Admixtures.
3. Daravair or Darex Series, by W.R. Grace.
4. Equivalent approved products.

I. Evaporation Retardant: Water-based polymer, sprayable.
1. Euco-Bar, by Euclid
2. MasterKure ER 50 by BASF Admixtures
3. Aquafilm, by Dayton Superior.

J. Liquid Membrane Curing and Sealing Compound: ASTM C 1315, Type I, Class A or B, 25% minimum solids content, clear non-yellowing with no styrene-butadiene.
1. Water Based, VOC less than 350 g/l:
   a. Super Aqua Cure, by Euclid Chemical Corp.

b. MasterKure CC 1315WB by BASF Admixtures.

K. Dissipating Curing Compound (For use below 40F): ASTM C 309 Type 1, Class A or B.
1. Solvent base, VOC less than 350 g/l: Cetri Vex EnvioCure 100 by Vexcon.

2.01 CONCRETE MIX

A. Design mix shall produce normal weight concrete consisting of Portland cement, supplementary cementitious materials, aggregates, admixtures, and water to produce specified requirements.

B. Geographical Weather Exposure Classification: Geographical exposure classification shall be [Neglibible F0] [Moderate F2] [Severe F3] exposure.

C. Concrete Site Pavement and Light Pole Bases
1. ACI Exposure Category and classification:
a. Negligible exposure: F0
b. Moderate exposure: F2
c. Severe exposure: F3
2. Compressive Strength: Strength at 28 days, unless otherwise indicated on the Drawings:
a. Negligible exposure classification: 3,500 psi.
b. Moderate exposure classification: 4,500 psi.
3. Maximum Water-Cementitious Material Ratio (Cement Quantity Includes Fly Ash or slag):
a. Negligible exposure: 0.55 by wt.
b. Moderate and severe exposure classification: 0.45 by wt.
4. Slump Range: Slump at the point of placement shall be 2 to 4 inches for hand placed concrete, 1-1/14 to 3 inches for machine placed (slip form) concrete. Maximum slump variance shall be 2 inches.
5. Air Content: As shown in the table below.

D. Air Entrainment as shown below:

Nominal Maximum Size Aggregate (Inch)	Average Air Content (%) +/- 1.5% By Exposure Category	
	Negligible - F0	Moderate or Severe – F2 & F3
3/8	4.5	7.5
1/2	4.0	7.0
3/4	3.5	6.0
1	3.0	6.0
1-1/2	2.5	5.5

E. Supplementary Cementitious Materials (SCM):
1. Concrete mix shall contain SCM at the amounts specified unless other amounts are approved by the Civil Engineer. Either fly ash or ground granulated blast furnace slag (GGBFS) may be used for the SCM but shall not be used together to form a ternary mix. Use of fly ash or GGBFS in the concrete mix is mandatory.
2. Fly Ash: Substitute fly ash for Portland cement at 20% of the total cementitious content.
a. If used to mitigate potential aggregate reactivity, up to 30% fly ash substitution of Portland cement is allowed. Only Type F fly ash may be used and shall have the following maxi-

mum properties: 1.5% available alkali and 8.0% CaO. When a maximum of 30% replacement is used, up to 10.0% CaO is permitted.

3. Ground Granulated Blast Furnace Slag (GGBFS): Substitute GGBFS for Portland cement at 25% of the total cementitious content.
   a. If required to mitigate potential sulfate exposure or aggregate reactivity, up to 50% GGBFS substitution of Portland cement is allowed.
4. Maintain air-entrainment at specified levels.

F. Calcium Chloride:
1. Calcium chloride (Type L) may be used in solution form as part of the mixing water to accelerate concrete setting and early-strength development.
2. Amount of calcium chloride added shall not be more than necessary to produce the desired results and shall not exceed 2% by weight of cement.
3. The dosage range for the calcium chloride for the entire project shall not vary by more than 1%. Range is defined as the difference between the maximum and minimum dosages of calcium chloride for the entire project.
4. Calcium chloride shall not be used in the following applications unless approved by the Civil Engineer:
   a. concrete containing embedded dissimilar metals or aluminum
   b. slabs supported on permanent galvanized steel forms
   c. concrete exposed to deicing chemicals
   d. prestressed or post-tension concrete
   e. concrete containing aggregates with potentially deleterious reactivity and concrete exposed to soil
   f. concrete exposed to soil or water containing sulfates.
5. Use calcium chloride in accordance with manufacturer's recommendation.
6. Chloride-ion Concentration: Maximum water-soluble chloride-ion concentrations in hardened concrete at ages from 28 to 42 days contributed from the ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed the following limits unless approved by the Civil Engineer:

Type of Member	Maximum water-soluble chloride ion (Cl-) content in concrete (percent by weight of cement)
Prestressed concrete	0.06
Reinforced concrete exposed to chloride in service	0.15
Reinforced concrete that will be dry or protected from moisture in service	1.00
Other reinforced concrete construction	0.30

7. When using calcium chloride or other admixtures containing chlorides, measure water-soluble chloride-ion content (percent by weight of cement) per ASTM C 1218. Sample shall be from concrete representing the submitted mix design and maximum chloride dosage anticipated for the project.

3.01 MIXING

A. Mix concrete and deliver in accordance with ASTM C 94.

PART 3 - EXECUTION

1.01 PREPARATION

A. Proofroll prepared base material surface to check for unstable areas in accordance with Section 02 30 00 including documentation and re-proof rolling as required. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.

B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

2.01 AGGREGATE BASE PLACEMENT

A. Unless otherwise specified on the Drawings, place aggregate base as specified herein.

B. Aggregate Base:
1. Install aggregate base where shown on Drawings.
2. Compact to final thickness shown in layers not exceeding 6 inches with minimum of 2 passes per layer with vibratory compactor.
3. Compact fill to 98% of aggregate's Standard Proctor as determined by Method D of ASTM D698.
4. Leave base up to 2 inches low until just prior to concrete placement.

C. Aggregate Base Fine Grading:
1. Compact to final thickness shown with 2 passes minimum vibratory compactor to produce smooth, flat, dense surface.
2. Do not allow excess moisture in or on base at time of placing concrete.
3. Level off aggregate base top surface with a maximum 3/4" thick aggregate choker material to achieve the following:
   a. To reduce surface friction and to meet specified fine grade tolerances specified below.
   b. To level areas exposed to rain, traffic, or excavations for buried utilities.
   c. At areas where aggregate base material does not have sufficient fine particles to produce a surface that is free of exposed aggregate or surface voids greater than 3/8" in size at time of slab installation.
4. Wal-Mart Construction Testing Laboratory shall verify adequate fines at surface immediately prior to concrete slab placement.
5. Provide dry, smooth, flat, dense surface
6. Proof-roll 48 hrs. maximum prior to concrete placement. Depression under a fully loaded ready mix truck shall not exceed 1/2 inch.

D. Pavement Aggregate Base Fine Grade Tolerance: +0 inch, -3/4 inch with transition no greater than 3/4 inch vertically to 8 inches horizontally.

3.01 INSTALLATION

A. Form Construction
1. Set forms to required grades and lines, rigidly braced and secured.
2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
3. Check completed formwork for grade and alignment to following tolerances:
   a. Top of forms not more than 1/8-inch in 10'-0".
   b. Vertical face on longitudinal axis, not more than 1/4-inch in 10'-0".
4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

B. Reinforcement: Fasten reinforcing bars or welded wire fabric (if required) accurately and securely in place with suitable supports and ties. Remove from reinforcement all dirt, oil, loose mill scale, rust, and other substances that will prevent proper bonding of the concrete to the reinforcement.

C. Concrete Placement
   1. Mix and place concrete when the air temperature in the shade and away from artificial heat is a minimum of 35 degrees F and rising. Hot and cold weather concreting shall be in accordance with ACI 305.1 (hot weather) and 306.1 (cold weather).
   2. Do not place concrete until base material and forms have been checked for alignment and grade. Concrete shall not be placed around manholes or other structures until they are at required finish elevation and alignment.
   3. Place concrete using methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
   4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place construction joint.

D. Contraction and Construction Joints: Construct contraction and construction joints straight with face perpendicular to concrete surface. Construct transverse joints perpendicular to centerline, unless otherwise detailed.
   1. Contraction Joints: Provide joints at spacing of 12'-0" on centers, maximum each way. Construct control joints for depth equal to at least 1/4 of the concrete thickness, as follows:
      a. Form tooled joints in fresh concrete by grooving top with recommended tool and finishing edge with jointer.
      b. Sawed Contraction Joints:
         1) Use saws, blades, skid plates, and accessories by Soff-Cut International, Inc. or approved equal.
         2) Start cutting sawed joints as soon as concrete has hardened sufficiently to prevent raveling or dislodging of aggregates. This will typically be from 1 hour in hot weather to 4 hours in cold weather after completing finishing of slab in that joint location.
         3) Provide at least two “Soff-Cut” saws on site with blades capable of achieving the required depth of saw cut.
         4) Extend sawed joint to the slab boundaries and abutments, including columns, drains, and other penetrations in the path of a defined joint. Implement methods and timing of the saw cut beyond the limits of the Soff-Cut saw reach to provide a consistent depth of cut with minimal raveling of joint edges.
   2. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for period of more than 1/2 hour. Construct joints in accordance with details shown.

E. Isolation and Fixed Object Joints: Construct joint at locations and in accordance with details shown.

F. Pavement Joint Materials: Place joint fillers, back-up material, and sealants at locations shown and in accordance with manufacturer’s instructions.
   1. Soft Preformed Joint Fillers: Extend preformed joint fillers full-width and depth of joint, and not less than 1/2-inch or more than 1-inch below finished surface. Furnish preformed joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip preformed joint filler sections together in a single plane.

4.01 CONCRETE FINISHING

A. After initial striking off and consolidating of concrete paving, smooth surface using either magnesium straight edge, wood, or magnesium channel float.

B. Round edges of slabs and formed joints to 1/2-inch radius with edging tool. Eliminate tool marks on concrete surface.

C. After completion of straightedge / floating and when excess moisture or surface sheen has disappeared, uniformly finish surface to provide a coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to flow of traffic so as to produce regular corrugations not over 1/16 of an inch deep. Initial nonslip finishing shall be approved by the Wal-Mart Construction Manager.

D. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Owner.

5.01 CURING AND PROTECTION

A. Protect and cure finished concrete paving using curing compound. Cure for a period not less than 7 days.

B. Use solvent based curing compound when compound is applied below 40 F.

6.01 CLEANING AND ADJUSTING

A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

7.01 FIELD QUALITY CONTROL

A. Field quality control testing and inspection shall be at the discretion of the Contractor as necessary to assure compliance with Contract requirements. Owner T&I shall not be considered a substitute for the Contractor's responsibility to perform similar routine, necessary, and customary testing and inspection of the methods and frequency suitable for the type of work involved.

B. Responsibilities and Duties Relative to Owner Testing and Inspection:
1. Notify Owner's CTL in advance of concrete placements to allow sufficient time to prepare for a site visit.
2. Assist Owner's agency in securing field specimens.
3. Provide and maintain for sole use of CTL, facilities for safe storage and proper curing of concrete test cylinders at project site as required by ASTM C31 and acceptable to Wal-Mart Testing Laboratory.

C. Correction of Deficient Work:
1. When directed by the Owner, remove and replace or repair concrete and related Work which does not conform to specified requirements including strength, tolerances, and finishes.
2. Bear cost of corrections or delays to other work affected by, or resulting from, corrections to concrete Work.
3. If results of compressive strength tests reveal deficiencies in concrete, meet requirements of ACI 318 and ACI 301.

OWNER TESTING AND INSPECTION (T&I) AND OBSERVATION

A. The Contractor will perform testing and inspection (T & I) as specified in Section 01 40 00.

END OF SECTION

SECTION 02 92 00

LAWNS AND GRASSES

PART 1 GENERAL

1.01 Section Includes

Soil preparation, sodding, seeding, mulching, fertilizing, watering, and maintenance of grassed areas

1.02 References

Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest implemented edition.

1.03 Submittals

All sod shall have a valid and current state of Florida, Division of Plant Industry (DPI) inspection certification prior to being transported to the construction site. Submit the DPI certification to the Engineer and maintain a copy of the certification onsite with the construction records.

1.04 Warranty

All seeding shall be warrantied by the General Contractor to be true to name and in a vigorous growing condition through one growing cycle including one summer and one winter season.

1.05 Maintenance

Maintenance for lawns shall begin immediately after seeding or sodding. Provide watering, mowing and replanting and continue as necessary until a close healthy stand of specified grasses is established.

PART 2 PRODUCTS

2.01 Lime

Lime shall be agricultural grade dolomitic limestone, ground sufficiently fine so that at least 80 percent will pass through a No. 8 sieve, and it shall contain not less than 80 percent calcium carbonate equivalent. Moisture content at time of delivery shall not exceed 8 percent.

2.02 Fertilizer

Fertilizer shall be a composition recommended by a local County Agricultural Agent or State Agricultural Extension Service or a preformulated 10-6-4 mixture.

2.03 Water

Water shall be free from oil, acid, alkali, salts, and other harmful substances.

2.04 Sod

A. Sod shall be either field or nursery grown sod that is native to the locality of the Project. The Contractor shall obtain Engineer's approval of the source of the sod prior to cutting the sod.

B. Sod grown on soil high in organic matter, such as peat, will not be acceptable. The consistency of sod shall be such that it will not break, crumble or tear during handling and placing. Sod shall be reasonably free of stones, crab grass, noxious weeds, and other objectionable plants or substances injurious to plant growth.

C. Sod shall have at least 1 inch of soil adhering firmly to the roots and cut in rectangular pieces with the shortest side not less than 12 inches. At the time of cutting sod the grass shall be mowed to a height not less than 2 inches nor more than 4 inches.

D. Sod cut for more than 48 hours shall not be used without the approval of the Engineer.

E. Bermuda Sodding shall be 419 Tifway Bermuda.

F. Bahia Sodding shall be Argentine Bahia Sod.

G. If so designated on the drawings, Bahia Sodding along coastal areas subject to high salt content shall be Seashore Paspalum Bahia (Paspalum vagination), such as Sea Isle 1, as produced by Turfgrass America, or approved equal.

2.05 Seeding and Mulching

A. Permanent grass seed shall be argentine bahia, in accordance with FDOT specification 981.

B. Temporary grass seed shall be annual rye grass in accordance with FDOT specification 981.

C. Mulch shall be dry mulch in accordance with FDOT specification 981.

PART 3 EXECUTION

3.01 Regrading of Topsoil

Topsoil shall be graded reasonably smooth and level after final settlement. All humps shall be removed and depressions or eroded areas filled in with additional topsoil before proceeding with seeding or sodding.

3.02 Preparation for Sodding or Seeding

A. Preparation shall not be started until all other site and utility work and finished grading within the areas to be seeded have been completed.

B. Loosen topsoil by tilling it to a depth of at least 3 inches and smooth out all surface resulting irregularities. Leave area free of rocks or hard soil clods that will not pass through the tines of a standard garden rake.

C. At least 7 days before applying fertilizer, spread lime uniformly in sufficient quantity to produce a soil pH of 6.5. Work lime thoroughly into topsoil to a depth of 3 inches.

D. Apply fertilizer uniformly at a rate of 20 pounds per 1000 square feet. Work fertilizer into soil prior to seeding or sodding.

3.03 Sodding

A. Provide sod in areas indicated on the Drawings. Sodding shall also be used in ditches and drainage swales and on all embankment slopes steeper than 3 to 1 unless protection is provided against erosion of seeding.

B. Place sod with the edges in close contact and alternate courses staggered. Lightly tamp or roll to eliminate air pockets. On slopes 2 to 1 or steeper, stake sod with not less than 4 stakes per square yard and with at least one stake for each piece of sod. Stakes shall be driven with the flat side parallel to the slope. Do not place sod when the ground surface is frozen or when air temperature may exceed 90 degrees F. Water the sod thoroughly within 8 hours after placement and as often as necessary to become well established.

C. In ditches, the sod shall be placed with the longer dimension perpendicular to the flow of water in the ditch. On slopes, starting at the bottom of the slope, the sod shall be placed with the longer dimension parallel to the contours of the ground.

D. All exposed edges of sod shall be buried flush with the adjacent turf.

3.04 Seeding and Mulching

A. Scatter seed uniformly over the grassing area while the soil is still loose and moist at the rate of 100 pounds per acre.

B. Seed of quick growing species of grass, such as rye, Italian rye, millet or other cereal grass, shall be spread in conjunction with the permanent type seed mixture. The type of quick-growth seed used shall be appropriate to provide an early ground cover during the particular season when planting is done. The rate of spread shall be 30 pounds per acre, unless otherwise specified.

C. Apply approximately 2 inches, loose thickness, of the mulch material uniformly over the seeded area, and cut into the soil so as to provide an early ground cover during the particular season when planting is done. The rate of spread shall be 30 pounds per acre, unless otherwise specified.

D. Roll thoroughly the entire seeded area immediately after completion of the seeding.

3.05 Watering

Immediately after placing erosion control or mulch, water seeded areas thoroughly with a fine mist spray. Keep soil thoroughly moist until seeds have sprouted and achieved a growth of 1 inch. For sod, immediately begin watering and continually keep moist until the sod has firmly knit itself to the topsoil.

3.06 Protection of Work

Protect newly seeded and sodded areas from all traffic by erecting temporary fences and signs. Protect slopes from erosion. Properly and promptly repair all damaged work when required.

3.07 Application of Fertilizer

Six weeks after completion of seeding or sodding apply granular fertilizer over all areas at the rate of two pounds of nitrogen nutrients per 1000 square feet of area.

3.08 Clean-Up

At the time of final inspection of work, but before final acceptance, remove from seeded and sodded areas all debris, rubbish, excess materials, tools, and equipment.

3.09 Lawn Replacement

Lawns not showing a close uniform stand of healthy specified grasses at the end of the guaranty period shall be replaced and maintained until acceptance. Scattered bare spots, none of which is larger than one square foot, will be allowed up to a maximum of 3% of the total area.

END OF SECTION

SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Form accessories.

C. Form stripping.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including Contractual Conditions and Divisions 1 Specification Sections, apply to this section.

B. Section 04 20 01 - Masonry Veneer: Spacing for veneer anchor reglets recessed in concrete.

C. Section 05 12 00 - STRUCTURAL STEEL: Placement of embedded steel anchors and plates in cast-in-place concrete.

1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials ; 2010.

B. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International ; 2010 (Errata 2012).

C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute ; 2011.

D. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute ; 2004.

E. ASME A17.1 - Safety Code for Elevators and Escalators; The American Society of Mechanical Engineers ; 2013.

F. PS 1 - Structural Plywood ; 2009.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

C. Delegated Design Data: As required by authorities having jurisdiction.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.

C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

D. Comply with relevant portions of ACI 347, ACI 301, and ACI 318.

2.02 WOOD FORM MATERIALS

A. Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I. 3/4 inch Minimum thickness.

2.03 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, 1 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.

1. Provide stainless steel form ties for all exterior surfaces exposed to view.
2. Approved Manufacturers:
    a. Dayton: Sure-Grip"
    b. Henchman: "Snapties"
    c. Richmond: "Snop-Tys"

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
1. Composition: Colorless reactive, mineral oil-based, soy-based, or vegetable-oil based compound.
2. Do not use materials containing diesel oil or petroleum-based compounds.
3. VOC Content: In compliance with applicable local, State, and federal regulations.

C. Filler Strips for Chamfered Corners: Wood strip type; 3/4 by 3/4 inch size; maximum possible lengths.

D. Dovetail Anchor Slot: Galvanized steel, at least 22 gage, 0.0299 inch thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

E. Dovetail Anchor Slot: Zinc coated (oriented vertically) shall be located at 3 feet - 0 inches on center horizontally wherever concrete surfaces adjoin masonry. Where concrete masonry units (CMU) abut columns, provide dovetail slot at centerline of adjoining CMU.
1. Approved Manufacturers:
    a. Henchman: Number 100 Standard, 24 gauge
    b. Hohman & Barnard, Inc. Number 305
    c. Wire Products Company, Number F-17
    d. Gateway Building Products: DAS-STD

F. Flashing Reglets: Galvanized steel, at least 22 gage, 0.0299 inch thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

G. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

H. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 12 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members that are not indicated on drawings.

F. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

G. Coordinate this section with other sections of work that require attachment of components to formwork.

3.03 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.04 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Position recessed anchor slots for brick veneer masonry anchors to spacing and intervals specified in Section 04 20 01.

E. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.05 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.06 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

B. Construct permanent insulated foam panel formwork to maintain tolerances required by ACI 301.

C. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

D. Camber slabs and beams in accordance with ACI 301.

3.07 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 - Quality Requirements.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Do not reuse wood formwork more than 3 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.08 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including Contractual Conditions and Divisions 1 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).

B. ACI SP-66 - ACI Detailing Manual; 2004.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

D. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2007b (Reapproved 2014).

E. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.

F. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars; 2001 (Reapproved 2007).

G. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.

H. CRSI (DA4) - Manual of Standard Practice; 2009.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.

B. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Plain billet-steel bars. for bars numbers 3 to number 18.
   2. Epoxy coated in accordance with ASTM A775/A775M.

B. Steel Welded Wire Reinforcement (WWR): Class A epoxy coated, deformed type; ASTM A884/A884M.

C. Reinforcement Accessories:
   1. Tie Wire: Federal specifications QQ-W-461Annealed steel, minimum 16 gage, 0.0508 inch for use on epoxy coated steel reinforcement.
   2. Bar Supports and Spacers:

a. For unexposed concrete, bar supports and spacers shall be manufactured of standard brights basic wire upturned legs.
b. For concrete which will be exposed to view from the underside upon completion of the structures, use plastic capped bar supports and spacers.
c. For slabs on grade, use bolsters with runners where base will not support chair legs.
d. Do not use wood, brick or other non-specified material.

3. Welded electrodes: AWS A5.1, Low Hydrogen, E70 Series.
4. Welded Inserts: Provide wedge inserts for the support of brick ledger angles. Wedge inserts shall be placed at 4'-0" o.c. unless drawings indicate a more restrictive spacing. Provide the F-7 wedge insert and 3/4" diameter askew bolt, nut and washers as manufactured by Dayton Superior, 10101 C General Drive, Orlando, Florida, or equal.
   a. Wedge inserts and 3/4" diameter bolts to be deemed equal shall submit test information documenting an ultimate capacity of at least 8,500 pounds when the shelf angle is loaded 2-1/4" from the face of concrete, with the bottom of the insert 1-1/2" clear from the beam bottom, for concrete strength of 4,000 psi.

2.02 RE-BAR SPLICING:

A. Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing full steel reinforcing design strength in tension and compression.
   1. Products:
      a. Dayton Superior Corporation; Bar Lock Coupler System: www.daytonsuperior.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for connecting dowels; capable of developing full steel reinforcing design strength in tension and compression.
   1. Products:
      a. Dayton Superior Corporation; Dowel Bar Splicer D101A with Straight Dowel-In: www.daytonsuperior.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Taper Tie Hole Plug: Mechanical device for plugging tie holes; anchors optional flush or recessed grout.
   1. Products:
      a. Dayton Superior Corporation; A58 Sure Plug: www.daytonsuperior.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.
   1. Products:
      a. Dayton Superior Corporation; Sleeve-Lock Grout: www.daytonsuperior.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is permitted only with the specific approval of Architect. Perform welding in accordance with AWS D1.4/D1.4M.

C. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.

PART 3 EXECUTION

3.01 GENERAL:

A. Cleaning and storage reinforcement: Steel reinforcement at the time concrete is placed shall be free from heavy rust, scale or other coating that will destroy or reduce the bond.

B. All reinforcing steel shall be stored in neat piles at the site clear of the ground in such a manner that all bars can be readily identified when required.

C. Excessive form oil on the reinforcing shall be removed by washing the reinforcing with kerosene. Exercise due care that no smoking or welding is permitted in the area of cleaning. Provide fire extinguisher at cleaning site.

D. Supports for reinforcing steel: All reinforcing steel shall be rigidly supported, accurately located and held in position by the use of proper reinforcing steel supports, spacers and accessories before the concrete placement begins.

E. The legs of all reinforcing supports shall be bent to form a foot so that the side and not the end of leg rods bears on the form.

F. Metal reinforcement shall be protected by the thickness of the concrete indicated on the drawings. Where not otherwise shown, the concrete cover shall be not less than the following:
   1. 3 inches for footings and other principal structural members poured directly against the ground.
   2. 2 inches for bars larger than number 5, and 1-1/2 inches for number 5 bars and smaller where concrete will be exposed to the ground or weather after removal of forms.
   3. 1-1/2 inches in all beams, girders and columns.
   4. 3/4 inches for all slabs and walls not exposed to the ground or weather.
   5. In any event, there shall be not less than 3/4" of concrete protection over all reinforcing bars.

G. Do not use bar supports or reinforcing as support for concrete runways or construction loads.

H. Placing tolerances: Clear distance to formed surfaces: +/- 1/4 inch. Minimum spacing between bars: -1/4 inch:
   1. Top Bars in Slabs or Beams:
      a. Members 8" or less in depth: +/- 1/4 inch
      b. Members 8" to 24" in depth: +/- 1/4 inch
      c. Members 24" or greater in depth: +/- 1/2 inch
   2. Crosswire of Slabs or Beams: Spaced evenly within 2 inches.
   3. Lengthwise of Member: +/- 2 inches

I. Bending details: Typical bending and placing diagrams are shown on the drawings. For parts not shown, bending details and lengths shall conform to the requirements of the ACI Building Code 318 and "Manual of Standard Practice for Detailing Reinforced Concrete Structures" ACI 315.

J. Bends for stirrups and ties shall be made around a pin having the diameter no less than 1-1/2 inches for number 3, and 2 inches for number 4.

K. Bends for other bars shall be made around a pin having a diameter not less than six bar diameters for number 3 to number 6, 8 bar diameters for number 9, number 10 and number 11, 10 bar diameters for number 14 and number 18.

L. All bars shall be bent cold. Heating of bars will not be allowed

3.02 SPECIAL REINFORCING REQUIREMENTS:

A. Where walls or other items are shown as built integrally with other section, but are placed as separate pours, key and dowels must be provided. Dowels shall be the same size and at the same spacing as reinforcing.

B. Main reinforcing bars shall not be spliced unless so noted on the drawings or approved by the Architect.

C. Provide 6 X 6 - W1.4 X W1.4 electrically welded wire fabric, ASTM A-185 reinforcing in all concrete slabs on ground unless shown otherwise.

D. Provide corner bars of same size and spacing as main reinforcement at all intersections and corners.

E. Where openings occur in walls, or slabs, provide two number 5 bars at all sides and extending at least two feet beyond the corners and two number 5 bars at least three feet long diagonally across each re-entrant corner.

F. Unless permitted by an Inspector employed by the owner reinforcement shall not be bent after being embedded in hardened concrete.

3.03 INSPECTION OF REINFORCEMENT:

A. Reinforcing placement must be checked by an Inspector employed by the owner before any concrete is placed. Any corrections shall be made before concrete is placed.

B. Placement of reinforcing shall occur in such sequence that the Inspector has sufficient time to inspect the correctness of the reinforcing within the placement area and retains the right to require necessary revisions be made before concrete is placed.

C. The Contractor shall notify the Inspector at least 24 hours in advance of concrete placement for a particular portion of the building.

D. Galvanized wire ties of double loop and tightly fastened to secure the proper spacing of rods and ties are required.

3.04 LAP SPLICING:

A. Welded wire fabric shall be overlapped wherever successive mats or rolls are continuous such that the overlap measured between outermost cross wires is not less than one wire spacing plus 2 inches.

B. Longitudinal (continuous) footing reinforcing: Class B.

C. Beam Reinforcing: Class B.

D. Column Reinforcing: Class B Offset lap splices.

E. Column/footing dowels: Class B

F. Masonry vertical reinforcing: Class B.

G. Splices not included above: Class B

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floors and slabs on grade.

B. Joint devices associated with concrete work.

C. Miscellaneous concrete elements, including equipment pads.

D. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including Contractual Conditions and Divisions 1 Specification Sections, apply to this section.

B. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.

C. Section 03 20 00 - Concrete Reinforcing.

D. Section 07 92 00 - Joint Sealants: Products and installation for sealants for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2009).

B. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International; 2010 (Errata 2012).

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (Errata 2007).

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.

E. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.

F. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.

G. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).

H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.

I. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2014.

J. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.

K. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.

L. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

M. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.

N. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.

P. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.

Q. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2013.

R. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2010.

S. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).

T. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011.

U. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

V. COE CRD-C 48 - Method of Test for Water Permeability of Concrete; 1992.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
   1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
   2. Provide certificates signed by material manufacturer, certifying that each material complies with the specified requirements.

C. Mix Design: Submit proposed concrete mix design.
   1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
   2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.

D. Test Reports
   1. Submit results of all compression, slump and air content tests performed during mix design and throughout the duration of the project as required by the Specifications.
   2. Submit sieve analysis of coarse and fine aggregate intended for use in the project.
   3. Submit a copy of State Certification that the concrete batching and weighing equipment has been inspected and approved.
   4. Submit letters from the cement and aggregate suppliers certifying that furnished materials meet appropriate ASTM Standards.

E. Samples: Submit samples of underslab vapor retarder to be used.

F. Samples: Submit two, 12 inch long samples of waterstops and construction joint devices.

G. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.05 QUALITY ASSURANCE

A. Do not commence placement of concrete until mix designs have been approved by the Architect.

B. Any concrete work which does not conform to the specified requirements, including strength, tolerance and finishes shall be corrected by the Contractor at his expense and as directed by the Architect.
   1. Tolerances listed in sub-paragraphs of 3.03 below.

C. Perform work of this section in accordance with ACI 301 and ACI 318.
   1. Maintain one copy of each document on site.

D. Follow recommendations of ACI 305R when concreting during hot weather.

E. Follow recommendations of ACI 306R when concreting during cold weather.

1.06 TESTING:

A. Concrete shall be sampled and tested for Quality Control during placement of concrete.

B. Failure to detect defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate Architect for final acceptance.

C. Required Sampling and Testing
   1. Samples, for strength tests of each concrete mix shall be taken not less than once a day nor less than once for each 50 cu. yd. of concrete.

D. If the total volume of concrete is such that the frequency of testing required above would provide less than five strength tests for a given mix, tests shall be made from at least five randomly selected batches.
   1. Secure composite samples in accordance with ASTM C172.
   2. Mold and cure five specimens from each sample in accordance with ASTM C31.
      a. Samples for test shall be taken at the 1/4 and 3/4 points of the load mixer.
      b. Cure specimens under laboratory conditions except as follows:
         1) When in the opinion of the Architect there is a possibility of the surrounding air temperature failing below 40 degrees F, he may require additional specimens to be cured under job conditions.
         2) In hot weather or periods of low humidity the Architect may require additional specimens to be cured under job conditions
            (a) Test specimens in accordance with ASTM C39.
               (1) Test one specimen at 3 days.
               (2) Test one specimen at 7 days.
               (3) Test two specimens at 28 days for acceptance. This test of two specimens constitutes one strength test. The results of the strength test shall be the average of the strengths of the two specimens tested.
            (b) Hold one specimen for future use if test does not comply at 28 days.
            (c) Determine slump of the concrete sample for each strength test and whenever consistency appears to vary, using ASTM C143.
            (d) Determine air content for each strength test in accordance with either ASTM C231, ASTM C173, or ASTM C138.
            (e) Determine temperature of concrete sample for each strength test.

E. Evaluation of Test Results
   1. For evaluation each specified concrete mix shall be represented by at least five strength tests.

F. The strength level of the concrete will be considered satisfactory if both of the following requirements are met.
   1. The average of all sets of three consecutive strength tests (average of two cylinders) exceeds specified strength.
   2. No individual strength test (average of two cylinders) falls below the specified strength by 500 psi.

G. If the strength level does not meet the above requirements, the Architect shall consider the concrete to be deficient and shall have the right to reject the work or require load tests on the structure in the areas the tests represent at no cost to the Owner.

H. Report tests results in writing to the Architect and the Contractor on the same day that tests are made. Reports of compressive strength tests shall contain:
   1. Project identification name and number
   2. Date of concrete placement
   3. Name of Contractor
   4. Name of Concrete Supplier and Truck Number
   5. Name of Concrete Testing Service
   6. Concrete type and class
   7. Location of concrete batch in the structure
   8. Design compressive strength at 28 days
   9. Slump
   10. Air Content

11. Concrete temperature
12. Concrete mix identification number
13. Compressive breaking strength
14. Type of break for both 7-day tests and 28-day tests.

I. TESTING SERVICES:
   1. The Contractor will employ an independent testing laboratory meeting the requirements of ASTM E329 and approved by the Architect to perform the following services:
      a. Sample concrete at placement and make slump, air content, temperature and compression tests as described above.
      b. Report tests results to the Architect.
   2. Contractor Responsibilities
      a. Pay for additional testing and inspection of materials or concrete occasioned by their failure by test or inspection to meet specification requirements.
      b. Provide the necessary testing services for the qualification of proposed materials and the establishment of mix designs; and for any other testing services required by the Contractor.
      c. Furnish any necessary labor to assist the designated testing agency in obtaining and handling samples.
      d. Advise the testing agency sufficiently in advance of operations to allow for completion of tests.
      e. Provide and maintain for the sole use of the testing agency adequate facilities for safe storage and proper curing of concrete test specimens as required by ASTM C31.
      f. The use of Testing Services shall in no way relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.
   1. Acquire all cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C 33.
   1. Acquire all aggregates for entire project from same source.
   2. Fine Aggregate: Clean, sharp sand, free from loam, clay, lumps or other deleterious substance.
      a) Fineness Modulus – 2.4
         Bulk Specific Gravity – 2.6
   3. Coarse Aggregate For Normal Weight Concrete: Comply with ASTM C33 size #57. Clean, uncoated, processed aggregate of crushed stone or washed gravel containing no clay, mud, loam or foreign matter. Use of pit or bank run gravel is not permitted. Aggregate shall meet ASTM C33 Size No. 56 or 57.
      a) Pea Gravel Size – 3/8”
         Dry Unit Weight – 90-95 lb/cuft
         Bulk Specific Gravity – 2.6
   4. Where contractor elects to place concrete by pumping he shall provide a pump with sufficient capacity to place this size of aggregate.
   5. ASTM C404 for masonry grout. Maximum aggregate size shall be 3/8".

C. Water: Clean and not detrimental to concrete.
   1. Water shall be fresh and potable. Water shall be obtained from city water system. The Contractor shall pay for the quantity of water used during construction and also furnish, install and maintain a water meter if required by the Water Department.

2.02 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.
   1. Products:
      a. "Darex" by W.R. Grace.
      b. "SikaAer" by Sika Chemical Co.
      c. "MBVR" by Master Builders
      d. "Air-Mix" by Euclid
      e. "Sealtight" by W.R. Meadows

C. High Range Water Reducing Admixture: ASTM C494/C494M Type F and shall contain no chloride ions..
   1. Products:
      a. "Melmet" by American Admixtures.
      b. "WRDA 19" by W.R. Grace Co.
      c. "Sikament" by Sika Chemical Co.
   2. Dosage and use of any mix containing this admixture shall be in strict accordance with the manufacturers direction and only with the written permission of the Engineer.
   3. A representative of the admixture manufacturer shall be present to observe the products use and to assure that it is being used in accordance with the manufacturers directions.

D. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
   1. Provide pigmented type, with ASTM C979/C979M inorganic pigments.
   2. Products:
      a. "Daratard 17" by W.R. Grace & Company.
      b. "Pozzolith 100XR" by Master Builders, Inc..
      c. "Lubricon R" by American Admixture
      d. "Plastocrete 161R" by Sika Chemical Co.

E. Water Reducing Admixture: ASTM C494/C494M Type A.
   1. Products:
      a. "Pozzolith 300 Series" by Master Builders.
      b. "WRDA/HYCOL" by Grace.
      c. "Plastocrete 161" by Sika
      d. "Eucon-WR-75" by Euclid

F. Calcium Chloride
   1. Do not use calcium chloride in any concrete.

2.03 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
   1. Installation: Comply with ASTM E1643.
   2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder.
   3. Products:
      a. Fortifiber Building Systems Group; Moistop Ultra 10: www.fortifiber.com.
      b. W.R. Meadows, Inc.; PERMINATOR Class A - 10 mils: www.wrmeadows.com.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Products:
      a. Five Star U.S. Grout
      b. Euco NS Euclid Chemical
      c. Masterflow 713 Master Builders

2.04 BONDING AND JOINTING PRODUCTS

A. Epoxy Bonding System:

1. Complying with ASTM C881/C881M and of Type required for specific application.
2. Products:
   a. Sikadur Hi-Mod — Sika Chemical
   b. Thiopoxy — W.R. Grace
   c. Epoxy #452 — Euclid Chemical
   d. Sika Armatec EPO CEM 110 — Sika Chemical

B. Slab Isolation Joint Filler: Thichness as indicated in drawings. If not indicated provide 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
   1. Material: ASTM D1751, non-staining, non-extruding and resilient bituminous type.

2.05 CURING MATERIALS

A. Membrane curing compound:
   1. Conform to ASTM C171, Class B, Clear 100% resin type.
   2. Do not use on any surface which will later receive paint, sealer, hardener, carpeting, tile or other bonded covering.
      a. Acceptable Products:
   3. Sealtight AR-30 W.R. Meadows
   4. Kurez Euclid Chemical
   5. Horncure W.R. Grace
   6. Hydrocide Resin Sonneborn

B. Curing/sealing compound:
   1. Sodium Silicate Sealer
      a. Acceptable Products
      b. Cure Hard Meadows
      c. Eucosil Euclid Chemical
      d. WB-309 Grace
      e. Sonosil Sonneborn
      f. Acurion Anti-Hydro Waterproofing
   2. Verify compatibility of finish with curing/sealing compounds.

C. Moisture-Retaining Sheet: ASTM C171.
   1. Polyethylene film, clear, minimum nominal thickness of 0.0040 in..

2.06 CONCRETE MIX DESIGN

A. Contractor shall provide all testing services for approval of mixes.

B. The Contractor shall furnish the Architect for approval a mix design for each class of concrete at least 15 days prior to start of work.

C. Do not begin production until mixes have been approved by Architect.

D. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

E. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

F. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

G. Normal Weight Concrete:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch.
   2. Water-Cement Ratio: Maximum .57 percent by weight.
   3. Total Air Content: 2-4 percent, determined in accordance with ASTM C173/C173M.
   4. Maximum Slump: 4 inches.
   5. Maximum Aggregate Size: 5/8 inch.

2.07 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

B. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Verify that forms are clean and free of rust before applying release agent.

B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
   2. Use latex bonding agent only for non-load-bearing applications.

D. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Notify Architect not less than 24 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

G. Place concrete within the tolerances specified below:
   1. Dimensional tolerances for formed surfaces:
      a. Variation from plumb:
         1) In the lines and surfaces of columns, piers, walls and in arises:
            (a) In any 10 ft. of length.....1/4 in.
            (b) Maximum for the entire length (length greater than 40'-0").....1 in.
         2) Exposed corner columns, control-joint grooves, and other conspicuous lines:
            (a) In any 20 ft. of length.....1/4 in.

(b) Maximum for the entire length.....1/2 in.

b. Variation from the level or from the grades specified in the contract documents:
   1) In slab soffits, ceilings, beam soffits and in arises, measured before removal of supporting shores
      (a) In any 10 ft. of length.....1/4 in.
      (b) In any bay or in any 20 ft. of length.....3/8 in.
      (c) Maximum for the entire length.....3/4 in.
   2) In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
      (a) In any bay or in 20 ft. length.....1/4 in.
      (b) Maximum for the entire length.....1/2 in.

c. Variation of the linear building lines from established position in plan and related position of columns, walls, and partitions:
   1) In any bay.....1/2 in.
   2) In any 20 ft. of length.....1/2 in.
   3) Maximum for the entire length.....1 in.

d. Variation in the sizes and location of sleeves, floor openings, and wall openings.....+1/4 in.

e. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls:
   1) Minus.....1/4 in.
   2) Plus.....1/2 in.

f. Footings*
   1) Variations in dimensions in plan:
      (a) Minus.....1/4 in.
      (b) Plus.....1/2 in.
      (c) Misplacement or eccentricity:
         (1) 2 percent of the footing width in the direction of misplacement but not more than.....2 in.
      (d) Thickness:
         (1) Decrease in specified thickness.....5%
         (2) Increase in specified thickness.....No limit
   2) Footing Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items.

3.04 SLAB JOINTING

A. Locate joints as indicated on the drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

3.05 CONCRETE FINISHING

A. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.06 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: Not less than 7 days.

C. Surfaces Not in Contact with Forms:

1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
2. Final Curing: Begin after initial curing but before surface is dry.
    a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.
    b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.07 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

E. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.

F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

H. Slab Testing: Cooperate with manufacturer of specified moisture vapor reduction admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

3.08 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.09 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

D. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

G. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

H. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

I. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.03 SUBMITTALS

A. See Section 01-30-00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

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

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

E. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

B. Lintels: As detailed; prime paint finish.

C. Door Frames for Overhead Door Openings and Wall Openings: Channel sections; prime paint finish.

2.04 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: Two coats.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on shop drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES

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

B. Maximum Offset From True Alignment: 1/4 inch.

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

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including Contractual Conditions and Divisions 1 Specification Sections, apply to this section.
B. Section 01-61-16 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

1.03 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2014.
B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

1.04 SUBMITTALS

A. See Section 01-30-00 - Administrative Requirements, for submittal procedures.
B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.
   6. Substrates for which laboratory adhesion and/or compatibility testing is required.
   7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
   8. Sample product warranty.
   9. Certification by manufacturer indicating that product complies with specification requirements.
   10. SWRI Validation: Provide currently available sealant product validations as listed by SWRI (VAL) for specified sealants.
C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
   1. Dow Corning Corporation; www.dowcorning.com/construction/#sle.
   2. Tremco Global Sealants: www.tremcosealants.com.
   3. Sika Corporation: www.usa-sika.com.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. In wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
         1) Exception: Such gaps and openings in gypsum board finished stud walls and suspended ceilings.
   2. Do not seal the following types of joints.
      a. Intentional weepholes in masonry.
      b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
      c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      d. Joints where installation of sealant is specified in another section.
      e. Joints between suspended panel ceilings/grid and walls.

2.03 JOINT SEALANTS – GENERAL

A. Sealants and Primers: Provide products with levels of volatile organic compound (VOC) content as indicated in Section 01-61-16.
B. Colors: To be selected by Architect from manufacturer's standard range.

2.04 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: minimum.
   2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Cure Type: Single-component, neutral moisture curing
   5. Service Temperature Range: Minus 65 to 180 degrees F.
C. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
   1. Color: White.
D. Polyurethane (STPU) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 12-1/2 percent, minimum
   2. Hardness Range: 25 to 30, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
E. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multicomponent; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Service Temperature Range: Minus 40 to 180 degrees F.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.
B. Verify that backing materials are compatible with sealants.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.
B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
B. Perform installation in accordance with ASTM C1193.
C. Perform acoustical sealant application work in accordance with ASTM C919.
D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
E. Install bond breaker backing tape where backer rod cannot be used.
F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Thermally insulated hollow metal doors with frames.

D. Hurricane resistant hollow metal doors and frames.

E. Accessories, including glazing.zdF

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including Contractual Conditions and Divisions 1 Specification Sections, apply to this section.

B. Section 08 71 00 - Door Hardware.

1.03 REFERENCE STANDARDS

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

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors ; 2011.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) ; 2014.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames ; 2011.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process ; 2015.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable ; 2015.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength ; 2014.

H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference ; 2014.

I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames ; 2014 (ANSI/BHMA A156.115).

J. FBC TAS 201 - (Florida Building Code) Impact Test Procedures; Testing Application Standard ; 1994.

K. FBC TAS 202 - (Florida Building Code) Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure; Testing Application Standard ; 1994.

L. FBC TAS 203 - (Florida Building Code) Criteria for Testing Products Subject To Cyclic Wind Pressure Loading; Testing Application Standard ; 1994.

M. FLA (PAD) - Florida Building Code Online - Product Approval Directory ; database at www.floridabuilding.org.

N. ICC A117.1 - Accessible and Usable Buildings and Facilities; International Code Council ; 2009 (ANSI).

O. Miami (APD) - Approved Products Directory; Miami-Dade County ; database at www.miamidade.gov/development/product-control.asp.

P. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames ; 2002.

Q. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames ; 2011.

R. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames ; 2007.

S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives ; 2013.

T. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives ; 2013

U. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies ; 2012.

V. UL (BMD) - Building Materials Directory ; current edition.

W. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies ; Current Edition, Including All Revisions.

X. UL 1784 - Standard for Air Leakage Tests of Door Assemblies ; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes .

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

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

B. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes installation requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door , an Assa Abloy Group company: www.assaabloydss.com.
   2. De La Fontaine Inc : www.delafontaine.com.
   3. Republic Doors : www.republicdoor.com.
   4. Steelcraft , an Allegion brand: www.allegion.com/us.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DESIGN CRITERIA

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Door Edge Profile: Manufacturers standard for application indicated.

4. Typical Door Face Sheets: Flush.
5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
6. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
7. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Type Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 1 - Standard-duty.
    b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 1 - Full Flush.
    d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
2. Door Thickness: 1-3/4 inch, nominal.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Exterior Door Frames: Welded
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Frame Metal Thickness: 18 gage, 0.042 inch, minimum.
3. Weatherstripping: Separate, see Section 08 71 00.

2.05 ACCESSORIES

A. Glazing: Clear sheet glass, 1/4 inch (6 mm) thick , factory installed.

B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners ; prepared for countersink style tamper proof screws.

C. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

D. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.06 FINISHES

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

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Coordinate installation of hardware.

E. Coordinate installation of glazing.

F. Coordinate installation of electrical connections to electrical hardware items.

3.03 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified door and frame standards or custom guidelines indicated.

B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

3.05 SCHEDULE

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

END OF SECTION

SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead coiling doors, operating hardware, exterior, manual operation.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.

1.04 SUBMITTALS

A. See Section 01-30-00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general construction, electrical equipment, and component connections and details.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

E. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Overhead Coiling Doors:
   1. Alpine Overhead Doors, Inc: www.alpinedoors.com.
   2. The Cookson Company: www.cooksondoor.com.
   3. Wayne-Dalton, a Division of Overhead Door Corporation; Advanced Systems - 800c ADV : www.wayne-dalton.com.

2.02 COILING DOORS

A. Exterior Coiling Doors: Steel slat curtain.
   1. Capable of withstanding positive and negative wind loads without undue deflection or damage to components.
      a. Windload Design:
         1) Windload shall meet or exceed:
            (a) FBC certification FL# 1421 & 1672.
   2. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 4.75.
   3. Nominal Slat Size: 2 inches wide x required length.
   4. Finish: Galvanized.
   5. Finish: Factory painted, color as selected by owner.
   6. Guides: Angles; galvanized steel.
   7. Hood Enclosure: Manufacturer's standard; aluminum.
   8. Mounting: Within framed opening.
   9. Locking Devices: Slide bolt on inside.

2.03 MATERIALS

A. Curtain Construction: Interlocking slats.
   1. Slat Ends: Each slat fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
   3. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.

B. Aluminum Slats: ASTM B221 (ASTM B221M), aluminum alloy Type 6063.

C. Guide Construction: Continuous, of profile to retain door in place, mounting brackets of same metal.

D. Steel Guides: ASTM A36/A36M steel angles, size as required for wind loading, hot-dip galvanized per ASTM A 123/A 123M.

E. Hood Enclosure: Internally reinforced to maintain rigidity and shape.

F. Lock Hardware:
   1. Latching Mechanism: Inside mounted, adjustable keeper, spring activated latch bar feature to keep in locked or retracted position.
   2. Latch Handle: Manufacturer's standard.
   3. Manual Chain Lift: Provide padlockable chain keeper on guide.

G. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Install perimeter trim and closures.

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch.

C. Maximum Variation From Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:
   1. Mechanical and electrified door hardware for:
      a. Swinging doors.

B. Related Sections:
   2. Division 01 Section “Alternates” for alternates affecting this section.
   3. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
   4. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.

1.03 REFERENCES

A. UL - Underwriters Laboratories
   5. UL 10B - Fire Test of Door Assemblies
   6. UL 10C - Positive Pressure Test of Fire Door Assemblies
   7. UL 1784 - Air Leakage Tests of Door Assemblies
   8. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute
   9. Sequence and Format for the Hardware Schedule
   10. Recommended Locations for Builders Hardware
   11. Key Systems and Nomenclature

C. ANSI - American National Standards Institute
   12. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties.

D. Florida Building Codes.

1.04 SUBMITTALS

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

B. Action Submittals:
   16. Product Data: Product data including manufacturers’ technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
   17. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
      a. Wiring Diagrams: For power, signal, and control wiring and including:
         1) Details of interface of electrified door hardware and building safety and security systems.
         2) Schematic diagram of systems that interface with electrified door hardware.
         3) Point-to-point wiring.
         4) Risers.

18. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
    a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
19. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
    a. Door Index; include door number, heading number, and Architects hardware set number.
    b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
    c. Type, style, function, size, and finish of each hardware item.
    d. Name and manufacturer of each item.
    e. Fastenings and other pertinent information.
    f. Location of each hardware set cross-referenced to indications on Drawings.
    g. Explanation of all abbreviations, symbols, and codes contained in schedule.
    h. Mounting locations for hardware.
    i. Door and frame sizes and materials.
    j. Name and phone number for local manufacturer's representative for each product.
    k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.
        1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.
20. Key Schedule:
    a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
    b. Use ANSI/BHMA A156.28 “Recommended Practices for Keying Systems” as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
    c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
    d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
    e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
        1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
    f. Prepare key schedule by or under supervision of supplier, detailing Owner’s final keying instructions for locks.
21. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:
22. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
23. Product Certificates for electrified door hardware, signed by manufacturer:
    a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

24. Certificates of Compliance:
    a. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
    b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in “QUALITY ASSURANCE” article, herein.
    c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in “QUALITY ASSURANCE” article, herein.
25. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
26. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:
27. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
    a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    b. Catalog pages for each product.
    c. Name, address, and phone number of local representatives for each manufacturer.
    d. Parts list for each product.
    e. Final approved hardware schedule edited to reflect conditions as installed.
    f. Final keying schedule
    g. Copies of floor plans with keying nomenclature
    h. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
    i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
28. Where specific manufacturer’s product is named and accompanied by “No Substitute,” including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
    a. Where no additional products or manufacturers are listed in product category, requirements for “No Substitute” govern product selection.

B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
29. Warehousing Facilities: In Project's vicinity.
30. Scheduling Responsibility: Preparation of door hardware and keying schedules.
31. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
32. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
    a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.

D. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
   33. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
   34. Can provide installation and technical data to Architect and other related subcontractors.
   35. Can inspect and verify components are in working order upon completion of installation.
   36. Capable of producing wiring diagrams.
   37. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.

E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
   38. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
   39. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

G. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
   40. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at tested pressure differential of 0.3-inch wg of water.

H. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

I. Means of Egress Doors: Latches do not require more than 15 lbf to release latch. Locks do not require use of key, tool, or special knowledge for operation.

J. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.
   41. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf.
   42. Maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
      b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
      c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
   43. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
   44. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches from latch, measured to leading edge of door.

K. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.
   45. Attendees: Owner, Contractor, Architect, Installer, and Supplier’s Architectural Hardware Consultant.
   46. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
      a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
      b. Preliminary key system schematic diagram.
      c. Requirements for key control system.
      d. Requirements for access control.
      e. Address for delivery of keys.

L. Pre-installation Conference: Conduct conference at Project site**.**
   47. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   48. Inspect and discuss preparatory work performed by other trades.
   49. Inspect and discuss electrical roughing-in for electrified door hardware.
   50. Review sequence of operation for each type of electrified door hardware.
   51. Review required testing, inspecting, and certifying procedures.

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
   54. Deliver each article of hardware in manufacturer’s original packaging.

C. Project Conditions:
   55. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
   56. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:
   57. Promptly replace products damaged during shipping.
   58. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
   59. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

F. Deliver keys **and permanent cores** to Owner by registered mail, overnight package service or hand delivery with signed receipt.

1.07 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

F. Direct shipments not permitted, unless approved by Contractor.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   60. Warranty Period: Years from date of Substantial Completion, for durations indicated.
      a. Closers:
         1) Mechanical: 10 years.
      b. Locksets:
         1) Mechanical: 3 years.
   61. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.09 MAINTENANCE

A. Maintenance Tools:
   62. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and particular project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings Awarding Authority has elected to prepare proprietary specifications.

B. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

C. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

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

2.02 MATERIALS

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

2.03 HINGES

A. Provide Five-knuckle, Ball Bearing hinges.
   67. Manufacturers and Products:
      a. Scheduled Manufacturer and Product: Stanley FBB series
      b. Acceptable Manufacturer: Ives 5BB series, McKinney TA series, Hager BB series.

B. Requirements, unless otherwise specified:
   68. 1-3/4" thick doors, up to and including 36 inches wide:
      a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inch high.
      b. Interior: Standard weight, steel, 4-1/2 inch high.
   69. 1-3/4" thick doors over 36 inches wide:
      a. Exterior: Heavy weight, bronze/stainless steel, 5 inch high.
      b. Interior: Heavy weight, steel, 5 inch high.
   70. 2" or thicker doors:
      a. Exterior: Heavy weight, bronze or stainless steel, 5 inch high.
      b. Interior: Heavy weight, steel, 5 inch high.
   71. Provide three hinges per door leaf for doors 90 inches or less in height, and one additional hinge for each 30 inches of additional door height.
   72. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
   73. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
      a. Steel Hinges: Steel pins.
      b. Non-Ferrous Hinges: Stainless steel pins.
      c. Out-Swinging Exterior Doors: Non-removable pins.
      d. Out-Swinging Interior Lockable Doors: Non-removable pins.
      e. Interior Non-lockable Doors: Non-rising pins.
   74. Width of hinges: 4-1/2" at 1-3/4" thick doors, and 5" at 2" or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
   75. Doors 36" wide or less furnish hinges 4-1/2" high; doors greater than 36" wide furnish hinges 5" high, heavy weight or standard weight as specified.
   76. Provide mortar guard for each electrified hinge specified, unless specified in hollow metal frame specification.

2.04 MORTISE LOCKS – GRADE 1, HEAVY DUTY

A. Manufacturers and Products:
   77. Scheduled Manufacturers and Products: Best 45H Heavy Duty Mortise.
   78. Acceptable Manufacturers: Dorma M9000 Series, Sargent 8200 series.

B. Mortise Type Locks and Latches:
   79. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Heavy Duty, Security Grade 2 and be UL10C.
   80. Fit ANSI A115.1 door preparation.
   81. 2-3/4" backset.
   82. Solid, one-piece, 3/4" throw, anti-friction latchbolt made of self-lubricating stainless steel.
   83. Deadbolt functions shall have 1" throw bolt made of hardened stainless steel.
   84. Auxiliary deadlatch to be made of one-piece stainless steel, permanently lubricated.
   85. Provide sufficient curved strike lip to protect door trim.
   86. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable.
   87. Lock shall have self-aligning, thru-bolted trim.
   88. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
   89. Provide locksets with 7-pin removable and interchangeable core cylinders.
   90. Core face must be the same finish as the lockset.
   91. Functions as indicated in the hardware groups.
   92. Lever Design: "14" Lever, "H" Rose

2.05 CYLINDERS

A. Manufacturer and Product:
   93. Scheduled Manufacturer and Product: Best Cormax.
   94. Acceptable Manufacturers: Dorma, Sargent.

B. Requirements: Provide cylinders/cores complying with the following requirements.
   95. Cylinders/cores compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated.

C. Full-sized cylinders with small format interchangeable cores (SFIC), in the below-listed configuration(s), distributed throughout the Project as indicated.
   96. Keying: Manufacturer-keyed permanent cylinders/cores, configured into keying system per "KEYING" article herein.
   97. Features: Cylinders/cores shall incorporate the following features.

D. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.

E. Identification stamping provisions must be approved by the Architect and Owner.

F. Failure to comply with stamping requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
   98. Forward cylinders/cores to Owner, separately from keys, by means as directed by Owner.

G. Project Cylinder/Core Distribution: Provide cylinders/cores complying with the following requirements in Project locations as indicated.

H. Replaceable Construction Cores.
   99. Provide temporary construction cores replaceable by permanent cores. Provide 12 operating keys for contractor use during construction.

I. Permanent Keyed Cores:
   100. Contractor to replace construction cores with permanent cores as directed by Owner. Installation will be in presence of owner representative, indicating keys operate locking hardware and to turn over all permanent keys.

2.06 KEYING

A. Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Keying Requirements – General for Commercial
   101. Permanent cylinders/cores keyed by the manufacturer according to the following key system.

C. Key Features: Provide keys with the following features.
   102. Patent Protection: Keys and blanks protected by a special broching in restricted keyway

D. Keys
   103. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
   104. Identification: Stamp all keys with keyset symbol
   105. Quantity of keys:
      a. Provide (2) operating keys per keyed core.
      b. Provide (6) Master Keys.
      c. Provide (2) Control Keys

E. Coordinate with cylinder/core and key identification requirements above.

F. Stamp keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE".

G. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.

2.07 DOOR CLOSERS – HEAVY DUTY

A. Manufacturer and Product:
   1. Scheduled Manufacturer and Product: Stanley Commercial QDC100 series.
      a. Acceptable Manufacturers: Dorma 8900, LCN 4040 XP Series.

B. Requirements:
   1. Tested and approved by BHMA for ANSI 156.4, Grade 1.
   2. UL10C certified.
   3. Closer shall have extra-duty arms and knuckles.
   4. Conform to ANSI 117.1.
   5. Maximum 2 7/16” case projection with non-ferrous cover.
   6. Separate adjusting valves for closing and latching speed, and backcheck.
   7. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions.
   8. Full rack and pinion type closer with 1-1/2” minimum bore.
   9. Mount closers on non-public side of door, unless otherwise noted in specification.
   10. Closers shall be non-handed, non-sized and multi-sized.

2.08 PROTECTION PLATES

A. Manufacturers:
   1. Scheduled Manufacturer: Trimco
   2. Acceptable Manufacturers: Burns, Don-Jo, Ives, Rockwood

B. Requirements:
   1. Provide kick plates, mop plates, and armor plates minimum of 1/8 inch thick as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
   2. Sizes of plates:
      a. Kick Plates: 10 inches high by 2 inches less width of door on single doors, 1 inch less width of door on pairs

2.09 DOOR STOPS AND HOLDERS

A. Manufacturers:
   1. Scheduled Manufacturer: Trimco
   2. Acceptable Manufacturers: Burns, Don-Jo, Ives, Rockwood

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

2.10 THRESHOLDS, SEALS, DOOR SWEEPS, AND GASKETING

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

B. Requirements:
   1. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
   2. Size of thresholds:
      a. Saddle Thresholds: 1/2” high by jamb width by door width
      b. Bumper Seal Thresholds: 1/2” high by 5” wide by door width

3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.11 SILENCERS

A. Manufacturers:
   1. Scheduled Manufacturer: Trimco
   2. Acceptable Manufacturers: Burns, Don-Jo, Ives, Rockwood

B. Requirements:
   1. Provide "push-in" type silencers for hollow metal or wood frames.
   2. Provide one silencer per 30 inches of height on each single frame, and two for each pair frame.
   3. Omit where gasketing is specified.
   4.

2.12 KEY CONTROL CABINET

A. Manufacturers:
   1. Telkee, Lund, MMF.

B. Key Control Cabinet: Provide one wall mounted key cabinet complete with hooks, index and tags to accommodate 50% expansion. Coordinate mounting location with architect.

2.13 FINISH

A. Designations used in Schedule of Finish Hardware - 3.7, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products

B. Powder coat door closers to match other hardware, unless otherwise noted.

C. Aluminum items shall be finished to match predominant adjacent material. Gasketing to coordinate with frame color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.02 PREPARATION

A. Where on-site modification of doors and frames is required:
   1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
   2. Field modify and prepare existing door and frame for new hardware being installed.
   3. When modifications are exposed to view, use concealed fasteners, when possible.
   4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
      a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
1. Replace construction cores with permanent cores as indicated in keying section.

I. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.

J. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

K. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

L. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

M. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

N. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including

adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 09 91 13

EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, varnishes, and sealers.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Exposed surfaces of steel lintels and ledge angles.
   2. Mechanical and Electrical:
      a. On the roof and outdoors, paint equipment that is exposed to weather or to view, including factory-finished materials.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically indicated.
   9. Ceramic and other types of tiles.
   10. Glass.
   11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.

C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2012).

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.

E. SSPC-SP 1 - Solvent Cleaning; 2015.

F. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

G. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

H. SSPC-SP 13 - Surface Preparation of Concrete; (Reaffirmed 2015); 2003.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. MPI product number (e.g. MPI #47).
3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
4. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
3. Allow 30 days for approval process, after receipt of complete samples by Architect.
4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
3. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.

B. Paints:
1. Benjamin Moore & Co: www.benjaminmoore.com.
2. Glidden Professional, a product of PPG Architectural Coatings: www.gliddenprofessional.com.
3. PPG Paints: www.ppgpaints.com.
4. Sherwin-Williams Company: www.sherwin-williams.com.
5. Valspar Corporation: www.valsparpaint.com.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Supply each paint material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated in Color Schedule.
1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - EXTERIOR

A. Ferrous Metals, Primed, Alkyd, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
2. Semi-gloss: Two coats of alkyd enamel.

B. Galvanized Metals, Alkyd, 3 Coat:
1. One coat galvanize primer.
2. Semi-gloss: Two coats of alkyd enamel.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Alkali Resistant Water Based Primer; MPI #3.
2. Anti-Corrosive Alkyd Primer for Metal; MPI #79.
3. Interior/Exterior Quick Dry Alkyd Primer for Metal; MPI #76.

4. Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
    a. Shop primer by others.
    b. One top coat.
    c. Top Coat: Alkyd Dry Fall; MPI #55, 89, or 225.
    d. Flat: MPI gloss level 1; use this sheen at all locations.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
    1. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
    2. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Galvanized Surfaces:
    1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
    2. Prepare surface according to SSPC-SP 2.

H. Ferrous Metal:
    1. Solvent clean according to SSPC-SP1.
    2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
    3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

I. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 91 23
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
      c. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically indicated.
   8. Glass.
   9. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.

C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2012).

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.

E. SSPC-SP 1 - Solvent Cleaning; 2015.

F. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

G. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

H. SSPC-SP 13 - Surface Preparation of Concrete; (Reaffirmed 2015); 2003.

1.05 SUBMITTALS

A. See Section 01-30-00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
   3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.

D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01-60-00 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
   2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
   3. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.

B. Paints:
   1. PPG Paints: www.ppgpaints.com/sle.
   2. Sherwin-Williams Company: www.sherwin-williams.com.

C. Stains:
   1. Sherwin-Williams Company: www.sherwin-williams.com.

D. Primer Sealers: Same manufacturer as top coats.

E. Substitutions: See Section 01-60-00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each paint material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Architectural coatings VOC limits of the State in which the Project is located.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated on drawings.
   1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
   2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
   3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - INTERIOR

A. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
   1. Medium duty applications include hollow metal doors and door frames.
   2. Two top coats and one coat primer.
   3. Primer: Pro Industrial Pro-Cryl Universal Primer, B66W1310/20, MPI #134
   4. Top Coat(s): Interior Alkyd, Water Based.
      a. Products:
         1) Cloverdale Renaissance Semi-Gloss Hybrid Waterborne Alkyd Enamel, 03113. (MPI #169)
         2) PPG Paints Speedhide Interior/Exterior WB Alkyd Semi-Gloss, 6-1510 Series.
         3) Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane, Semi-Gloss, B53W1150.

B. Paint I-TR-C - Transparent Finish on Concrete Floors.
   1. 2 coats clear sealer.
   2. Clear moisture cure urethane, MPI #31
      a. Products:
         1) Sherwin-Williams ArmorSeal Rexthane I Floor Coating, B65-60 Series.
         2) Substitutions: Section 01-60-00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Masonry, Concrete, and Concrete Masonry Units : 12 percent.
   3. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches. Allow to dry.
   3. Clean concrete according to ASTM D4258. Allow to dry.

4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

G. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.
   3. Clean surfaces with pressurized water. Use pressure range of 600 to 1500 psi at 6 to 12 inches. Allow to dry.

H. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

I. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

J. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

K. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

L. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

M. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

N. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 13 34 19

METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufacturer-engineered, shop-fabricated structural steel building frame.

B. Non Insulated Metal wall and roof panels including soffits and gutters and downspouts.

C. Exterior louvers.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications.

B. Section 07 92 00 - Joint Sealants: Sealing joints between accessory components and wall system.

C. Section 08 11 13 - Hollow Metal Doors and Frames.

D. Section 08 33 23 – Overhead Coiling Doors

1.03 REFERENCE STANDARDS

A. AISC 360 - Specification for Structural Steel Buildings; 2016.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014, with Editorial Revision (2017).

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2020.

G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

H. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2014.

I. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2018.

J. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

K. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

L. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2020.

M. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.

N. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2016.

O. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

P. ASTM C991 - Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings; 2016.

Q. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2017.

R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

S. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

T. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2018.

U. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019, with Editorial Revision (2020).

V. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

W. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

X. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems; 2018.

Y. MBMA (MBSM) - Metal Building Systems Manual; 2012.

Z. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

AA. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene two weeks before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on profiles, component dimensions, fasteners.

C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections, attachments, openings, cambers, and loads; wall and roof system dimensions, panel layout, general construction details, anchors and methods of anchorage, and installation; framing anchor bolt settings, sizes, locations from datum, and foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.

D. Samples: Submit two samples of precoated metal panels for each color selected, 4 by 4 inch in size illustrating color and texture of finish.

E. Manufacturer's Instructions: Indicate preparation requirements, anchor bolt placement.

F. Erection Drawings: Indicate members by label, assembly sequence, and temporary erection bracing.

G. Designer's Qualification Statement.

H. Manufacturer's Qualification Statement: Provide documentation showing metal building manufacturer is accredited under IAS AC472.

1. Include statement that manufacturer designs and fabricates metal building system as integrated components and assemblies, including but not limited to primary structural members, secondary members, joints, roof, and wall cladding components specifically designed to support and transfer loads and properly assembled components form a complete or partial building shell.

I. Erector's Qualification Statement.

J. Project Record Documents: Record actual locations of concealed components and utilities.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this type of work.
   1. Design Engineer Qualifications: Licensed in Florida. Responsibility shall provide signed and sealed drawings, application to local governing jurisdiction.
   2. Comply with FBC for submission of design calculations, reviewed shop and erection drawings, and concrete foundation plans as required for acquiring permits.
   3. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.

B. Perform work in accordance with AISC 360 and MBMA (MBSM).
   1. Maintain one copy on site.

C. Perform welding in accordance with AWS D1.1/D1.1M.

D. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
   1. Not less than three years of experience.
   2. Accredited by IAS in accordance with IAS AC472.

E. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for water tightness.
   1. Include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading. Include coverage for weather tightness of building enclosure elements after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Buildings Systems:
   1. Ceco Building Systems; www.cecobuildings.com/#sle.
   2. Nucor Building Systems; www.nucorbuildingsystems.com/#sle.
   3. VP Buildings; www.vp.com/#sle.
   4. Or equal.

2.02 ASSEMBLIES

A. Single span rigid frame; Continuous beam frame.

B. Bay Spacing: 20 ft.

C. Primary Framing: Rigid frame of rafter beams and columns, and wind bracing.

D. Secondary Framing: Purlins, Girts, Eave struts, Flange bracing, Sill supports, and Clips, and other items detailed.

E. Wall System: Preformed metal panels of vertical profile, with sub-girt framing/anchorage assembly, and accessory components.

F. Roof System: Preformed metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly, and accessory components.

G. Roof Slope: 2 inches in 12 inches.

2.03 PERFORMANCE REQUIREMENTS

A. Design structural members to withstand 20 psf live load.

B. Design structural members to withstand Class 90 wind uplift in accordance with UL 580.

C. Exterior wall and roof system shall withstand imposed loads with maximum allowable deflection of 1/180.

D. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.

E. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.

2.04 MATERIALS - FRAMING

A. Structural Steel Members: ASTM A36/A36M.

B. Structural Tubing: ASTM A500/A500M, Grade B cold-formed.

C. Plate or Bar Stock: ASTM A529/A529M, Grade 50.

D. Anchor Bolts: ASTM A307, Grade A.

E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1; galvanized to ASTM A153/A153M.

F. Welding Materials: Type required for materials being welded.

G. Primer: SSPC-Paint 20, zinc rich.

H. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
   2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

2.05 MATERIALS - WALLS AND ROOF

A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M.

B. Joint Seal Gaskets: Manufacturer's standard type.

C. Fasteners: Manufacturer's standard type, galvanized to comply with requirements of ASTM A153/A153M.

D. Bituminous Paint: Asphaltic type.

E. Sealant: Manufacturer's standard type.

F. Sealant: ASTM C920, elastomeric sealant with movement capability of at least plus/minus 50 percent; 100 percent silicone; for exposed applications, match adjacent colors as closely as possible.

G. Metal Mesh: Galvanized steel wire, woven.

H. Trim, Closure Pieces, Caps, Flashings, Gutters, Downspouts. Same material, thickness and finish as exterior sheets; brake formed to required profiles.

2.06 COMPONENTS

A. Wall Louvers: type Z blade design, same finish as adjacent material, with steel mesh bird screen and frame, blank sheet metal at unused portions.

2.07 FABRICATION - FRAMING

A. Fabricate members in accordance with AISC 360 for plate, bar, tube, or rolled structural shapes.

B. Anchor Bolts: Formed with straight shank, assembled with template for casting into concrete.

C. Provide framing for exhaust fan and louver openings.

D. Provide wall opening framing for doors and other accessory components.

2.08 FABRICATION - WALL AND ROOF PANELS

A. Siding: Minimum 26 gauge profile indicated.

B. Roofing: Minimum 26 gauge profile lapped fitted with continuous gaskets.

C. Soffit Panels: Minimum 26 Gauge.

D. Girts/Purlins: Rolled formed structural shape to receive siding, roofing sheet.

E. Internal and External Corners: Same material thickness and finish as adjacent material, profile brake formed to required angles.

F. Expansion Joints: Same material and finish as adjacent material where exposed.

G. Flashings, Closure Pieces, Fascia; Infills; Caps: Same material and finish as adjacent material, profile to suit system; or formed as detailed.

H. Fasteners: To maintain load requirements and weather tight installation, same finish as cladding, non-corrosive type.

2.09 FABRICATION - GUTTERS AND DOWNSPOUTS

A. Fabricate of same material and finish as roofing metal.

B. Form gutters and downspouts to collect and remove water. Fabricate with connection pieces.

C. Form sections in maximum possible lengths. Hem exposed edges.

D. Fabricate support straps of same material and finish as roofing metal, color as selected.

2.10 FINISHES

A. Framing Members: Clean, prepare, and galvanize to ASTM A123/A123M.

B. Exterior Surfaces of Wall or Roof Components and Accessories: Precoated enamel on steel color as selected from manufacturer's standard range.

C. Interior Surfaces of Wall or Roof Components and Accessories: Precoated enamel on steel of fluoropolymer; as selected from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position.

3.02 ERECTION - FRAMING

A. Erect framing in accordance with AISC 360.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing.

C. Set column base plates with non-shrink grout to achieve full plate bearing.

D. Do not field cut or alter structural members without approval.

E. After erection, prime welds, abrasions, and surfaces not galvanized.

3.03 ERECTION - WALL AND ROOF PANELS

A. Install in accordance with manufacturer's instructions.

B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.

C. Fasten cladding system to structural supports, aligned level and plumb.

D. Locate end laps over supports. End laps minimum 2 inches. Place side laps over bearing.

E. Provide expansion joints where indicated.

F. Use exposed fasteners.

G. Install sealant and gaskets, providing weather tight installation.

3.04 ERECTION - GUTTERS AND DOWNSPOUTS

A. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.

B. Apply bituminous paint on surfaces in contact with cementitious materials.

C. Slope gutters minimum 1/8 inch/ft.

D. Install splash pads.

3.05 ERECTION - SKYLIGHTS

A. Install in accordance with manufacturer's instructions.

B. Coordinate with installation of roofing system and related flashings.

C. Apply bituminous paint on aluminum surfaces of units in contact with dissimilar metals.

3.06 INSTALLATION - ACCESSORY COMPONENTS IN WALL SYSTEM

A. Install door frames; doors; overhead doors; in accordance with manufacturers instructions.

3.07 TOLERANCES

A. Framing Members: 1/4 inch from plumb.

B. Siding and Roofing: 1/8 inch from true position.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Nonmetallic-sheathed cable.

C. Underground feeder and branch-circuit cable.

D. Metal-clad cable.

E. Power and control tray cable.

F. Wiring connectors.

G. Electrical tape.

H. Wire pulling lubricant.

I. Cable ties.

J. Firestop sleeves.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011 (Reapproved 2017).

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

G. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.

H. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF); 2007.

I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2009.

J. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

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

L. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

P. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.

Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

R. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members; Current Edition, Including All Revisions.

S. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.
   3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

D. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

H. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.

I. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.

J. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.

K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

L. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
   3. Color Code:
      a. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      b. Equipment Ground, All Systems: Green.
      c. Isolated Ground, All Systems: Green with yellow stripe.
      d. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      a. Cerro Wire LLC: www.cerrowire.com/#sle.
      b. Encore Wire Corporation: www.encorewire.com/#sle.
      c. General Cable Technologies Corporation; _____: www.generalcable.com/#sle.

d. Service Wire Co: www.servicewire.com/#sle.
e. Southwire Company: www.southwire.com/#sle.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.04 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

A. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.

B. Provide equipment grounding conductor unless otherwise indicated.

C. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

2.05 METAL-CLAD CABLE

A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

B. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

E. Grounding: Full-size integral equipment grounding conductor.

F. Armor: Steel, interlocked tape.

2.06 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

2.07 ACCESSORIES

A. Electrical Tape:
1. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).

B. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

C. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Include circuit lengths required to install connected devices within 10 ft (3.0 m) of location indicated.
   4. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   5. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.

E. Install metal-clad cable (Type MC) in accordance with NECA 120.

F. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

G. Direct Burial Cable Installation:
   1. Protect cables from damage in accordance with NFPA 70.
   2. Provide underground warning tape in accordance with Section 26 0553 along entire cable length.

H. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

I. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

J. Terminate cables using suitable fittings.
   1. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

K. Install conductors with a minimum of 6 inches (_____ mm) of slack at each outlet.

L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

N. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

P. Insulate ends of spare conductors using vinyl insulating electrical tape.

Q. Identify conductors and cables in accordance with Section 26 0553.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

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

C. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
   2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
   3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
   4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
   5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
   6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.

2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 26 0553.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

C. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

D. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

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

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Installer's Qualification Statement: Include evidence of compliance with specified requirements.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. Comply with MFMA-4.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: Also comply with Section 26 0533.13.

I. Box Support and Attachment: Also comply with Section 26 0533.16.

J. Secure fasteners according to manufacturer's recommended torque settings.

K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 33.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Intermediate metal conduit (IMC).

C. PVC-coated galvanized steel rigid metal conduit (RMC).

D. Electrical metallic tubing (EMT).

E. Rigid polyvinyl chloride (PVC) conduit.

F. Reinforced thermosetting resin conduit (RTRC).

G. Conduit fittings.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 27 1000 - Structured Cabling: Additional requirements for communications systems conduits.

F. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

A. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2015.

B. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2018.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.

E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

G. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2018.

H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2016.

J. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series; 2015.

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

L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

N. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

O. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

P. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

Q. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   2. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.

D. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

E. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
   1. Maximum Length: 6 feet (1.8 m).

G. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
   3. Vibrating equipment includes, but is not limited to:
      a. Motors.
      b. Fans.

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Communications Systems Conduits: Also comply with Section 27 1000.

C. Fittings for Grounding and Bonding: Also comply with Section 26 0526.

D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

E. Provide products listed, classified, and labeled as suitable for the purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 1/2 inch (16 mm) trade size.
   2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
   3. Control Circuits: 1/2 inch (16 mm) trade size.
   4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
   5. Underground, Interior: 3/4 inch (21 mm) trade size.
   6. Underground, Exterior: 1 inch (27 mm) trade size.

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Thomas & Betts Corporation; _____: www.tnb.com/#sle.
   2. Robroy Industries; _____: www.robroy.com/#sle.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil (1.02 mm).

D. PVC-Coated Fittings:
   1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
   2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
   4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil (1.02 mm).

E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil (0.38 mm).

2.06 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

2.07 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular/#sle.
   3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Cantex Inc: www.cantexinc.com/#sle.
   2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
   3. JM Eagle: www.jmeagle.com/#sle.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

A. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).

B. Supports: Per manufacturer's recommendations.

C. Fittings: Same type and manufacturer as conduit to be connected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

G. Install electrical nonmetallic tubing (ENT) in accordance with NECA 111.

H. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   5. Arrange conduit to maintain adequate headroom, clearances, and access.
   6. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   7. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
   8. Route conduits above water and drain piping where possible.
   9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   10. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
   11. Group parallel conduits in the same area together on a common rack.

I. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   3. Use conduit strap to support single surface-mounted conduit.
      a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
   4. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
   5. Use conduit clamp to support single conduit from beam clamp or threaded rod.

6. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
7. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
8. Use of wire for support of conduits is not permitted.

J. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
5. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
6. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

K. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

L. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 31 2316.13.
2. Minimum Cover, Unless Otherwise Indicated or Required:
a. Underground, Exterior: 24 inches (610 mm).

M. Provide grounding and bonding in accordance with Section 26 0526.

N. Identify conduits in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

B. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 05 33.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

C. Boxes and enclosures for integrated power, data, and audio/video.

1.02 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 2726 - Wiring Devices:
   1. Wall plates.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

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

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - UL Standard for Safety Industrial Control Panels; 2018.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.

4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.

9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
12. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Box Locations:
1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes so that wall plates do not span different building finishes.
4. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.

G. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

H. Install boxes plumb and level.

I. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.

2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.

J. Install boxes as required to preserve insulation integrity.

K. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

L. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

M. Close unused box openings.

N. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

O. Provide grounding and bonding in accordance with Section 26 0526.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 26 2726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

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

D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
         5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
   2. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
      a. Service equipment.
      b. Industrial control panels.
      c. Motor control centers.
      d. Elevator control panels.
      e. Industrial machinery.

C. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
   2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

D. Identification for Luminaires:
   1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Materials:
   2. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Receptacle Identification:
   1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
   2. Legend: Power source and circuit number or other designation indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch (5 mm).
   5. Color: Black text on clear background.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch (3 mm).

F. Color: Black text on white background unless otherwise indicated.

2.04 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Non-detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 4 mil (0.1 mm).

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:
   1. Tape for Buried Power Lines: Black text on red background.
   2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.05 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
   2. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conductors and Cables: Legible from the point of access.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.

G. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION

SECTION 26 21 00

LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0533.13 - Conduit for Electrical Systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 2416 - Panelboards: Service entrance equipment.

1.03 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.04 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code; 2017.

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

1.05 ADMINISTRATIVE REQUIREMENTS

A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.

B. Coordination:
   1. Verify the following with Utility Company representative:
      a. Utility Company requirements, including division of responsibility.
      b. Exact location and details of utility point of connection.
      c. Utility easement requirements.
      d. Utility Company charges associated with providing service.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
   3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

D. Utility Company charges associated with providing permanent service to be paid by Owner.

E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

F. Scheduling:
   1. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.07 QUALITY ASSURANCE

A. Comply with the following:

1. IEEE C2 (National Electrical Safety Code).
2. NFPA 70 (National Electrical Code).
3. The requirements of the Utility Company.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Products Furnished by Contractor: Comply with Utility Company requirements.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Lighting and appliance panelboards.

B. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

D. NEMA PB 1 - Panelboards; 2011.

E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.

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

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 67 - Panelboards; Current Edition, Including All Revisions.

J. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

PART 2 PRODUCTS

2.01 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet (2,000 m).
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

2. Boxes: Galvanized steel unless otherwise indicated.
    a. Provide wiring gutters sized to accommodate the conductors to be installed.
3. Fronts:
    a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.02 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Aluminum.
3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Provide clear plastic circuit directory holder mounted on inside of door.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
    a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
    b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
    a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.

I. Provide minimum of six spare 1 inch (27 mm) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 26 0526.

K. Install all field-installed branch devices, components, and accessories.

L. Provide filler plates to cover unused spaces in panelboards.

3.03 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.04 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2017h.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); 2017g.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2015).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.

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

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual installed locations of wiring devices.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

2.02 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.03 WALL DIMMERS

A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

2.04 RECEPTACLES

A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

2.05 WALL PLATES

A. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard; _____.
   3. Screws: Metal with slotted heads finished to match wall plate finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches (1200 mm) above finished floor.
      b. Wall Dimmers: 48 inches (1200 mm) above finished floor.
      c. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Install wiring devices plumb and level with mounting yoke held rigidly in place.

I. Install wall switches with OFF position down.

J. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

K. Do not share neutral conductor on branch circuits utilizing wall dimmers.

L. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.04 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.05 CLEANING

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

END OF SECTION

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

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

B. UL 1598 - Luminaires; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

END OF SECTION

SECTION 27 10 00
STRUCTURED CABLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Copper cable and terminations.

B. Fiber optic cable and interconnecting devices.

C. Communications grounding and bonding.

D. Communications identification.

1.02 RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Identification products.

1.03 REFERENCE STANDARDS

A. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

B. ICEA S-83-596 - Indoor Optical Fiber Cables; 2016.

C. ICEA S-90-661 - Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cables (With or Without An Overall Shield) For Use in General Purpose and LAN Communications Wiring Systems Technical Requirements; 2012.

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

E. TIA-492AAAC - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009b.

F. TIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; 2015c.

G. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2019.

H. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2009c, with Addendum (2016).

I. TIA-568.3 - Optical Fiber Cabling and Components Standard; 2016d.

J. TIA-569 - Telecommunications Pathways and Spaces; 2019e.

K. TIA-598 - Optical Fiber Cable Color Coding; 2014d.

L. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2019d.

M. UL 444 - Communications Cables; Current Edition, Including All Revisions.

N. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
   3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

B. Evidence of qualifications for installer.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

D. Field Test Reports.

1.06 QUALITY ASSURANCE

A. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

B. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
   1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
   2. Supervisors and installers factory certified by manufacturers of products to be installed.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 WARRANTY

A. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 COPPER CABLE AND TERMINATIONS

A. Copper Backbone Cable:
   1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2, ICEA S-90-661, and listed and labeled as complying with UL 444; arranged in 25-pair binder groups.
   2. Cable Type: TIA-568.2 Category 3 UTP (unshielded twisted pair); 24 AWG.
   3. Cable Capacity: Quantity of pairs as indicated on drawings.

B. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

C. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
   1. Performance: 500 mating cycles.
   2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

2.02 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES

A. Fiber Optic Backbone Cable:
   1. Description: Tight buffered, non-conductive fiber optic cable complying with TIA-568.3, TIA-598, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.
   2. Cable Type: Multimode, laser-optimized 50/125 um (OM3) complying with TIA-492AAAC.
   3. Cable Capacity: Quantity of fibers as indicated on drawings.
   4. Cable Applications:

B. Fiber Optic Interconnecting Devices:
   1. Connector Type: Type LC.
   2. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.
   3. Maximum Attenuation/Insertion Loss: 0.3 dB.

2.03 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

B. Comply with Section 26 0553.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), BICSI N1, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

3.02 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
   1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
   2. Do not over-cinch or crush cables.
   3. Do not exceed manufacturer's recommended cable pull tension.
   4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
   1. At Distribution Frames: 120 inches (3000 mm).
   2. At Outlets - Copper: 12 inches (305 mm).
   3. At Outlets - Optical Fiber: 39 inches (1000 mm).

C. Copper Cabling:
   1. For 4-pair cables in conduit, do not exceed 25 pounds (110 N) pull tension.
   2. Use T568B wiring configuration.

D. Fiber Optic Cabling:
   1. Prepare for pulling by cutting outer jacket for 10 inches (250 mm) from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
   2. Support vertical cable at intervals as recommended by manufacturer.

E. Identification:
   1. Use wire and cable markers to identify cables at each end.

3.03 FIELD QUALITY CONTROL

A. Comply with inspection and testing requirements of specified installation standards.

B. Visual Inspection:
   1. Inspect cable jackets for certification markings.
   2. Inspect cable terminations for color coded labels of proper type.
   3. Inspect outlet plates and patch panels for complete labels.

C. Testing - Copper Cabling and Associated Equipment:
   1. Test backbone cables after termination but before cross-connection.
   2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
   3. Category 3 Backbone: Perform attenuation test.
   4. Category 3 Links: Test each pair for short circuit continuity, short to ground, crosses, reversed polarity, operational and ring-back, and dial tone.

D. Testing - Fiber Optic Cabling:
   1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests.
   2. Multimode Backbone: Perform tests in accordance with TIA-526-14.

E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION

SECTION 31 31 16
TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

1.02 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; United States Code ; 1947 (Revised 2001).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Test Reports: Indicate regulatory agency approval reports when required.

D. Manufacturer's Application Instructions: Indicate caution requirements .

E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

F. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.

G. Record moisture content of soil before application.

H. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work.
   1. Having minimum of 5 documented experience.
   2. Approved by manufacturer of treatment materials.
   3. Licensed in the State in which the Project is located.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year installer's warranty against damage to building caused by termites.
   1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers:
   1. Bayer Environmental Science Corp : www.backedbybayer.com/pest-management.
   2. FMC Professional Solutions : www.fmcprosolutions.com.
   3. Syngenta Professional Products : www.syngentaprofessionalproducts.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Toxicant Chemical: EPA approved; synthetically color dyed to permit visual identification of treated soil.

C. Diluent: Recommended by toxicant manufacturer.

2.02 MIXES

A. Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:
   1. Under Slabs-on-Grade.

D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

E. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

F. Re-treat disturbed treated soil with same toxicant as original treatment.

G. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

A. Do not permit soil grading over treated work.

END OF SECTION

EXHIBIT A

GEOTECHNICAL EXPLORATION REPORT

Final Report of Geotechnical Exploration

For

Storage Building at Maxwell Snyder Armory

MAE Project No. 0106-0010
December 8, 2020

Prepared for:

The Department of Military Affairs

and

cph

5200 Belfort Road, Suite 220
Jacksonville, FL-32256

Prepared by:

MAE
Meskel & Associates Engineering
Geotechnical ◤ Environmental ◤ Inspection ◤ Testing

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December 8, 2020

Meskel & Associates Engineering
Geotechnical ⌜ Environmental ⌜ Inspection ⌜ Testing

CPH, Inc.
5200 Belford Road, Suite 220
Jacksonville, Florida-32256

Attention: Mr. Wade P. Olszewski, P.E.

Reference: Final Report of Geotechnical Exploration
Storage Building at Maxwell Snyder Armory
Jacksonville, Florida
MAE Project No. 0106-0010

Dear Mr. Olszewski:

Meskel & Associates Engineering, PLLC has completed a geotechnical exploration for the subject project. Our work was performed in general accordance with our subcontractor agreement dated October 13, 2020. The purposes of geotechnical exploration are to evaluate the general subsurface conditions within the areas of the planned construction and to provide recommendations for foundation support, design and construction, and site preparation. This report has been updated to include review comments and supersedes our draft report dated November 24, 2020.

In general, the soil borings encountered medium dense fine sands with silt (SP-SM), silty fine sands (SM), and clayey fine sands (SC) from the ground surface through the depths explored. Groundwater levels were encountered and measured at depths of approximately 2 feet 4 inches and 3 feet 1 inch below the existing ground surface at the boring locations. Based on our site exploration and laboratory results, we believe the subsurface conditions at the site are adaptable for a monolithic, turned-down edge slab supporting the proposed structure as discussed in this report, provided the recommendations in this report are followed.

We appreciate this opportunity to be of service as your geotechnical consultant on this phase of the project. If you have any questions, or if we may be of any further service, please contact us.

Sincerely,
MESKEL & ASSOCIATES ENGINEERING, PLLC
MAE FL Registry No. 28142

P. Rodney Mank, State of Florida, Professional Engineer, License No. 41986. This item has been electronically signed and sealed by P. Rodney Mank, P.E. on 12/08/2020 using a Digital Signature. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Khushbu Purani, E.I.
Staff Engineer

P. Rodney Mank, P.E.
Principal Engineer
Licensed, Florida No. 41986

Distribution: Mr. Wade P. Olszewski, P.E.– CPH 1 pdf

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1.0 PROJECT INFORMATION

1.1 General

Project information was provided to us by Mr. Wade P. Olszewski, P.E. with CPH, Inc. via email correspondence on July 21, 2020. This information included the Snyder Storage Building site plan containing dimensions of the structure.

1.2 Project Description

The project site is at Maxwell Snyder Armory, located at 9900 Normandy Boulevard in Jacksonville, Florida. The general site location is shown in Figure 1.

Based on the provided information, we understand that the project will include construction of a single-story pre-engineered metal building. The building will be 30 feet by 60 feet in plan dimensions. We have assumed the floor slab will be a 6-inch monolithic, turned-down-edge cast-in-place concrete floor slab. We have also assumed maximum walls loads of 2 kips/linear foot in compression applied to the turned-down edge footings.

We received a copy of the Grading and Erosion and Sedimentation Control Plan sheet (Sheet No. C1.2) for the project that shows the Finished Floor Elevation to be El. 71.45 feet. Existing grade is shown on this plan sheet to be about elevation El. 71.4 feet. Therefore, it is our understanding that the floor slab will be within 6 inches of existing grade, thus requiring little or no fill to be placed within the building area.

If the final building and site design details vary from those described above, then the recommendations contained in this report may need to be re-evaluated. Any changes in these details should be provided so the need for re-evaluation of our recommendations can be assessed prior to final design.

2.0 FIELD EXPLORATION

A field exploration was performed on November 10, 2020. A copy of the plan provided to us was used to determine the boring locations. These locations were transferred to a Google Earth aerial photograph, which is included in this report as the *Boring Location Plan*, Figure 2. Prior to starting our field exploration, a utility locate request was submitted to the Sunshine State One-Call Center (SSOC) to determine any underground utility conflicts. We also contacted onsite personnel for any possible utility conflicts within the proposed building area. Once the site utilities were located and marked, our field crew mobilized to the site. GPS coordinates for each boring location were determined from Google Earth and our field personnel located each boring using a Garmin GPSMAP 78 hand-held GPS receiver. The boring locations as shown on Figure 2 should be considered accurate only to the degree implied by the method of measurement used.

Two Standard Penetration Test (SPT) borings were performed at the locations shown in Figure 2. The borings were initially advanced using a hand-held bucket auger to a depth of 4 feet below existing grade to avoid any potential utility conflicts. The portion of the borings performed using a hand auger were performed in general accordance with the methodology outlined in ASTM D1452. The borings were then continued as an SPT boring to a depth of 25 feet below the existing ground surface. The SPT portion of each boring was continuously sampled to a depth of 10 feet below existing grade, and thereafter sampled every 5 feet in general accordance with the methodology outlined in ASTM D1586. The bucket auger and split-spoon soil samples recovered during performance of the borings were described in the field by the field crew, and representative portions of the samples were transported to our laboratory for

classification and testing. The borings were backfilled with soil cuttings upon completion. A summary of the field procedures used for the SPT borings is included in Appendix A.

3.0 LABORATORY TESTING

3.1 Visual Classification

Representative soil samples obtained during our field exploration were visually classified by a geotechnical engineer using the *Unified Soil Classification System (USCS)* in general accordance with ASTM D2488. A summary of the resulting soil descriptions is shown on the *Generalized Soil Profiles* sheet, Figure 3. A Key to the Soil Classification System is included in Appendix A.

3.2 Index Tests

Quantitative laboratory testing was performed on selected samples of the soils encountered during the field exploration to better define the soil composition and to provide data for correlation to their anticipated strength and compressibility characteristics. The laboratory testing determined the natural moisture content and percent material finer than the U.S. No. 200 sieve (percent fines) of the selected soil samples. The results of the laboratory testing are shown in the *Summary of Laboratory Index Test Results* table, included in Appendix B. These results are also shown on the *Generalized Soil Profiles*, Figure 3, and on the Log of Boring records at the respective depths from which the tested samples were recovered. A summary of the laboratory test procedures is included in Appendix B.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General Soil Profile

Graphical presentation of the generalized subsurface conditions is presented on the *Generalized Soil Profiles* sheet, Figure 3. Detailed boring records are included in Appendix A. When reviewing the soil profiles sheet and the soil boring logs, it should be understood that the soil conditions will vary between the boring locations.

Generally, the encountered subsurface conditions consisted of a surficial topsoil layer, 3 to 4 inches in thickness, underlain by medium dense fine sands with silt (SP-SM), silty fine sands (SM), and clayey fine sands (SC) to the boring termination depth of 25 feet below the existing ground surface. The soil samples below the topsoil layer to a depth of 2 feet for both borings contained trace amounts of organic fines and root fragments. However, no excessively organic soils or other deleterious materials were encountered at the boring locations.

4.2 Groundwater Level

The groundwater level was encountered at each of the boring locations and recorded at the time of drilling at depths of 2 feet 4 inches and 3 feet 1 inch below the existing ground surface. However, it should be anticipated that the groundwater levels will fluctuate seasonally and with changes in climate. As such, we recommend that the water table be re-measured prior to construction. Measured groundwater levels are shown on the boring profiles and boring logs.

4.3 Review of the USDA Web Soil Survey Map

The results of a review of the USDA Soil Survey Conservation Service (SSCS) Web Soil Survey of Duval County are shown in the table below. There is 1 predominant soil map unit at the project site. The soil

drainage class, hydrological group, and estimated seasonal high groundwater levels reported in the Soil Survey are as follows:

Map Unit Symbol	Map Unit Name	Drainage Class	Hydrologic Group	Depth to the Water Table[(1)] (inches)
14	Boulogne fine sand, 0 to 2 percent slopes	Poorly Drained	C/D	6 to 18

[(1)] The "Water Table" above refers to a saturated zone in the soil which occurs during specified months, typically the summer wet season. Estimates of the upper limit shown in the Web Soil Survey are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

4.4 Seasonal High Groundwater Level

In estimating seasonal high groundwater level, a number of factors are taken into consideration including antecedent rainfall, soil redoximorphic features (i.e., soil mottling), stratigraphy (including presence of hydraulically restrictive layers), vegetative indicators, effects of development, and relief points such as drainage ditches, low-lying areas, etc.

Based on our interpretation of the current site conditions, including the boring logs and review of published data, we estimate the seasonal high groundwater level at the proposed building area to be generally 1 to 1.5 feet below the existing ground surface. It is possible that groundwater levels may exceed the estimated seasonal high groundwater level as a result of significant or prolonged rains. Therefore, we recommend that design drawings and specifications account for the possibility of groundwater level variations, and construction planning should be based on the assumption that such variations will occur.

5.0 DESIGN RECOMMENDATIONS

5.1 General

The following evaluation and recommendations are based on the provided project information as presented in this report, the results of the field exploration and laboratory testing performed, and the construction techniques recommended in Section 6.0 below. If the described project details are incorrect or changed after this report, or if subsurface conditions encountered during construction are different from those reported, then MAE should be notified so that these recommendations can be re-evaluated and revised, if necessary. We recommend that MAE be allowed to review the foundation plans and earthwork specifications to verify that the recommendations in this report have been properly interpreted and implemented.

5.2 Foundation Design Recommendations

Based on the results of our exploration, we consider the subsurface conditions at the site adaptable for support of the proposed structure when constructed on a properly designed shallow foundation system. Provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for foundation design.

The soil borings encountered predominately fine sands with silt, silty fine sands, and clayey fine sands.

No significant organic soils were encountered. However, we do not recommend bearing the turned-down-edges of the monolithic floor slab on the clayey soils, as their plasticity and affinity for moisture make them difficult to achieve the recommended level of compaction. Therefore, we recommend that the clayey soils that are within 12 inches of the bottom of the turned-down edges be excavated to a depth of 24 inches below the turned-down edges and replaced with compacted sand fill as discussed in Section 6.0.

5.2.1 Bearing Pressure

The maximum allowable net soil bearing pressure for use in design of the turned-down edge portion of the monolithic slabs should not exceed 2,500 psf. Net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of the overburden effective pressure at that level. The foundations should be designed based on the maximum load that could be imposed by all loading conditions. We recommend a soil modulus of subgrade reaction of 250 pci be used for slab design.

5.2.2 Foundation Size

The minimum widths recommended for the turned-down edge of the monolithic floor slab is 12 inches. Even though the maximum allowable soil bearing pressure may not be achieved, this width recommendation should control the size of the foundation.

5.2.3 Bearing Depth

The turned-down edge portion of the monolithic slabs should bear at a depth of at least 12 inches below outside finished grades to provide confinement to the bearing level soils. It is recommended that stormwater be diverted away from the structure exteriors to reduce the possibility of erosion beneath the turned-down edges.

5.2.4 Bearing Material

The foundations may bear in compacted suitable natural soils or compacted structural fill. The bearing level soils, after compaction, should exhibit densities equivalent to 95 percent of the modified Proctor maximum dry density (ASTM D1557), to a depth of at least one foot below the foundation bearing level.

5.2.5 Settlement Estimates

Post-construction settlements of the structure will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundations; and (3) site preparation and earthwork construction techniques used by the contractor. Our settlement estimates for the structure are based on the use of site preparation/earthwork construction techniques as recommended in Section 6.0 of this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlements of the structure.

Due to the sandy nature of the subsurface soils encountered in the borings, we expect the majority of settlement of the proposed structure to occur in an elastic manner and fairly rapidly during construction. Using the recommended maximum bearing pressure, and the field and laboratory test data that we have correlated to geotechnical strength and compressibility characteristics of the subsurface soils, we estimate the total settlement of the structure to be on the order of one inch or less.

Differential settlements result from differences in applied bearing pressures and variations in the compressibility characteristics of the subsurface soils. Because of the general uniformity of the subsurface

conditions and the recommended site preparation and earthwork construction techniques outlined in Section 6.0, we estimate the differential settlement to be on the order of 0.5 inch or less.

5.2.6 Additional Slab Considerations

It is recommended that the slab bearing soils be covered with an impervious membrane to reduce moisture entry and floor dampness, where necessary. A 6-mil thick plastic membrane is commonly used for this purpose. Care should be exercised not to tear large sections of the membrane during placement of reinforcing steel and concrete. In addition, we recommend that a minimum separation of 2 feet be maintained between the finished floor levels and the estimated normal seasonal high groundwater level.

6.0 SITE PREPARATION AND EARTHWORK RECOMMENDATIONS

Site preparation as outlined in this section should be performed to provide more uniform foundation bearing conditions, to reduce the potential for post-construction settlements of the proposed structure.

6.1 Clearing and Stripping

Prior to construction, the location of existing underground utility lines within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. It should be noted that, if underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion, which may subsequently lead to excessive settlement of the overlying structure.

The "footprint" of the proposed structure plus a minimum additional margin of 5 feet, should be stripped of all surface vegetation, stumps, debris, organic topsoil, or other deleterious materials. During grubbing operations, roots with a diameter greater than 0.5-inch, stumps, or small roots in a concentrated state, should be grubbed and completely removed.

Based on the results of our field exploration, it should be anticipated that up to 4 inches of topsoil and soils containing significant amounts of organic materials may be encountered across the site. The actual depths of unsuitable soils and materials should be determined by MAE using visual observation and judgment during earthwork operations. Any topsoils removed from the construction areas can be stockpiled and used subsequently in areas to be grassed.

6.2 Temporary Groundwater Control

The groundwater level was encountered at depths of 2 feet 4 inches and 3 feet and 1 inch below the existing ground surface at the time of our exploration. Because of the need for densification of the structure subgrade soils, it may be necessary to install temporary groundwater control measures to facilitate the compaction efforts. Dewatering methods should be determined by the contractor; however, we recommend the groundwater control measures remain in place until construction of the floor slab is complete. The site should be graded to direct surface water runoff from the construction areas.

Note that discharge of produced groundwater to surface waters of the state from dewatering operations or other site activities is regulated and requires a permit from the State of Florida Department of Environmental Protection (FDEP). This permit is termed *Generic Permit for the Discharge of Produced Groundwater From Any Non-Contaminated Site Activity*. If discharge of produced groundwater is anticipated, we recommend sampling and testing of the groundwater early in the site design phase to prevent project delays during construction. MAE can provide the sampling, testing, and professional consulting required to evaluate compliance with the regulations.

6.3 Compaction of Slab Bearing Soils

Once the surficial topsoil has been stripped and grubbed, and the temporary groundwater control measures have been installed if necessary, then the exposed soils should be compacted with a vibratory drum roller having a minimum static, at-drum weight, on the order of 10 tons. Typically, the material should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (ASTM D1557) during the compaction operations. Compaction should continue until densities of at least 95 percent of the modified Proctor maximum dry density (ASTM D1557) have been achieved within the upper 2 feet of the compacted subgrade soil below the structure.

Should the surface soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated. The disturbed soils should be removed and backfilled with dry structural fill soils, which are them compacted, or the excess moisture content within the disturbed soils should be allowed to dissipate before recompacting.

Care should be exercised to avoid damaging any nearby structures while the compaction operation is underway. Prior to commencing compaction, the existing conditions of the adjacent structures should be documented with photographs and survey. Compaction should cease if deemed detrimental to adjacent structures, and MAE should be contacted immediately. It is recommended that the vibratory roller remain a minimum of 50 feet from existing structures. Within this zone, use of track, mounted bulldozer, front-end loader or a vibratory roller, operating in the static mode, is recommended.

6.4 Structural Backfill and Fill Soils

Any structural backfill or fill required for site development should be placed in loose lifts not exceeding 12 inches in thickness and compacted by the use of the vibratory drum roller described above. The lift thickness should be reduced to 8 inches if the roller operates in the static mode or if track-mounted compaction equipment is used. If hand-held compaction equipment is used, the lift thickness should be further reduced to 6 inches.

Structural fill is defined as a non-plastic, inorganic, granular soil having less than 12 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. The fine sands (SP) and slightly silty fine sands (SP-SM), without roots, as encountered in the borings, are suitable as fill materials and, with proper moisture control, should densify using conventional compaction methods. It should be noted that soils with more than 12 percent passing the No. 200 sieve will be more difficult to compact, due to their nature to retain soil moisture, and may require drying. Typically, the material should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (ASTM D1557) during the compaction operations. Compaction should continue until densities of at least 95 percent of the modified Proctor maximum dry density (ASTM D1557) have been achieved within each lift of the compacted structural fill.

6.5 Foundation Areas

After satisfactory compaction of the existing subgrade soils and placement and compaction of any structural fill, the turned-down edge foundation area may be excavated to the planned bearing level. Any clayey sand (SC) soils within 12 inches of the foundation bottom, such as encountered at borings B-1 between depths of 2 and 3 feet below existing grade and boring B-2 between depths of 4 and 8 feet below existing grade, should be excavated to a depth of at least 24 inches below the foundation bearing depth and replaced with compacted structural fill as defined in Section 6.4 above.

The foundation bearing level soils, after compaction, should exhibit densities equivalent to 95 percent of the modified Proctor maximum dry density (ASTM D 1557), to a depth of one foot below the bearing level.

If clayey soils are excavated below the foundation bearing level as discussed above, then this level of comp0action should be achieved to a depth of 2 feet below the foundation bearing level. For confined areas, such as the footing excavations, any additional compaction operations can probably best be performed by the use of a lightweight vibratory sled or roller having a total weight on the order of 500 to 2000 pounds.

7.0 QUALITY CONTROL TESTING

A representative number of field in-place density tests should be made in the upper 2 feet of compacted natural soils, in each lift of compacted fill, and in the upper 12 inches below the turned-down edge bearing level. The density tests are considered necessary to verify that satisfactory compaction operations have been performed. We recommend density testing be performed as listed below as a minimum:

- Two locations within the structure area, and
- One location for every 100 linear feet of turned-down edge portion of the slab, minimum of 2.

8.0 REPORT LIMITATIONS

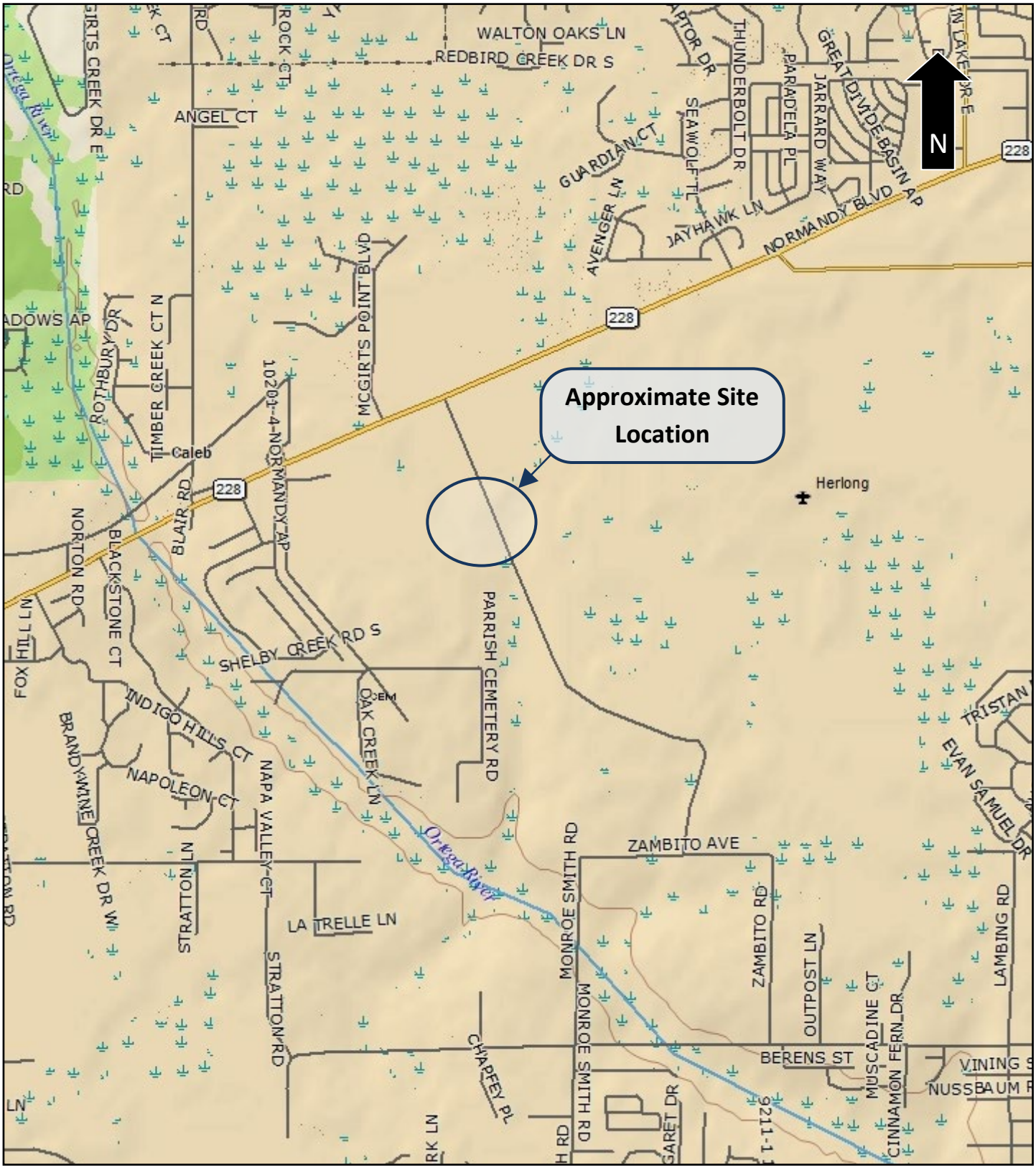
This report has been prepared for the exclusive use of CPH, Inc. and their partners for specific application to the design and construction of the *Storage Building at Maxwell Snyder Armory* project. An electronically signed and sealed version, and a version of our report that is signed and sealed in blue ink, may be considered an original of the report. Copies of an original should not be relied on unless specifically allowed by MAE in writing. Our work for this project was performed in accordance with generally accepted geotechnical engineering practice. No warranty, express or implied, is made.

The analyses and recommendations contained in this report are based on the data obtained for this project. This testing indicates subsurface conditions only at the specific locations and times, and only to the depths explored. These results do not reflect subsurface variations that may exist away from the boring locations and/or at depths below the boring termination depths. Subsurface conditions and water levels at other locations may differ from conditions occurring at the tested locations. In addition, it should be understood that the passage of time may result in a change in the conditions at the tested locations. If variations in subsurface conditions from those described in this report are observed during construction, the recommendations in this report must be re-evaluated.

The scope of our services did not include any environmental assessment or testing for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the subject site. Any statements made in this report, and/or notations made on the generalized soil profiles or boring logs, regarding odors or other potential environmental concerns are based on observations made during execution of our scope of services and as such are strictly for the information of our client. No opinion of any environmental concern of such observations is made or implied. Unless complete environmental information regarding the site is already available, an environmental assessment is recommended.

If changes in the design or location of the structure occur, then the conclusions and recommendations contained in this report may need to be modified. We recommend that these changes be provided to us for our consideration. MAE is not responsible for conclusions, interpretations, opinions or recommendations made by others based on the data contained in this report.

Figures



Site Location Map

PREPARED BY	PROJECT NAME	
Meskel & Associates Engineering	**Storage Building at Maxwell Snyder Armory Jacksonville, Florida**	
	REFERERENCE	SCALE
	Delorme XMap 7.0	NTS
PREPARED FOR	MAE PROJECT NO.	**FIGURE NO.**
CPH	0106-0010	1

Boring Location Plan

PREPARED BY	PROJECT NAME	
MAE Meskel & Associates Engineering	Storage Building at Maxwell Snyder Armory Jacksonville, Florida	
	REFERENCE	SCALE
	Google Earth	AS SHOWN
PREPARED FOR	MAE PROJECT NO.	**FIGURE NO.**
CPH	0106-0010	2

B-1
Latitude: 30°16'36.2"N
Longitude: 81°49'11.4"W

N

HA

w = 25
-200 = 22

	Topsoil (3")
	Dark grayish brown to gray fine SAND with silt, trace root fragments, poorly graded. (SP-SM)
	Gray to yellowish brown clayey fine SAND, trace root fragments, poorly graded. (SC)
11	Medium dense, Gray fine SAND with silt, poorly graded. (SP-SM)
11	Medium dense, Gray to light brown silty fine SAND with clay, poorly graded. (SM)
12	
	Medium dense, Light gray to light yellowish brown fine SAND with silt, poorly graded. (SP-SM)
8	
	Medium dense, Light gray fine SAND with silt, poorly graded. (SP-SM)
12	
	Medium dense, Light olive brown fine SAND with silt, poorly graded. (SP-SM)
10	

w = 25
-200 = 5

BT @ 25.'
Date Drilled: 11/10/2020

B-2
Latitude: 30°16'35.5"N
Longitude: 81°49'11.3"W

N

HA

w = 21
-200 = 22

	Topsoil(4")
	Very dark gray fine SAND with silt, trace organic fines, poorly graded. (SP-SM)
	Brown fine SAND with silt, poorly graded. (SP-SM)
8	Medium dense, Gray to brownish yellow clayey fine SAND with silt, poorly graded. (SC)
10	Medium dense, Gray to light reddish brown clayey fine SAND, poorly graded. (SC)
10	
	Medium dense, Yellowish brown to gray silty fine SAND, trace clay, poorly graded. (SM)
8	
	Medium dense, Light gray fine SAND with silt, poorly graded. (SP-SM)
13	
	Medium dense, Light yellowish brown fine SAND with silt, poorly graded. (SP-SM)
11	Medium dense, Light olive brown silty fine SAND, poorly graded. (SM)

BT @ 25.'
Date Drilled: 11/10/2020

Depth (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26

Legend

Topsoil
Fine Sand with Silt
Clayey Fine Sand
Silty Fine Sand

N — Standard Penetration Resistance, Blows/Foot
BT — Boring Terminated at Depth Below Existing Grade
(SP) — Unified Soil Classification System (USCS)
▽ — Depth to Groundwater at Time of Drilling
w — Natural Moisture Content (%)
-200 — % Passing No. 200 U.S. Standard Sieve
HA — Boring Advanced by hand-held bucket auger due to possible underground utilities.

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

P. RODNEY MANK, P.E. P.E. NO.: 41986
Meskel & Associates Engineering
FL. Registry No. 28142
3728 Philips Highway, Suite 208, Jacksonville, FL 32207

CPH	
DATE:	MAE PROJECT NO.
12/08/2020	0106-0010

SHEET TITLE: Generalized Soil Profiles

PROJECT NAME: Storage Building at Maxwell Snyder Armory
Jacksonville, Florida

FIGURE NO. 3

Appendix A

Meskel & Associates Engineering, PLLC
FL. Registry No. 28142
3728 Philips Highway, Suite 208
Jacksonville, FL 32207
P: (904)519-6990 F: (904)519-6992

Meskel & Associates Engineering

BORING B-1

PROJECT NO. 0106-0010

PROJECT NAME Storage Building at Maxwell Snyder Armory

PROJECT LOCATION Jacksonville, Florida **CLIENT** CPH

DATE STARTED 11/10/2020 **COMPLETED** 11/10/2020 **LATITUDE** 30°16'36.2"N **LONGITUDE** 81°49'11.4"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.McLellan **CHECKED BY** C.Purvis **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Topsoil (3") Dark grayish brown to gray fine SAND with silt, trace root fragments, poorly graded.	SP-SM											
	2	▽ Gray to yellowish brown clayey fine SAND, trace root fragments, poorly graded.	SC				25	22						
5	3	Medium dense, Gray fine SAND with silt, poorly graded.	SP-SM		5 5 6 5	11								
	4	Medium dense, Gray to light brown silty fine SAND with clay, poorly graded.	SM		3 5 6 6	11								
10	5	Medium dense, Light gray to light yellowish brown fine SAND with silt, poorly graded.	SP-SM		6 5 7 7	12								
15	6	Medium dense, Light gray fine SAND with silt, poorly graded.	SP-SM		3 4 4	8								
20	7	Medium dense, Light olive brown fine SAND with silt, poorly graded.	SP-SM		5 6 6	12	25	5						

NOTES *Boring backfilled with soil cuttings.*
Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2 ft 4 in *▽ **END OF DAY** ---

(Continued Next Page)

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Meskel & Associates Engineering

BORING B-1

PROJECT NO. 0106-0010

PROJECT NAME Storage Building at Maxwell Snyder Armory

PROJECT LOCATION Jacksonville, Florida **CLIENT** CPH

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense, Light olive brown fine SAND with silt, poorly graded. *(continued)*	SP-SM											
25	8				4 6 4	10								
		Bottom of borehole at 25 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2 ft 4 in *▽ **END OF DAY** ---

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Meskel & Associates Engineering

BORING B-2

PROJECT NO. 0106-0010

PROJECT NAME Storage Building at Maxwell Snyder Armory

PROJECT LOCATION Jacksonville, Florida **CLIENT** CPH

DATE STARTED 11/10/2020 **COMPLETED** 11/10/2020 **LATITUDE** 30°16'35.5"N **LONGITUDE** 81°49'11.3"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.McLellan **CHECKED BY** C.Purvis **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Topsoil(4") Very dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM											
	2	▽ Brown fine SAND with silt, poorly graded.	SP-SM											
5	3	Medium dense, Gray to brownish yellow clayey fine SAND with silt, poorly graded.	SC		4 3 5 3	8								
	4	Medium dense, Gray to light reddish brown clayey fine SAND, poorly graded.	SC		3 4 6 6	10	21	22						
10	5	Medium dense, Yellowish brown to gray silty fine SAND, trace clay, poorly graded.	SM		5 6 4 5	10								
15	6	Medium dense, Light gray fine SAND with silt, poorly graded.	SP-SM		2 3 5	8								
20	7	Medium dense, Light yellowish brown fine SAND with silt, poorly graded.	SP-SM		6 7 6	13								

NOTES *Boring backfilled with soil cuttings.*
Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 3 ft 1 in *▽ **END OF DAY** ---

(Continued Next Page)

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Meskel & Associates Engineering

BORING B-2

PROJECT NO. 0106-0010

PROJECT NAME Storage Building at Maxwell Snyder Armory

PROJECT LOCATION Jacksonville, Florida **CLIENT** CPH

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense, Light yellowish brown fine SAND with silt, poorly graded. *(continued)*	SP-SM											
25	8	Medium dense, Light olive brown silty fine SAND, poorly graded.	SM		5 5 6	11								
		Bottom of borehole at 25 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 3 ft 1 in *▽ **END OF DAY** ---

FIELD EXPLORATION PROCEDURES

Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPT) boring(s) were performed in general accordance with the latest revision of ASTM D 1586, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils." The borings were advanced by rotary drilling techniques. A split-barrel sampler was inserted to the borehole bottom and driven 18 to 24 inches into the soil using a 140-pound hammer falling an average of 30 inches per hammer blow. The number of hammer blows for the final 12 inches of penetration (18" sample) or for the sum of the middle 12 inches of penetration (24" sample) is termed the "penetration resistance, blow count, or N-value." This value is an index to several in-situ geotechnical properties of the material tested, such as relative density and Young's Modulus.

After driving the sampler, it was retrieved from the borehole and representative samples of the material within the split-barrel were containerized and sealed. After completing the drilling operations, the samples for each boring were transported to the laboratory where they were examined by a geotechnical engineer to verify the field descriptions and classify the soil, and to select samples for laboratory testing.

Hand Auger Boring

The auger boring(s) were performed manually by the use of a hand-held bucket auger in general accordance with the latest revision of ASTM D 1452, "Standard Practice for Soil Exploration and Sampling by Auger Borings." Representative samples of the soils brought to the ground surface by the auger were placed in sealed containers and transported to our laboratory where they were examined by a geotechnical engineer to verify the field descriptions and classify the soil, and to select samples for laboratory testing.

KEY TO BORING LOGS – USCS

Soil Classification

Soil classification of samples obtained at the boring locations is based on the Unified Soil Classification System (USCS). Coarse grained soils have more than 50% of their dry weight retained on a #200 sieve. Their principal descriptors are: sand, cobbles and boulders. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve. They are principally described as clays if they are plastic and silts if they are slightly to non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

BORING LOG LEGEND

Symbol	Description
N	Standard Penetration Resistance, the number of blows required to advance a standard spoon sampler 12" when driven by a 140-lb hammer dropping 30".
WOR	Split Spoon sampler advanced under the weight of the drill rods
WOH	Split Spoon sampler advanced under the weight of the SPT hammer
50/2"	Indicates 50 hammer blows drove the split spoon 2 inches; 50 Hammer blows for less than 6-inches of split spoon driving is considered "Refusal".
(SP)	Unified Soil Classification System
-200	Fines content, % Passing No. 200 U.S. Standard Sieve
w	Natural Moisture Content (%)
OC	Organic Content (%)
LL	Liquid Limit
PI	Plasticity Index
NP	Non-Plastic
PP	Pocket Penetrometer in tons per square foot (tsf)

MODIFIERS

SECONDARY CONSTITUENTS
(Sand, Silt or Clay)

Trace	Less than 5%
With	5% to 12%
Sandy, Silty or Clayey	12% to 35%
Very Sandy, Very Silty or Very Clayey	35% to 50%

ORGANIC CONTENT

Trace	2% or less
Few	3% to 5%
Little	5% to 10%
With	Greater than 10%

MINOR COMPONENTS
(Shell, Rock, Debris, Roots, etc.)

Trace	Less than 5%
Few	5% to 10%
Little	15% to 25%
Some	30% to 45%

RELATIVE DENSITY (Coarse-Grained Soils)

Relative Density	N-Value *
Very Loose	Less than 3
Loose	3 to 8
Medium Dense	8 to 24
Dense	24 to 40
Very Dense	Greater than 40

CONSISTENCY (Fine-Grained Soils)

Consistency	N-Value *
Very Soft	Less than 1
Soft	1 to 3
Firm	3 to 6
Stiff	6 to 12
Very Stiff	12 to 24
Hard	Greater than 24

RELATIVE HARDNESS (Limestone)

Relative Hardness	N-Value *
Soft	Less than 50
Hard	Greater than 50

* Using Automatic Hammer

Unified Soil Classification System (USCS)
(from ASTM D 2487)

Major Divisions			*Group Symbol*	*Typical Names*
Coarse-Grained Soils More than 50% retained on the 0.075 mm (No. 4) sieve	**Gravels** 50% or more of coarse fraction retained on the 4.75 mm (No. 4) sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands 50% or more of coarse fraction passes the 4.75 (No. 4) sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils More than 50% passes the 0.075 mm (No. 200) sieve	**Silts and Clays** Liquid Limit 50% or less		ML	Inorganic silts, very fine sands, rock four, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic
Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay, LL < 50%, H = Clay, LL > 50%

Appendix B

TABLE 1
Summary of Laboratory Index Test Results
Storage Building at Maxwell Snyder Armory
Jacksonville, Florida
MAE Project No.: 0106-0010

Boring No.	Sample No.	Approximate Test Depth[2] (ft)	Coordinates[1]		Percent Passing No. 200 Sieve	Natural Moisture Content, %	USCS Classification
			Latitude	Longitude			
B-1	2	2 to 4	30°16'36.2"N	81°49'11.4"W	22	25	SC
B-1	7	18.5 to 20	30°16'36.2"N	81°49'11.4"W	5	25	SP-SM
B-2	4	6 to 8	30°16'35.5"N	81°49'11.3"W	22	21	SC

[1] Coordinates were recorded using a hand-held GPS reciever.

[2] Feet below existing ground surface.

LABORATORY TEST PROCEDURES

Percent Fines Content

The percent fines or material passing the No. 200 mesh sieve of the sample tested was determined in general accordance with the latest revision of ASTM D 1140. The percent fines are the soil particles in the silt and clay size range.

Natural Moisture Content

The water content of the tested sample was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of “pore” or “free” water in a given mass of material to the mass of solid material particles.