SPECIFICATIONS

POLICE/FIRE STATION ACCESS ROAD & PARKING LOT SECURITY FENCING
WASHINGTON DULLES INTERNATIONAL AIRPORT
(CONTRACT 1-17-C094-T-003)
PROJECT IDENTIFIER IL1801

PREPARED FOR:

MWAA
Metropolitan Washington Airports Authority
Washington, DC

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

The articles and paragraphs of this Section represent supplements or additions to the Contract Provisions or the Special Provisions. The requirements of this section are the sole responsibility of the Contractor. No additional payment will be made to the Contractor to fulfill these requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PERMITTING

A. Comply with all requirements set forth in the Authority's “Building Codes Manual”. This manual describes building codes organization, construction permitting process, building code inspection process, certificate of occupancy requirements, and information regarding elevators, escalators, and moving walks.

3.2 MAINTENANCE OF PEDESTRIAN AND VEHICULAR TRAFFIC

A. Maintain adequate pedestrian and vehicular traffic flow and safety along the service roads, sidewalks, parking lots and other roadways on Airport property. In addition, this requirement applies to crossroads, approaches, and entrances affected by or made necessary by the Work. Coordinate activities throughout the project in a manner that allows emergency access, without delays to emergency response vehicles, to all areas of the Project that are occupied by employees.

B. Prior to starting construction operations affecting pedestrian, vehicular, or aircraft traffic movement, submit and obtain the COTR's written approval of a Traffic Maintenance Plan. Develop plan in accordance with the safety requirements of the FAA, Airport Operations, and the Commonwealth of Virginia Department of Transportation's “Manual of Uniform Traffic Control Devices”. Utilize the form indicated in the latest edition of the Virginia Department of Transportation’s “Virginia Work Area Protection Manual – Standards and Guidelines”.

C. Provide and maintain temporary signage, "Jersey barriers," and such other traffic control devices or personnel as required complying with approved Traffic Maintenance Plan.

D. Maintain the construction operations affecting pedestrian, vehicular, or aircraft traffic movement from the beginning of construction operations until final acceptance of the project. The maintenance shall constitute continuous and effective work prosecuted day by day with
adequate equipment and forces to the end of project to ensure that roadways and structures are maintained in satisfactory condition at all times, including barricades and warning signs as necessary for performance of the work.

E. Keep the portions of the project being used by public, pedestrian, aircraft, [mobile lounges] and vehicular traffic, whether it is through or local traffic, in such condition that traffic will be adequately accommodated. Remove snow and control all ice within the project boundaries. Removal of snow and ice for the benefit of the traveling public will be performed by the Authority. Bear all cost of maintenance work during construction and before the project receives a Certificate of Occupancy for constructing and maintaining approaches, crossings, intersections and other features as may be necessary.

F. Keep the portions of the road and aircraft pavement surfaces being used by the public free from irregularities, obstructions, mud, dirt, snow, ice, and any characteristic that might present a hazard or annoyance to traffic in such condition that traffic will be adequately accommodated. Maintain a vacuum/sweeper and flusher truck at the site at all times to clean roadway and aircraft surfaces affected by construction traffic at the request of Airport Operations or the COTR.

3.3 TENANT OPERATIONAL REQUIREMENTS

The Work of this Project will be performed in close proximity to tenant-occupied areas. Coordinate and conduct work activities in such fashion that public circulation, tenant operations, and access to the tenant spaces will not be impaired in any manner except as detailed on Contractor's Work Plans. COTR will review and approve in writing all Work Plans.

3.4 ENVIRONMENTAL PROTECTION

A. Comply with all Federal, state and local laws and regulations controlling pollution of the environment. Take necessary precautions to prevent pollution of streams, rivers, lakes, ponds, and reservoirs with fuels, oils, bitumens, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

B. Notify COTR immediately in the event that abnormalities, discolorations, odors, oil, or other signs of potential contamination by hazardous materials are encountered during excavation or other construction activities. Follow with written notice within 24 hours, indicating date, time, and location of potential contaminants encountered. The COTR will provide further direction to Contractor regarding disposition of materials encountered.

C. All painted surfaces are assumed to contain lead-based paint. The Contractor shall maintain the necessary health and safety requirements for all personnel in accordance with OSHA regulations to work in these conditions. The removal and disposal of lead-based paint is part of this contract.

D. Aircraft deicing fluids will be encountered in the water (including utility manholes) and in the soils. Concentrations of aircraft deicing fluids in water and soils will range from non-detect to saturation. Aircraft deicing fluids are propylene based Type I and Type IV fluids. The fluids emit an unpleasant odor when the breakdown (biodegradation) is occurring. Follow OSHA requirements while working in aircraft deicing impacted areas. Coordinate with the COTR for obtaining Material Safety Data Sheet (MSDS) for aircraft deicing fluids.
E. Petroleum contaminated soils and water may be encountered during the construction of this project. Petroleum impacted soils range from saturated to 1.0 ppm. Petroleum impacted water ranges from free product to “non-detect.” Maintain the necessary health and safety requirements for all personnel in accordance with OSHA regulations.

F. Do not use petroleum-contaminated soils as backfill around new piping or utilities. Transport petroleum contaminated soils to a location identified by the COTR. Place the contaminated soils on two layers of reinforced 6 mil plastic sheeting, install and maintain sediment and erosion controls, and adequately cover the stockpile to prevent water infiltration.

3.5 ARCHAEOLOGICAL AND HISTORICAL FINDINGS

Notify COTR immediately if subsurface structural features, concentrations of artifacts, rubble, bone/shell, or burnt material are uncovered or otherwise discovered. Prompt reporting will avoid potentially severe problems resulting from the destruction of significant resources and may limit the impact on construction operations and schedules.

3.6 DAMAGES AND PRE-EXISTING CONDITIONS

A. Be responsible for all damages caused by Contractor’s construction activities. Provide all labor, materials, etc. to return any damaged areas, systems or equipment to their original condition at no additional cost to the Authority.

B. Perform a survey of pre-existing conditions in the vicinity of Contractor’s construction activities, utilizing photographs and other means as necessary to document existing damage or conditions. Submit one (1) electronic copy of this survey to the Contracting Officer within 21 calendar days after Notice-to-Proceed. This survey will assist in resolving any damage claims against the Contractor during and after construction.

C. Preserve all roadways, pedestrian and directional signage. Deliver all signs removed and not required for reinstallation to the Authority as directed by the COTR.

D. Replace or repair lost or damaged signs at no cost to the Authority.

3.7 SECURITY DURING CONSTRUCTION

A. Establish and maintain the security of Contractor’s staging areas, equipment and materials.

B. No firearms or weapons of any type are allowed on the airport.

C. No cartridge style nail guns, nor any tools that use a cartridge or any explosive charge, are allowed without prior written notification of COTR. Obtain written approval from the COTR before bringing such tools on the project.

D. Conform to all Orders and Instructions pertaining to vehicle inspection.

3.8 MATERIAL HAULING

A. Access and egress to and from the Airport for hauling operations shall be through the entrances indicated. Conduct hauling operations between 9:30 am until 3:30 pm weekdays. Work outside
of these hours, weekends, and holidays must be requested in writing and authorized by the COTR.

B. The designated haul routes for hauling operations will not require vehicles crossing and/or utilizing existing taxi lanes or taxiways. Under no conditions shall the Contractor plan use of taxways and taxi lanes for hauling equipment. Haul routes for this project are as indicated.

C. Notify the COTR at least 72 hours in advance of all closure requirements for scheduled roadway closures. Obtain the written approval of Airport Operations prior to closing or crossing a roadway.

D. Use load covers on all dump trucks. Load dump trucks so that no spillage occurs during transit on the State, municipal, or Airport roadways. Clean wheels of trucks leaving the Project construction site of all soil and rocks. Provide a truck washing rack on the Project site to minimize the tracking of soil onto paved surfaces.

E. Be responsible for the cost of the immediate cleaning of earth tracking and spills on paved surfaces resulting from the Contractor's operations.

3.9 PORTABLE LIGHTING

Portable lighting: If used for Contractor operations, aim and shield portable lighting at all times to eliminate glare that could impair runway, taxiway, apron, ground operations, and Airport Traffic Control Tower operations. Equip portable lighting with reflectors and glare shields to prevent spillover of light into operational areas.

3.10 HEIGHT LIMITATION

A. For all demolition and construction within the Airport, limit the height of Contractor's equipment to a maximum of 60 feet.

B. Prior to beginning any work coordinate with the COTR the height of all cranes, boom trucks, scaffolds or similar vehicles of construction. Properly mark all construction equipment with safety flags and warning lights in accordance with current FAA and Airport Operations requirements. Submit FAA Form 7460, provided by COTR, for all variations on approved crane heights.

3.11 NOISE CONTROL

A. The Authority recognizes and can tolerate a normal level of noise created by a majority of construction activity. However, in the interest of the Authority's neighbors, the maximum acceptable noise level between the hours of 5:00 pm and 7:00 am the following morning is limited to 55 decibels. During daytime hours of 7:00 am through 5:00 pm, the maximum acceptable noise level for sustained or repetitive noises is 72 decibels. Measure the noise level using an "A" scale at a point 4'-0" above ground at property line nearest noise source.
B. Secure advance written approval from the COTR prior to scheduling any activity that is anticipated to produce a sustained or repetitive noise level higher than the decibel limits indicated above.

C. In and around Authority Offices and buildings whose normal occupancy is from 7 a.m. to 7 p.m., perform work that causes noise that is disruptive to the Authority Office personnel or the traveling public between the hours of 11:00 pm and 5:00 am. Measure noise for this situation using an “A” scale at a point 4’-0” above ground at the closest point to airport tenants or the traveling public.

3.12 EXAMINATION OF PLANS, SPECIFICATIONS AND SITE OF WORK

The offeror is expected to examine carefully the site of the proposed work, the proposal, plans, specifications, solicitation provisions, contract provisions, special provisions and contract forms before submitting a proposal. The submission of a proposal will be considered conclusive evidence that the offeror has made such examination and is satisfied as to the conditions to be encountered in performing the work as to the requirements of the Contract.

PART 4- MEASUREMENT (Not Used)

PART 5 - PAYMENT (Not Used)

END OF SECTION 007300
SECTION 007319 - SAFETY AND HEALTH REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections, apply to this Section.

B. Requirements included in this Section are the minimum acceptable and are in addition to the Airports Authority’s Construction Safety Manual, as well as all Local, State, and Federal requirements. Where conflicts or discrepancies exist between requirements, the more stringent requirement shall govern.

C. Related Work Described Elsewhere:


1.2 SUMMARY

A. Provide safe and healthful working conditions on each operation at all times. Conduct the various operations connected with the Work so that they will not be injurious to safety or health. Comply with all provisions, regulations and recommendations issued pursuant to the Occupational Safety and Health Act of 1970, and the Construction Safety Act of 1969, as amended, and with laws, rules and regulations of other authorities having jurisdiction, with regard to all matters relating to the safety and health of workers and the general public. Comply with all provisions, regulations and recommendations issued pursuant to Virginia Department of Labor and Industry Occupational Safety & Health (VOSH) Unique Safety Standards for Construction. Compliance with government requirements is mandated by law and considered only a minimum level of safety performance. Perform all work in accordance with best safe work practices recognized by the construction industry.

B. Noncompliance with Airports Authority Construction Safety Policies, FAA Requirements, OSHA 1926 Safety Regulations, VOSH Safety & Health Safety Regulations can result in an issuance of Notice of Non Compliance (NCN).

C. Stop work whenever a work procedure or a condition at a work site is deemed unsafe by the Contracting Officer’s Technical Representative (COTR), the Program Safety Manager (PSM), the Contractor’s Safety Manager, the Contractor’s Safety Engineer(s), the Contractor’s Industrial Hygienist (IH), or by any authorized Authority personnel (e.g. Airport Operations), representative, or supporting consultant.

D. Prior to the start of construction activities in the Airport Operations Area (AOA), the Contractor’s Safety Engineers shall tour the site with the COTR and his/her representative(s).
E. Implement and conduct safety meetings, as indicated in the Airports Authority’s Construction Safety Manual, with all subcontractors on the job site and all subcontractors anticipated to be on the job site from the previous safety meeting to the next safety meeting. The purpose of the safety meeting shall be safety coordination, review of safety procedures, and promoting safety awareness.

F. All work shall be pre-planned prior to starting any construction activity. Pre-task planning shall be required by all work crews and reviewed by management personnel. Work crews will review the Pre-Task Plan (PTP) with management personnel so they are aware of the hazards of the work their performing. Work crews and management will plan how to abate the hazards identified in their plan. Management and work crews will sign the PTP form acknowledging that they have read and understand the hazards of the work being performed and have planned how to mitigate the safety hazards that they have identified. (Refer to Pre-Task Planning Policy in the Airports Authority Construction Safety Manual).

G. Fire Safety: Conform to the following requirements:

1. Ensure adequate access to all construction areas for emergency response.

2. Complete application and obtain a permit from the Office of the Airports Authority Fire Marshal to store, handle, or use any hazardous material, including but not limited to fuels for equipment.

3. Perform all utility outages in accordance with the requirements of Division 01 Section “Summary.”

4. Be responsible for developing a site specific Hearing Conservation and Respiratory Protection Programs for all employees who may be exposed to health hazard. The Program Safety Manager must approve these programs prior to beginning work that may expose employees to health hazards associated with construction activities. All employees exposed to airborne contaminates and/or noise must, at a minimum, have an audiogram and pulmonary function test.

1.3 SAFETY AND HEALTH MANAGEMENT

A. Proposed Safety and Health Personnel

1. The Contractor shall provide a full-time on-site Contractor’s Safety Engineer for the duration of this Contract, who shall be responsible for all safety and health requirements as included herein and as required by the Airports Authority’s Construction Safety Manual. The Contractor’s Safety Engineer(s) and First Aid Attendant(s) shall all have a current Red Cross First Aid Certificate and CPR Certification.

2. The Contractor shall submit the résumés of all proposed safety and health professionals who shall serve in the role of Contractor’s Safety Engineers (CSE) and all other Contractor’s Site Supervision to the COTR for approval. The resumes shall include but not limited to such items as: work experience, education, safety and health training completed, memberships in professional associations, professional certifications, professional registrations, and professional references confirming the qualifications shall also be required. Documentation confirming the qualifications and personal references or
contacts for verification shall also be required. The COTR may reject the persons proposed for failure to have adequate qualifications, past performance or other reasonable and lawful causes.

3. Approval of the COTR is required, if at any time the Contractor seeks to remove or discharge the Contractor’s Safety Engineer(s).

B. Contractor’s Safety Engineer

1. The Contractor’s Safety Engineer(s) (CSE) shall be full-time on-site safety professional with a minimum 5 years safety experience in construction, hired by the Contractor to manage only the safety efforts of construction (Refer to Airports Authority Construction Safety Manual for job description requirements). The Contractor’s Safety Engineers shall be familiar with the type of work to be performed under this contract. The CSE shall perform the duties and responsibilities as stated in the Airports Authority’s Construction Safety Manual.

2. The Contractor’s Safety Engineer(s) shall have, at a minimum, a certificate of completion of a 30-hour OSHA Training Course in the following areas: Hazardous Materials, Respiratory Protection and Permit-Required Confined Space Entry. Training shall be conducted by an instructor accredited to perform such instruction by the Occupational Safety and Health Administration.

C. Contractor’s Industrial Hygienist (Contract Specific if IH is Needed)

D. Contractor’s Site Supervision (Superintendents and Foremen)

1. Superintendents and Foremen shall have a minimum of 5 years experience in the supervision in construction operations similar to the type of construction anticipated on this contract within the last 7 years.

2. In addition to the above, the Superintendents and Foremen employed by the Contractor on the Project shall have, at a minimum:

   a. A certificate of completion from a 30-Hour OSHA Hazard Recognition Training Course for the Notice-to-Proceed. An instructor accredited by the Occupational Safety and Health Administration to perform such instruction shall have conducted the course for which the certificate is offered.

E. Reference Codes, Standards and other Documents

1. OSHA - US Department of Labor, Occupational Safety and Health Administration, Construction Standards and Interpretations, 29 CFR Parts 1910 and 1926.


5. All other Federal, State and Local requirements and regulations in effect at the time of construction.
1.4 SUBMITTALS

A. Submit Safety and Health Program to COTR within 15 calendar days of Notice to Proceed and prior to the start of any construction activities. COTR and PSM must approve the Contractor’s Safety and Health Program prior to the start of any work.

B. Submit Fire Risk Assessment to COTR prior to any construction.

C. Submit qualifications of Contractor’s Site Supervision to COTR within 15 calendar days of employment at the project.

D. Submit Airports Authority provided Inspection reports by Contractor’s Safety Engineer to COTR weekly.

E. Submit to COTR Weekly the following:
   1. Meeting Minutes and attendance sheets of Safety Training
   2. Weekly Safety Meetings and related communications by Contractors and Subcontractors.

F. Submit disciplinary action notices to COTR weekly.

G. Submit notices from public authorities to COTR as soon as possible but no later than 24 hours of receipt by Contractor.

H. Submit Safety Data Sheets (SDS) for all substances to COTR for review as received by Contractor along with written Hazard Communication Program.

I. Submit copy of Contractor’s chemical inventory list to COTR and the Airports Authority Fire Marshal as developed and updated.

J. All equipment shall be inspected for possible safety problems and any safety problems found shall be corrected prior to piece of equipment being brought on to the project. All equipment shall be safety inspected monthly if not more often as directed by the COTR. Submit copies of these inspection reports to COTR within one week of the inspection.

K. Submit copies of the latest annual inspections as required by OSHA 1926.550 (Subpart N) to the COTR immediately upon any crane being brought on to the job site and within one week of any annual inspections that occur while that crane is on the project.

L. Submit a listing of all crane operators and their qualifications (Shall be a National Commission for Certified Crane Operator (NCCCO Certified) to the COTR for approval. Obtain approval in writing. In addition, crane plan, rigging plan, annual inspection with deficiencies report, rigging personnel and signalman certifications, crane placement verification, and dunnage documentation shall be submitted to the COTR and approve (refer to Airports Authority “Crane Policy” in the Airports Authority Construction Safety Manual for additional crane requirements).

M. Submit a safety mitigation plan for any subcontractors who have an Experience Modifier Rate (EMR) of over 1.0. The contractor shall provide documentation of the current year and last three years of safety related issues and address those issues in the safety mitigation plan.
1.5 SAFETY PROGRAM ADMINISTRATION

A. The contractor is responsible for establishing a committed unified safety team in a positive cooperative environment where all personnel and employees communicate, create, maintain, and verify the required level of safety in all aspects of construction as established in the Safety Plan and Contract Specifications.

1. Staffing Levels: Provide sufficient qualified safety personnel to monitor each work activity at all times.
   a. In cases where multiple trades, disciplines, or subcontractors are on site at the same time, each activity shall be monitored by safety personnel skilled and qualified in that portion of the work.
   b. In cases where multiple shifts are employed, the safety staff shall be increased to meet all personnel and safety requirements of this section and the contract specifications for each shift when work is performed. The maximum ratio of safety personnel to workers is one (1) qualified safety engineer per 100 workers per shift.
   c. In all cases, the safety staff shall not conduct escorting duties.

B. Roles and Responsibilities: The Contractor shall be directly responsible for establishing and implementing a project-specific Contractor Safety and Health Program for the protection of its workers, the workers of its Subcontractors, the COTR, Architect/Engineer, the Metropolitan Washington Airports Authority (Airports Authority) and the general public. The Contractor shall ensure that the necessary resources for an effective program, as set forth in the contract documents and specifications, are provided at all times during the course of the Work. The Contractor shall require that its Subcontractors comply with all requirements of the Work and of the Contractor Safety and Health Program. The Contractor shall include documentation of safety and health program implementation and accident experience as criteria for evaluating performance of its individual project managers and site supervisors.

1. The Contractor’s Project Manager shall:
   a. Ensure the implementation and administration of the Contractor’s Safety and Health Program.
   b. Support the Contractor’s Safety Engineer with the resources and authority to enable him/her to effectively administer and manage his/her designated portion(s) of the project safety effort.
   c. Attend scheduled safety and health meetings conducted by the Contractor pursuant to administration of the project safety effort.
   d. Cooperate with the COTR in enforcement of the Safety and Health Program responsibilities as set forth in these Specifications.

2. The Contractor’s Safety Engineer shall:
   a. Administer and manage the Contractor’s Safety and Health Program.
b. Cooperate with the COTR, PSM and Insurance Safety Consultant in their administration, management and oversight of the Contractor’s Project Safety and Health Program.

c. Prior to the start of work, conduct a physical survey of the job site(s) and make a survey of the work to be performed by reviewing the drawings and conducting discussions as applicable with the necessary parties toward identification of and planning for hazard controls. These activities shall be documented and submitted as a Project Safety and Health Survey to the COTR for review.

d. At the initiation of the work and throughout the course of the project, conduct and implement Job Hazard Analyses (JHAs) for operations deemed hazardous. The JHAs will identify potential hazards and actions required to control them. The JHAs will be submitted to the COTR for review. The CSE shall review PTP forms in the field with work crews and management personnel.

e. Be physically at the Project job site on a full-time basis for 8 hours per working day with minimal exceptions.

f. Conduct physical inspections of the job site, equipment, materials and operations to detect and promptly eliminate unsafe acts and unsafe conditions. The frequency of the inspections shall be determined on the basis of site activities. Hazardous activities will require continuous inspection. In no case shall the above-described inspections be conducted less than once per shift.

g. Document in a uniform, established format the findings of each inspection, including the nature of hazards identified, the corrective actions taken, and the person(s) exposed or potentially exposed to the hazard(s). Abatement photographs will be required for observed safety violations.

h. Schedule and conduct safety orientations, meetings and hazard recognition training for all workers and visitors on the project.

i. Develop and implement a program to readily identify individuals (i.e. Hard Hat Decals) who have completed the required safety and hazard training.

j. Administer the disciplinary action policies and procedures set forth in the Contractor’s Project Safety and Health Program.

k. Post and maintain the required safety information at appropriate locations on the project, including, but not limited to emergency action information (phone numbers, means of egress, etc), hazard warnings, hazard communication information, and injury and illness data.

l. Conduct investigations of all accident events and near misses and document the findings of such investigations within 24 hours in accordance with applicable rules and regulations and the Contractor’s Project Safety and Health Program. Abatement photographs shall be required by the contractor for observed safety violations.
m. Maintain written materials, such as codes, standards, references, hazard communication information, medical and exposure monitoring records and other safety and health program-related documents in an orderly manner at the project, readily available for use by the Contractor’s personnel and review by the COTR.

n. Perform all safety and health-related tasks necessary to achieve the highest degree of safety that the nature of the work permits.

o. Implement and manage a hot work permit program, making sure that it complies with the Airports Authority’s Fire Department rules and regulations.

p. Attend weekly walkthroughs with the COTR.

q. Attend project progress meetings as necessary or as required by the COTR.

3. The Contractor’s Site Supervisors (Superintendents and Foremen) shall:

a. Be directly responsible for ensuring the work is performed in a safe and healthful manner. They shall be knowledgeable of the hazards attendant to the work, aware of the necessary hazard controls and authorized to effect prompt action to control or eliminate them.

b. Assist the Contractor’s project management and safety staff in the inspection of job sites, equipment and materials, attending and participating in the Contractor’s safety meetings and training efforts, and enforcing safe work rules set forth in the Contractor’s Project Safety and Health Program.

c. Ensure that each job has the necessary safety appliances and personal protective equipment.

d. Monitor and report to the Contractor’s Safety Engineer the safety performance of Subcontractors on the project to determine their level of compliance with the Contractor’s Project Safety and Health Program.

e. Participate and cooperate fully with the COTR and Insurance Safety Consultant in the investigation of accidents and remediation of hazards.

f. Report all accidents immediately and near misses as promptly as conditions permit, with written follow up reports within 24 hours after the occurrence, to the COTR, and Insurance Safety Consultant.

4. Contractor’s employees shall be required by the Contractor to:

a. Fully support the Contractor’s Project Safety and Health Program by assisting the COTR and Insurance Consultant and Contractor’s Safety Engineer in the inspection of the job site, equipment and materials to detect hazards and reporting unsafe acts and unsafe conditions immediately.

b. Attend and actively participate in all orientation, safety and health training safety meetings and other functions for communication of safety and health prescribed by the Contractor’s Project Safety and Health Program.
c. Comply with the work rules set forth in the Contractor’s Project Safety and Health Program or as further established as a part of ongoing safety training and/or job hazard analysis.

d. Report to the Contractor’s Site Supervision any and all apparent unsafe acts or unsafe conditions.

e. Report any and all accidents, injuries, symptoms of illness and near miss events involving the worker to the Contractor’s Site Supervision immediately or as promptly as conditions permit.

f. Make recommendations for safety and health protection(s) that the worker has, from his or her own experience, observed to be successful on other projects.

PART 2 - PRODUCTS  (Not Used)

PART 3 - EXECUTION

3.1 CONTRACTOR’S SAFETY AND HEALTH PROGRAM - GENERAL REQUIREMENTS

A. This Section serves to outline the key elements for the Contractor’s Safety and Health Program. This Section also includes a number of additional project specific requirements for the Contractor’s Safety and Health Program. In addition, reference is made to the minimum requirements set forth in the Construction Safety Manual.

B. The Contractor’s Safety and Health Program shall include as a framework for safety and health programming the following minimum basic elements:

1. A statement of the Contractor’s commitment to providing a safe and healthful project.

2. A statement of the Contractor’s responsibility for implementing its Safety and Health Program.

3. Detailed procedures for:

   a. Training of site supervision.
   b. Safety and Health Project Orientation for workers.
   c. Ongoing Safety and Health training for workers.
   d. Providing safety and health information to the general public.

4. Specific assignments of safety and health-related roles and responsibilities.

5. Safety and health inspections on the project.

6. Procedures for accident-related record keeping, investigation and surveillance.
7. A disciplinary action procedure.

8. Schedule of safety related meetings and training.

9. A set of general work rules addressing hazards common to all types of construction and a site-specific set of work rules addressing the hazards of the work at hand.

10. A list of required permits for specific construction operations.

11. An emergency action plan addressing all types of emergencies with which the Contractor may reasonably and predictably be confronted.

12. A procedure for identifying how and under what circumstances job hazard analysis shall be conducted.

13. Reporting formats for required reports and submissions.

14. Detailed site-specific procedures for conducting safe working conditions associated with:
   a. Drilling.
   b. NATM, TBM and/or other types of tunneling, as applicable.
   c. Compressed air and gases.
   d. Concrete work.
   e. Confined spaces/permit-required confined spaces.
   f. Crane operations and maintenance.
   g. Rigging operations, equipment inspection and testing.
   h. Electrical hazards.
   i. Excavation and excavation support.
   j. Fall protection.
   k. Fire protection and prevention.
   l. First aid, CPR and blood borne pathogens.
   m. Hand and power tools.
   n. Hazard communication.
   o. Housekeeping.
   p. Scaffolding, ladders, and walking and working surfaces.
   q. Lockout/Control of Energy Sources.
   r. Materials handling and storage.
   s. Mechanized equipment.
   t. Construction health hazard monitoring.
   u. Personal protective equipment and clothing.
   v. Respiratory protection.
w. Sanitation.

x. Welding and cutting.

y. Existing utilities, including the requirement to provide, at no additional cost to the Airports Authority, 3rd party verification of utility locations each and every time Miss Utility is utilized.

15. Detailed site-specific procedures shall, as a minimum, comply with the guidelines identified in the Construction Safety Manual. All detailed site-specific procedures shall include requirements for mandatory eye and head protection and adherence to the 6-foot fall protection requirements. Site-specific procedures shall require all chainsaws used on-site to be equipped with kickback guards/breaks and require all other power tools to be equipped with all protective features as provided by the manufacturer.

16. Hazardous material handling.

17. A silica exposure plan to limit exposure of workers to silica dust. The plan shall include the applicable preventive measures recommended and contained in OSHA 1926.1153(k) “Occupational Exposure to Respirable Crystalline Silica”.

18. All equipment, not just the underground tunneling equipment, shall be inspected on a regular basis (monthly if not more often as approved by the COTR) with copies of the inspection report being submitted to the COTR. The purpose of these inspections is to identify and document possible safety problems and repair these problems before someone is injured.

3.2 SPECIFIC CONTRACTOR’S PROJECT SAFETY AND HEALTH PROGRAM REQUIREMENTS

A. The Contractor’s Project Safety and Health Program shall incorporate all basic elements of the construction project safety and health program set forth in Sub-Part 3.1 above, the Construction Safety Manual, and the following project-specific program elements:

1. A written, project-specific Safety and Health Plan (Plan), incorporating job hazard analysis for construction operations, encountering contaminated soil and water, detailed emergency action procedures and fire risk assessment shall be developed by the Contractor, for review by the COTR to point out deficiencies before the start of any construction. The Plan shall specifically address rescue operations, conditions affecting rescue operations, smoke venting procedures, back-up power supply and pumping systems, means of ingress and egress, communications, hot work permitting procedures, and training, orientation and refresher training for workers, emergency responders and visitors.

2. A written fire risk assessment portion of the Plan shall detail potential fire hazards, means of dealing with those hazards, fire prevention, fire suppression and emergency evacuation measures that will be employed by the Contractor during the course of the Project. The fire risk assessment shall include documentation that the material selected for the ventilation system ducting is in compliance with the specifications. The fire risk assessment shall be prepared and stamped by a registered fire protection engineer in the Commonwealth of Virginia.
3. The Plan shall be updated as substantive changes in the underground work environment occur. The Airports Authority’s and local fire departments shall be provided with a copy of the most current Plan and advised of changes in the Plan as they are implemented. The fire departments will be requested to review and comment on the Plan and any changes that occur to the Plan.

4. The Contractor is required to send all project supervisory personnel to an Authority provided Orientation prior to the start of any work.

5. The Contractor’s Safety Engineer shall train all workers and the COTR and his staff members in the details of the Plan.

6. In accordance with local and state regulations a permit system shall be used for all hot work performed on the project. The Contractor’s Safety and Health Plan shall detail the permit system’s procedures. The permit system shall be implemented and supervised by the Contractor’s Safety Engineer. The permits shall be made available for inspection by the Airports Authority, the COTR and the local fire department(s). Open flames and fire shall be prohibited in all construction operations, except as permitted for welding, cutting and other hot work operations pursuant to the Contractor’s Hot work Permit System. Smoking shall be allowed only in areas free of fire and explosion hazards. Readily visible signs prohibiting smoking and open flames shall be posted in areas having fire or explosion hazards.

7. The Contractor in all cases shall request responses by the fire department(s) to Project-related emergencies involving members of the general public. The Contractor shall fully coordinate and cooperate with the Airports Authority Fire and Rescue in its response to such emergencies.

8. In addition, the Contractor shall fully coordinate and cooperate with the Airports Authority’s Risk Management Department in its response to such emergencies.

9. The Contractor is required to obtain all permits required for the Contractor’s use of chemicals, and is responsible to meet all Federal, State and Local requirements. The Contractor shall develop a written chemical safety plan to address all chemicals used during construction. This safety plan shall include detailed procedures to prevent chemical accidents to the maximum extent possible during chemical transport, transfer, storage, use and disposal. The chemical safety plan shall include emergency response procedures, which identify all potential chemical emergencies and the recommended emergency response action to be taken for each incident. These procedures shall consider all potential chemical emergencies including chemical spills, incompatible reactions, fires and human exposures. Procedures shall describe methods to contain and isolate the accident, including the required protective clothing, equipment, first aid and response methods. Conduct, using Contractor’s staff emergency response training and drills to the extent necessary to control the specific chemicals used by the Contractor. The Contractor’s emergency response procedures shall be coordinated with support action from the Airports Authority’s and local fire departments and hazardous material response teams, to provide for a comprehensive emergency response plan. This coordinated response shall be adequate to manage all chemical emergencies and provide for the health, safety and evacuation of all site personnel as well the community. The Airports Authority’s and local fire departments shall be provided with a copy of the most current
plan and be requested to review and comment on the plan. At all times when chemicals are on site, the Contractor shall maintain a trained emergency response staff, equipment, protective clothing and supplies as needed to implement the chemical safety plan.

10. The Contractor shall have at least one (1) employee on site at all times who is trained and qualified to administer first aid and cardiopulmonary resuscitation (CPR) for every 25 employees on site.

11. The Contractor shall comply with all requirements identified in OSHA regulation § 1926.50 relating to medical services and first aid.

12. The Contractor shall provide the on-site safety staff an appropriate office on the job site(s) to maintain safety records, up-to-date copies of all pertinent safety rules, regulations and governing legislation, material safety data sheets, and the site safety and health plan including information concerning foreseeable emergency conditions, location of emergency and telephone contacts for supportive action and for all required notifications.

13. No visitors will be allowed on site without permission of the COTR.

3.3 ACCIDENT REPORTING, INVESTIGATION AND SURVEILLANCE

A. Accident Reporting

1. Accidents are defined for purposes of this Specification as: “Any unplanned event which results, or could have resulted, in an injury or illness to workers or the general public, property loss or damage to the environment.” The Contractor shall, as promptly as conditions permit, notify the COTR, Airports Authority Program Safety Manager, the Airports Authority’s Risk Management Department and the designated local Public Safety official of the nature and circumstances of the emergency. Provide such notice immediately and a written report no later than 24 hours after the event. Report all accident events in accordance with the following:

   a. The COTR’s Safety Engineer will establish and disseminate to the Contractor all required accident reporting formats.

   b. Ensure that all accidents involving scope of work on the project, including Subcontractors are reported in the established format to the COTR’s Safety Manager within twenty-four (24) hours of the event.

   c. Submit Airports Authority provided monthly safety report and submit to COTR’s Safety Manager no later than the tenth calendar day of the following month.

B. Accident Investigation

1. Investigate all accident events, as defined above and that occur on those portions of the Project under the Contractor’s control, in accordance with the contract documents and specifications.
a. Conduct a detailed investigation of any and all accidents. Addressing who, what, when where, and why questions. Personal information shall not be sent in any report or via email. Personal information (e.g. social security numbers, home address, etc.) shall be blackened out on all reports.

b. Provide the COTR, Airports Authority Program Safety Manager and the Airports Authority’s Risk Management Department with a detailed investigative report for any and all accidents.

c. Fully cooperate with the Airports Authority’s Risk Management Department, COTR, Airports Authority Program Safety Manager, Public Safety Department, Insurance Consultant and/or public authority having jurisdiction in the investigation of accidents.

d. Report accident investigations in a complete manner on the accident reporting format(s) designated by the Airports Authority Program Safety Manager.

e. Abatement photographs shall be required for corrective actions for observed safety violations and submitted to the COTR.

C. Accident Surveillance

The Airports Authority’s Insurance Safety Consultant and Airports Authority Program Safety Manager seek to collect accident information for purposes of identifying patterns, trends, performance and establishing appropriate policies and procedures related to protection of safety and health. To that end prepare and submit reports of accidents as detailed above.

PART 4 - MEASUREMENT (Not Used)

Part 5 - PAYMENT (Not Used)

END OF SECTION 007319
SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Work covered by the Contract Documents.
   2. Type of the Contract.
   3. Use of premises.
   4. The Airports Authority's occupancy requirements.
   5. Work restrictions.

B. Related Sections include the following:

Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of the Airports Authority's facilities.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Project consists of:
   1. Construction of an access road from Ariane Way to the Police/Fire Station and the installation of site security fencing around the employee parking lot serving the Police/Fire Station.


C. Architect/Engineer Identification: The Contract Documents, dated <Insert date indicated on the Contract Documents>, were prepared for Project by Alpha Corporation, 21351 Ridgetop Circle, Suite 200, Dulles, VA 20166..

D. The Work consists of:
   1. Demolition of an existing car wash building and cutting and capping of associated utilities;
   2. Demolition of an existing parking lot and other existing features;
   3. Construction of a new 28-feet wide access road from the Police/Fire Station employee parking to lot Ariane Way;
   4. Demolition of an existing parking lot on Hertz property;
5. Demolition of existing security fencing, mow strip, and landscaping;
6. Installation of 8-feet tall black vinyl security fence with barbed wire, concrete weed barrier, and three automatic controlled gates;
7. Installation of street lights, electric and communication conduits;
8. Replacement of an existing accessible ramp;
9. Installation of 5 feet sidewalk on south side of building;
10. Installation of an underground stormwater management facility;
11. For additional requirements for the examination of plans, specifications, and Project site see Section "Supplementary Conditions."
12. Infrastructure for all security devices for gate control to include AVI, card readers, cameras, intercoms and remote control to include but not limited to device boxes, supports, all associated controllers and conduit and cabling from security device to IT Closet in the Police station. MWAA will provide the security device
13. Commissioning of complete system.

1.4 TYPE OF CONTRACT

Project will be constructed under a general construction contract.

1.5 USE OF PREMISES

A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.

1. Authority Occupancy: Allow for Authority occupancy of site and day-to-day use.
2. Contractor shall have full use of premises for construction operations within the Contract Limit Lines indicated during construction period, during the hours indicated, and as directed by COTR. Contractor's use of premises is limited only by the Airports Authority's right to perform work.
3. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to the Airports Authority, the Airports Authority's employees and emergency vehicles at all times. Do not use driveways and entrances for parking or storage of materials.
   a. Schedule deliveries to minimize use of driveways and entrances.
   b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Utilize areas designated for Contractor staging, storage, and parking, as indicated. For additional requirements, see Section "Supplementary Conditions."

1.6 OCCUPANCY REQUIREMENTS

A. Full Authority Occupancy: The Airports Authority and/or its tenants will occupy site and existing building during entire construction period. Cooperate with COTR during construction operations to minimize conflicts and facilitate Authority usage, and perform the Work so as not to interfere with day-to-day Airport operations.
B. For additional requirements for Authority offices operational requirements, see Section "Supplementary Conditions."

1.7 CONTRACTOR HOURS OF OPERATION

Contractor Working Hours: The Airports Authority anticipates that the Contractor may be required to work multiple shifts to accomplish the work of this Contract within the established schedule. Contractor will be allowed and may be required by the nature of the Project to work 24 hours a day, seven days a week in the performance of the Work. Work is subject to restrictions of the Airport operational requirements. Notify the COTR 24-hours in advance of any change to the work schedule.

1.8 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: With the exception of Federal Aviation Administration (FAA) standard specifications and Virginia Department of Transportation standard specifications the Specifications are organized into Divisions and Sections using the 33-Division format using the CSI/CSC's "MasterFormat 2004" numbering system.

1. Section Identification: The Specifications use Section titles to help with cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete as all available Sections and Section numbers are not used and the CSI numbering system is not sequentially complete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Interpret words and meanings as appropriate. Infer words implied, but not stated, as the sense requires. Interpret singular words as plural, and plural words as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are used in these Specifications. This imperative language is directed to the Contractor, unless specifically noted otherwise. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

   a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
1.9 MARKING UTILITY SERVICES

A. The information in the Contract Documents concerning the type and location of underground utilities is neither guaranteed nor inclusive. The Contractor is responsible for determining the type and location of underground utilities, regardless of whether such utilities are indicated or not, so as to avoid damage thereto.

B. Employ a Subsurface Utility Engineering company to locate and mark the horizontal and vertical location of all utility lines in accordance with, *ASCE C-I 38-02, Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data, Quality level-A*. Utilities that might be impacted by construction activities, including but not limited to the following:

1. Electric power lines.
2. Natural gas lines.
4. Storm Sewers.
5. FAA communications, power, signal, and security lines.
6. Airfield series lighting lines
7. Water supply piping.
8. 530 KHz AM radio line - Parking Lot Availability Notification System -buried cable parallel to the Airport access road. The system utilizes antennas on the Airport thus there are no buried cables for this system within the fenced portion of the Airport property.
10. Telephone lines.
11. Data lines.
13. High Temperature Hot Water (HTHW) and chilled water lines.

C. Quality level A locating involves the use of nondestructive digging equipment at critical points to determine the precise horizontal and vertical position of underground utilities, as well as the type, size, condition, material, and other characteristics.

Within 60 calendar days of Notice to Proceed, submit to the COTR a survey of all subsurface utility engineering results, indicating the horizontal and vertical location, coordinates and elevation of all utilities. No land disturbance shall be performed until the utility survey is approved.

D. Contact the Airport Communications System (ACS) Help Desk at (703) 417-8300 a minimum of 72 hours prior to starting activities that include but are not limited to location and marking of horizontal locations of telephone and telecommunications lines belonging to the Airports Authority as part of the Airport Communication System. Contact the Airport Communications System (ACS) Help Desk a minimum of 72 hours prior to beginning operations, that include but are not limited to excavating, boring, pile-driving, digging or planting. Note the ACS does not locate utilities. Location is the responsibility of the Contractor’s underground utilities location subcontractor. The Airport Communications System (ACS) is merely notified as indicated previously.

E. Coordinate with the COTR, for access to and utilization of, Airport GIS information, MWAA Excavation & Trenching Check List, and notification procedures for the Utilities Locate Group.
F. The Contractor is responsible for following the requirements of the Virginia Underground Utility Damage Prevention Act. (Calling Miss Utility-VA811).

G. Report any unmarked utilities encountered during construction to the COTR immediately.

H. Repair any damage to utility lines due to construction operations at no expense to the Airports Authority.

I. Submit to the COTR the name of the independent Subsurface Utility Engineering (SUE) Company to be used. Individuals assigned by the SUE provider to carry out the work should be well-trained, experienced, and capable. Those in responsible charge of the work and responsible for certifying deliverables should be engineers, geologists, and land surveyors employed by the SUE provider in accordance with state professional registration requirements.

1.10 UTILITY OUTAGES

A. Prior to any utility outage/interruption, prepare a schedule of such outage. Include in outage schedule duration, identification of the service affected, temporary utility service to be provided, identification of available service alternative, and the action to be taken in any emergency. Apply for all outages of utility systems in writing. Fully coordinate outage requests with COTR. Obtain approval in writing from the Airports Authority. Schedule all outages at least three (3) weeks in advance with a 96-hour notification provided by the Contractor confirming date, time, and duration. Outages will normally be scheduled to occur between the hours of 11:00 pm and 5:30 am, Tuesday through Thursday.

B. Provide a suction/pump truck during all sanitary sewer line outages to support the disabled lift stations. Transport sewage to alternate lift stations located on the Airport and dispose of in accordance with Airport procedures. Provide a suction/pump truck with a capacity of 3,000 gallons or greater.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 – MEASUREMENT (Not Used)

PART 5 – PAYMENT (Not Used)

END OF SECTION 011000
SECTION 012900 – APPLICATION FOR PAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Coordinate the Schedule of Values and Applications for Payment with Contract CPM Schedule, List of Subcontracts, and Submittal Log.

C. Related Sections include the following:

1. Division 01 Section "Allowances" for procedural requirements governing handling and processing of allowances.
2. Division 01 Section "Unit Prices" for administrative requirements governing use of unit prices.
3. Division 01 Section "Measurement and Payment" for administrative requirements governing methods of measurement and determination of quantities of materials for use with unit prices.
4. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.
5. Division 01 Section “Project Closeout” for submittal of items required before final payment.
6. Division 01 Section “Project Record Documents” for procedural requirements governing the submission of Project Record Documents.
7. Division 01 Section “Operation and Maintenance Data” for submittal of items required before final payment.

1.3 DEFINITIONS

Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Price to various portions of the Work and once accepted, to be used as the basis for reviewing Contractor's Applications for Payment.
PART 3 - EXECUTION

3.1 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
   a. Application for Payment forms with Continuation Sheets.
   b. Submittals Schedule.
   c. Contract CPM Schedule.
   d. List of products.
   e. List of principal suppliers and fabricators.

2. Submit the Schedule of Values to the COTR at earliest possible date, but no later than 21 calendar days after the date of the Notice to Proceed.

3. On projects requiring cost-loaded CPM Schedules, the accepted cost loading will satisfy the requirements for the Schedule of Values.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:
   a. Project name and location.
   b. Name of COTR.
   c. Name of Architect/Engineer.
   d. The Airports Authority’s Contract number.
   e. Contractor's name and address.
   f. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Contract Modifications (numbers) that affect value.
   g. Dollar value.

1) Percentage of the Contract Price to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Price in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate. Include separate line items under required principal subcontracts for the following items. The value assigned to the total of these line items shall be 5 percent of the Contract Price:

a. Testing and commissioning activities.
b. Operation and Maintenance manuals.
c. Punch list activities.
d. Project Record Documents.
e. Bonds and warranties.
f. Demonstration and training.

4. Round amounts to nearest whole dollar. Total shall equal the Contract Price.

5. Contractor shall include all test and inspection activities in its CPM and establish a Schedule of Values for all required QC documentation, all tests and inspection activities, reports, and procedures required in the Contract on a Section-by-Section basis. Additionally, Contractor shall include a pay line item specifically for Quality activities and QC Organizational personnel required by the General Conditions.

6. Provide a separate line item in the Schedule of Values for each part of the Work where Application for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

7. Differentiate between potential items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.

8. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

9. Each item in the Schedule of Values and Application for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

10. Temporary facilities and other major cost items that are not direct cost of actual work-in-place must be shown as separate line items in the Schedule of Values.

11. Schedule Updating: Update and resubmit the Schedule of Values with the next Applications for Payment when Contract Modifications result in a change in the Contract Price.

3.2 APPLICATION FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Contracting Officer and paid for by the Airports Authority.

B. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

C. Payment Application Times: Application for Payment shall coincide with CPM schedule monthly update, or as otherwise indicated in the Agreement between the Airports Authority and Contractor. The period covered by each Application for Payment starts on the day following the end of the preceding period and shall not exceed one calendar month, unless otherwise approved by COTR.
D. Payment Application Forms: Use forms provided by the Contracting Officer, but supplied by COTR, for Application for Payment.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. The Airports Authority will return incomplete applications without action.

   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of Contract Modifications issued before last day of construction period covered by application.

F. Transmittal: Submit one signed and notarized copy of the Application for Payment electronically to the address indicated in the Section VII - Contract Provision, paragraph 04.B. Include waivers of lien and similar attachments if required.

   1. Transmit Applications for Payment with a transmittal form listing attachments and recording appropriate information about application in a manner acceptable to Contracting Officer.

G. Waivers of Mechanic's Lien: With Final Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers.

   1. The Airports Authority reserves the right to designate which entities involved in the Work must submit waivers.
   2. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to the Airports Authority.

H. Initial Application for Payment: Administrative actions and submittals that shall precede or coincide with submittal of first Application for Payment include the following:

   1. List of subcontractors.
   2. Schedule of Values/Unit Prices
   3. Contractor's Construction Schedule (preliminary if not final).
   5. Performance and payment bonds.
   6. Subcontractor Payment Form: (Form J, "Contract Conditions," Section IX, "LDBE").

I. Monthly Application for Payment: Administrative actions and submittals that shall accompany the submittal of Contractor's monthly Application for Payment include the following:

   1. Subcontractor Payment Form.
   2. Monthly Progress Report, prepared according to requirements specified in Division 01 Section "Construction Progress Documentation."
   3. Evidence of payment for material on-site if reimbursement for such material is being requested.
   4. Monthly Quality Control Summary Report, prepared according to requirements specified in Division 01, Section 40 00, Paragraph 1.7.B.13.
J. Application for Payment at Substantial Completion: After issuance of the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Price.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Authority occupancy of designated portions of the Work, if applicable.
3. Advise COTR of change-over in security provisions.

K. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Price.
4. Evidence that claims have been settled.
5. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when the Airports Authority took possession of and assumed responsibility for corresponding elements of the Work.
6. Final, liquidated damages settlement statement.
7. Return of all Airport identification badges and keys.

PART 4 - MEASUREMENT (Not Used)

PART 5 - PAYMENT (Not Used)

END OF SECTION 012900
SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes administrative requirements that the Contractor must provide for coordinating construction operations for the Contract including, but not limited to, the following:

1. General project coordination procedures.
2. Conservation.
3. Coordination drawings.
4. Administrative and supervisory personnel.
5. Project meetings:
   a. Pre-award conference.
   b. Pre-construction conference.
   c. Pre-installation conference.
   d. Progress meetings.
   e. Partnering meetings

B. All costs incurred by the Contractor to acceptably implement, as determined by the COTR, the requirements of this Section shall be borne by the Contractor, performed at no additional cost to the Airports Authority, and are considered a part of and incidental to this Contract.

C. Related Sections include the following:

1. Division 01 Section: "Execution" for the coordination of general installation and field-engineering services, including establishment of benchmarks and control points.
2. Division 01 Section "Project Closeout" for coordinating Contract closeout.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate
construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.

3. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, mechanical, electrical, and otherwise. Contractor is cautioned that, where specific dimensions are not indicated or where Drawings are schematic in nature, as with most Electrical and Mechanical Drawings, Contractor shall have sole responsibility to coordinate the work to meet this requirement. Prepare and submit Coordination Drawings to COTR for review and approval as provided in "Coordination Drawings" Paragraph in "Submittals" Article of this Section.

4. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

C. Prepare similar memoranda for COTR and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work and completion within the specified Contract duration. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Pre-installation conferences.
7. Start-up, check-out, and final acceptance of systems.
8. Project closeout activities.
9. Protection of existing and new work.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

F. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other sections for disposition of salvaged materials that are designated as the Airports Authority's property.

G. Temporary Utility Outages: Comply with requirements in Division 01 Section "Summary."
3.2 SUBMITTALS

A. Key Personnel Names: At the pre-construction meeting, submit a list of Contractor's key personnel assignments. Key personnel shall include but not necessarily be limited to Project Manager, Project Superintendent, Safety Manager, Quality Control Manager, Project Scheduler, Soil Excavation Engineers, and other personnel in attendance at Project site along with alternates. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep the list current at all times.

3.3 REQUESTS FOR INFORMATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor’s Superintendent or other designated representative acceptable to the COTR. RFIs submitted by entities other than Contractor’s accepted representative will be returned with no response.
2. RFIs shall be submitted through the Authority’s web-based Program Management Software designated by the COTR.
3. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

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

1. Contract Name
2. Contract Number
3. Date
4. Name of Contractor
5. Name of COTR
6. RFI number, numbered sequentially
7. Specification Section number and title and related paragraphs, as appropriate
8. Drawing number and detail references, as appropriate
9. Field dimensions and conditions, as appropriate
10. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
11. Contractor's signature
12. Attachments: Include drawings, descriptions, measurements, color photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
13. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
14.
C. COTR’s Action: COTR will review each RFI, determine action required, and return it. Allow seven (7) calendar days for COTR’s response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for coordination information already indicated in the Contract Documents.
   d. Requests for adjustments in the Contract Time or the Contract Sum.
   e. Requests for interpretation of Architect's actions on submittals.
   f. Incomplete RFIs or RFIs with numerous errors.

2. COTR's action may include a request for additional information, in which case COTR's time for response will start again.

3. COTR's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal.

   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify COTR in writing within 10 days of receipt of the RFI response.

D. On receipt of COTR’s action review response and notify COTR within seven (7) days if Contractor disagrees with response.

3.4 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

General: In addition to the Project Superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

3.5 PROJECT MEETINGS

A. Pre-award Conference:

1. General: At the request of the Contracting Officer, a pre-award conference with Contractor may be held before actual award of the Contract. The meeting will review Contractor's understanding of the Contract Documents, cost and pricing data, contractual requirements, and Contractor's capabilities, financial standing, and past experience prior to award.

   a. Minutes: CO will record and distribute meeting minutes to all attendees and all relevant parties.

2. Attendees: Contracting Officer, COTR, Authority Design Project Manager, Architect/Engineer, Contractor and its key personnel nominated for assignment to the Contract, and major subcontractors if so requested by the Contracting Officer. Concerned parties shall each be represented by persons thoroughly familiar with and authorized to conclude matters relating to the work described in the Contract Documents. The Contracting Officer will chair the pre-award meeting.
3. Agenda: Significant discussion items that could affect award include, but are not limited to, the following:
   a. Provision and acceptability of payment and performance bonds.
   b. LDBE/MBE/WBE/DBE participation.
   c. Qualifications of key individuals.
   d. Quality-control experience.
   e. Percentage of work performed by own forces.
   f. Contractor's experience with similar work, including previous Authority contracts.
   g. Scheduling capabilities of Contractor.
   h. Financial standing of Contractor.
   i. Mobilization plan.
   j. Understanding of work described in the Contract Documents and the physical constraints associated with work at the Airport.
   k. Equipment and manpower availability.
   l. Cost and pricing data.

4. Representations and commitments made by Contractor or its subcontractors shall be construed as binding to the Contract.

B. Pre-construction Conference:

1. General: COTR will schedule pre-construction conference and organizational meeting with Contractor after the Contracting Officer issues a notice of intent to award, or actually awards the Contract. The meeting will review the parties' responsibilities and personnel assignments.

2. Attendees: Contracting Officer, COTR, Architect/Engineer, and their sub-consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Airport security.
   b. LBDE/MBE/WBE/DBE participation and certifications.
   c. Authority-controlled wrap-up insurance program.
   d. Airport Operations coordination.
   e. Preliminary construction schedule.
   f. Phasing.
   g. Critical work sequencing.
   h. Designation of key personnel.
   i. Procedures for processing field decisions and Contract Modifications.
   j. Procedures for processing Applications for Payment.
   k. Distribution of the Contract Documents.
   l. Authority Construction guidelines.
   m. Submittal procedures.
   n. Preparation of Record Documents.
   o. Use of the premises.
   p. Responsibility for temporary facilities and controls.
   q. Parking availability.
   r. Office, work, and storage areas.
s. Equipment deliveries and priorities.
t. Safety procedures.
u. Quality-control requirements.
v. First aid.
w. Progress cleaning.
x. Working hours.
y. Authority Building Code requirements/permits.

4. Refer to Contract Provision "Pre-construction Requirements" for required submittals due at the pre-construction conference.

C. Project Closeout Conference: If requested by the Contractor or deemed necessary by the COTR, the COTR will schedule and conduct a Project Closeout Conference no later than 30 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Contracting Officer, COTR, Authority Design Project Manager, Architect/Engineer, Contractor and its key personnel; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
   a. Preparation of record documents.
   b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
   c. Submittal of written warranties.
   d. Requirements for preparing sustainable design documentation.
   e. Requirements for preparing operations and maintenance data.
   f. Requirements for demonstration and training.
   g. Preparation of Contractor's punch list.
   h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
   i. Submittal procedures.
   j. Coordination of separate contracts.
   k. Owner's partial occupancy requirements.
   l. Installation of Owner's furniture, fixtures, and equipment.
   m. Responsibility for removing temporary facilities and controls.

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

D. Weekly Progress Meetings:

1. General: COTR will conduct progress meetings weekly at regularly scheduled times convenient for all parties involved. Progress meetings are in addition to specific meetings held for other purposes, such as coordination and special pre-installation meetings. Additionally, discussions will address administrative and technical issues of concern, determining resolutions, and development of deadlines for resolution within allowable time frames.
2. Minutes: COTR will record and distribute meeting minutes.

3. Attendees: As may be required by COTR, in addition to representatives of the Airports Authority and Contractor, each subcontractor, supplier, Contractor’s Project Scheduler, and other entities concerned with current progress or involved in planning, coordination, or performance of future activities. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

4. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

   b. Review present and future needs of each entity present, including the following:

      1) Safety and Security.
      2) Interface requirements.
      3) Time.
      4) Sequence of operations.
      5) Status of submittals.
      6) Deliveries.
      7) Off-site fabrication.
      8) Storage Areas
      9) Access.
     10) Site utilization.
     11) Requests for information.
     12) Submittals.
     13) Noncompliance notices.
     14) Temporary facilities and controls.
     15) Work hours.
     16) Resource allocation.
     17) Hazards and risks.
     18) Progress cleaning.
     19) Quality and work standards.
     20) Contract Modifications.
     21) Documentation of information for payment requests.
     22) Preparation of Record Documents.

5. Submit at the weekly progress meeting, a two-week look-ahead schedule. This schedule shall include a three-week period, one week showing actual progress from the previous week and two weeks showing planned work for the two weeks after the meeting date. Include in the schedule all activities in sufficient detail as approved by COTR. A two-week look-ahead schedule form will be distributed at the pre-construction conference. Submit a list of subcontractors identifying dates of when subcontractors will be on-site or off-site. A form for this information will be provided by COTR.
6. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

E. Schedule Update Meetings:

1. If required by the COTR, conduct schedule update meetings before submittal of Contractor's Application for Payment. Determine where each activity is, in relation to Contractor's CPM Schedule. Ensure the incorporation of all changes made to the sequence of work and all change notices issued by the Contracting Officer. Submit the narrative and information specified in Division 01 Section "Construction Progress Documentation" if applicable.

2. Attendees: COTR, Contractor's Project manager or superintendent, the Contractor's Project Scheduler, and the Airports Authority's representative.

3. Submit the updated schedule, as bilaterally agreed on, along with the Application for Payment.

4. Present delay claims for discussion and, when possible, resolution.

PART 4 - MEASUREMENT (Not Used)

PART 5 - PAYMENT (Not Used)

END OF SECTION 013100
SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for various CPM schedules and reports required for proper performance of the Work.

B. All costs incurred by Contractor to correctly implement and update the schedule shall be borne by Contractor and are part of and incidental to this Contract.

C. Schedules required include the following:
   2. Submittals Schedule.
   3. Schedule of Tests and Inspections.
   4. Record, As-Built CPM Schedule.

D. Reports required include the following:
   1. Daily Construction Reports.
   2. Material Location Reports.
   3. Field Correction Reports.
   4. Special Reports.

E. Related Sections include the following:
   1. Division 01 Section "Application for Payment" for Schedule of Values.
   2. Division 01 Section "Project Management and Coordination" for Project meeting minutes.
   3. Division 01 Section "Quality Requirements" for test and inspection reports.
   4. Division 01 Section "Product Requirements" for Product List.

1.3 DEFINITIONS

A. Activity: The fundamental unit of work in a Project plan and schedule. Each activity has defined geographical boundaries. Each activity is assigned a unique description, activity number, activity codes, and dollar value.
B. CPM Network: The structure of the schedule. The network is the representation that defines the construction logic in terms of all the activities with their logical dependencies.

C. Contract CPM Schedule: A CPM schedule covering the entire Contract Duration from the Notice to Proceed through Final Acceptance of the Work.

D. Contract Duration/Time: The total time, in calendar days identified in Section III, "Schedule," representing the duration necessary for completion of all physical and administrative requirements under this Contract and any authorized extension thereof.

E. Critical Path: The critical path is the longest connected chain of interdependent activities in a CPM network that impacts the completion of the Project.

F. Excusable Delay: An unforeseeable delay, beyond the control of Contractor, experienced due to no fault or negligence by Contractor, its subcontractors, or suppliers.

G. Predecessor Activity: An activity that precedes another activity in the network.

H. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities shall equal the total Contract Price, unless otherwise approved by COTR. Cost Loading and cash flow curves are required for all contract types EXCEPT the following:
   1. Unit Price Contracts.
   2. Contracts with a duration of less than one (1) year.
   3. Contracts with an award amount less than $1,000,000.

I. Successor Activity: An activity that follows another activity in the network.

J. Total Float: The amount of time an activity can be delayed from its earliest start date without delaying the end of Project.
   1. Float time is not for the exclusive use or benefit of either the Airports Authority or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.

1.4 PLANNING

A. The total Contract Duration and intermediate milestones if applicable, as indicated in Section III, "Schedule," are the Contract requirements.

B. Contractor shall prepare a practical work plan to complete the Work within the Contract Duration, and complete those portions of work relating to each intermediate milestone date and other Contract requirements. Contractor shall generate a computerized cost-loaded CPM schedule in Precedence Diagram Method (PDM) format for the Work.

C. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of COTR approval of the Schedule.
D. Failure of Contractor to comply with requirements of this Section may be considered cause for withholding progress payments or termination for default.

1.5 SUBMITTALS

A. General: Contractor shall submit all schedule submittals via the Authority’s web-based Program Management Software. The latest version of Primavera P6 scheduling software shall be used. All costs incurred by Contractor to correctly implement, computerize and update the CPM Schedule shall be borne by Contractor and are included in the Contract Price. The number of copies of each submittal shall be as described in this Section or as may be requested by COTR.

B. Contract CPM Schedule: The Contract CPM Schedule and its related narrative as described in this Section shall be submitted along with the projected cash-flow curve as early as practicable after the Notice to Proceed, but in no event later than 30 calendar days after the Notice to Proceed. Within 15 calendar days, COTR will respond with approval or direction to change and Contractor shall resubmit within 10 calendar days, if required. A project cash-flow curve is NOT required for unit price contracts.

C. Daily Progress Report: Submit electronically via the Authority’s web-based Program Management Software to COTR by noon on the day following the date of actual progress.

D. Monthly Progress Report: All components of the Monthly Progress Report described in this Section shall be submitted as attachments to Contractor's monthly Application for Payment.

E. Record As-Built CPM Schedule: A Record CPM Schedule accurately reflecting actual progress of Work shall be submitted, as part of this Contract's Record Documents. All activities shall have actual dates that are true and accurate.

F. Qualification Data: For Project Scheduler.

1.6 QUALITY ASSURANCE

Project Scheduler Qualifications: Minimum of two years experience and not less than one project of similar size and scope, with capability to produce CPM reports and diagrams within 24 hours of COTR's request. Project Scheduler is classified as one of Contractor's key personnel.
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PROJECT SCHEDULER

A. Engage a project scheduler, either as Contractor's employee or as Contractor's consultant, to provide planning, evaluation, and reporting using CPM scheduling, and to prepare required schedules.

B. The Project Scheduler shall be an active participant at all meetings as requested by the COTR.

3.2 CONTRACT CPM SCHEDULE

A. Scheduling Requirements: The Contract CPM Schedule shall be a computerized cost-loaded, time-scaled CPM Schedule in PDM format. Cost loading is NOT required for Unit Price Contracts. The CPM Schedule shall include the following:

1. The order, sequence, and interdependence of all significant work items including mobilization, demobilization, testing and commissioning, construction, procurement, fabrication, and delivery of critical or special materials and equipment; utility interruption coordination; submittals and approvals of critical Samples, Shop Drawings, procedures, or other reasonable requirements that may be requested by COTR.
2. Work by the Airports Authority, or utility agencies, and other third parties that may affect or be affected by Contractor's activities.
3. Adequate referencing of all work items to identify subcontractors or other performing parties.
4. Activity Coding may be provided by the COTR to establish minimum requirements for structure and values for the first 5 code fields.
5. Activity durations not in excess of 14 calendar days, except non-construction activities such as procurement and fabrication. Activities shall be broken down in the level of detail prescribed by COTR.
6. Activities that are cost loaded to show the direct costs required to perform the Work, including work by subcontractors.
7. A narrative that explains the basis for Contractor's determination of construction logic, estimated durations, cost allocations, hours per shift, workdays per week, and types, numbers, and capacities of major construction equipment to be used. A listing of nonworking days and holidays incorporated into the schedule shall be provided.

B. Critical Path Activities: The Contract CPM Schedule shall be prepared to include the data for the total Contract and the critical path activities shall be identified, including critical paths for interim completion dates. Scheduled start or completion dates imposed on the schedule by Contractor shall be consistent with Contract milestone dates. Milestone dates shall be the scheduled dates specified in Section III, "Schedule," if applicable, and shall be prominently identified. The Contract CPM Schedule shall accurately show all as-built activities completed from the issuance of the Notice to Proceed up to the submittal of this schedule.

C. Assignment of Costs to Activities for Progress Payments:
1. Contractor shall assign cost to construction activities on the Contract CPM Schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with COTR's approval, be assigned to fabrication and delivery activities. Costs shall be assigned to testing and commissioning activities, O&M manuals, punchlist activities, and Project Record Documents.

2. Each activity cost shall reflect an accurate value subject to approval by COTR.

3. The total cost assigned to activities shall equal the total Contract Price.

4. Activities shall be cost coded as directed by COTR.

5. Schedule of Values: Contractor shall include all test and inspection activities in its CPM and establish a Schedule of Values for all required QC documentation, all tests and inspection activities, reports, and procedures required in the Contract on a Section-by-Section basis. Additionally, Contractor shall include a pay line item specifically for Quality activities and QC Organizational personnel required by the General Conditions. Quality activities shall be reported per Division 01 Section "Applications for Payment."

D. Required Submittals: On a monthly basis, Contractor shall submit via the Authority’s web-based Program Management Software each of the following components of the Contract CPM Schedule:

1. A time-scaled plot of the schedule network in PDM format showing logic ties for all activities including submittals and procurement activities.

2. Computer-generated CPM Schedule Reports that contain the following data for each work item: activity identification number, description, resource loading, duration, early start and early finish calendar dates, late start and late finish calendar dates, and total float in calendar days. The reports shall also show the logic ties of successor and predecessor work items. The reports shall be sorted as follows, or other sorts as required by COTR:
   a. By activity identification.
   b. By total float x early start.
   c. By early start x early finish x total float.

3. The narrative described in Subparagraph 3.2-A-6 above.

4. A cash-flow report, if required, showing monthly expenditures projected over the life of the Contract. A cumulative cash-flow curve based on early and late schedule events shall also be submitted. These reports shall be derived from the Contract CPM Schedule.

3.3 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report, recording the following information concerning events at the site, coordinate with requirements in Division 01 Section "Quality Requirements," and submit duplicate copies to COTR by noon of the day following day of actual progress:

1. List of subcontractors (by trade group) at the site.
2. List of separate contractors at the site.
3. Approximate count of personnel (by trade group) at the site.
4. Equipment (by trade group) at the site.
5. High and low temperatures, general weather conditions.
6. Accidents (refer to accident reports).
7. Meetings and significant decisions.
8. Unusual events (refer to special reports).
10. Meter readings and similar recordings.
11. Emergency procedures.
12. Orders and requests of governing authorities.
14. Services connected, disconnected.
15. Equipment or system tests and startups.
17. Substantial Completions authorized.
18. Material deliveries.

3.4 MATERIAL LOCATION REPORTS

At weekly intervals, prepare a comprehensive list of materials delivered to and stored at the site. Submit copies of list to COTR at weekly intervals.

3.5 FIELD CORRECTION REPORT

When the need to take corrective action that requires a departure from the Contract Documents arises, prepare a detailed report including a statement describing the problem and recommended changes. Indicate reasons the Contract Documents cannot be followed. Submit a copy to COTR immediately.

3.6 SPECIAL REPORTS

A. When an event of unusual or significant nature occurs at the site, prepare and submit a special report. List the chain of events, persons participating, and response by Contractor's personnel, an evaluation of the results or effects, and similar pertinent information. Advise COTR in advance when such events are known or predictable.

1. Include tabular CPM reports, time-scaled logic diagrams, resource curves and histograms, and narratives as requested by COTR.

B. Submit special reports directly to COTR within seven calendar days of an occurrence. Submit a copy to other parties affected by the occurrence.

3.7 MONTHLY PROGRESS REPORTING

A. General: Approval of Contractor's monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly schedule update.

B. Monthly Schedule Update Meetings: Monthly schedule update meetings, if required by the COTR, shall be the product of joint review meetings between Contractor, COTR, and major active subcontractors. The joint review shall focus on actual progress for the preceding month, planned progress for the upcoming month supported by a Contractor-prepared Four-Week Look-Ahead Schedule, impact to schedule if any due to change notices issued, adverse weather, and any effected changes to the Construction CPM Schedule. The agreed on progress, and
changes, if any, shall be incorporated into the schedule update to be submitted. The update shall always represent the actual history of accomplishment of all activities, and will form the basis for Contractor's Application for Payment. Contractor's delay claims shall be presented for discussion and, when possible, resolution.

C. Required Submittals: On a monthly basis, Contractor shall via the Authority’s web-based Program Management Software the updated CPM schedule and the following components of the Monthly Progress Report:

1. A monthly progress narrative, the content of which shall be prescribed by COTR, but shall include as a minimum a description of overall progress for the preceding month, a critical path analysis, a discussion of problems encountered and proposed solution thereof, delays experienced and proposed recovery measures, a monthly reconciliation of weather impact, the status and impact of contract modifications, documentation of any logic changes, and any other changes made to the schedule since the previous monthly update.

2. CPM schedule reports listing completed activities, activities in progress, and remaining activities in the format requested by COTR. For each activity, Contractor shall provide those details identified in Subparagraph 3.2-D-2.

3. Material Location Report: The Material Location Report shall include a cumulative list showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for all materials or items of equipment being fabricated or stored away from the building site. Documentation of delivered material shall include paid invoices or other evidence that Contractor has clear title for the material delivered.

D. If critical activities of the schedule are delayed and such delay is not excusable as defined in this Section, the remaining sequence of activities and/or duration thereof shall be adjusted by Contractor through such measures as additional manpower, additional shifts, or the implementation of concurrent operations until the schedule produced indicates Work will be completed on schedule. Except as provided elsewhere in the Contract, all costs incurred by Contractor to recover from inexcusable delays shall be borne by Contractor.

E. The monthly schedule update shall form the basis for Contractor's Application for Payment. The progress payment for an activity shall be based on its agreed on percentage of completion. On unit-priced contracts, the approval of Contractor's monthly requisition is contingent on the submittal of a satisfactory monthly schedule update; however, the basis of payment will be the actual measurement of COTR-accepted, in-place units of work.

3.8 DELAYS AND REQUESTS FOR EXTENSION OF TIME

A. The determination for an extension of the Contract Time will be made by the Contracting Officer according to the Contract Provision "Default."

B. The Contractor acknowledges and agrees that delays in activities, irrespective of the party causing the delay, which according to the computer mathematical analysis do not affect any critical activity or milestone dates on the CPM network at the time of the delay, shall not become the basis for an extension of the Contract Time. The only basis for any extension of time will be the demonstrated impact of an excusable delay on the critical path. In
demonstrating such impact, Contractor shall provide adequate detail as required by the Contract, and Contractor shall prove that:

1. An event occurred.
2. Contractor was not responsible for the event in that the event was beyond the control of Contractor, and was without fault or negligence of Contractor, subcontractor, or supplier, and the event was unforeseeable.
3. The event was the type for which an excuse is granted according to the "Default" provision of this Contract.
4. Activities on the critical path of the Work were delayed.
5. The event in fact caused the delay of the Work.
6. The requested additional time is an appropriate and reasonable extension of the Contract Time, given the actual delay encountered.

C. Time Extensions for Unusually Severe Weather:

1. If unusually severe weather conditions are the basis for a request for an extension of the Contract Time, such request shall be documented by data substantiating that weather conditions were abnormal for the period of time and could not have been reasonably anticipated, and that weather conditions had an adverse effect on the critical activities of the scheduled construction.
2. The schedule of anticipated adverse weather below will constitute the base line for monthly (or a prorated portion thereof) weather/time evaluation by the Contracting Officer. On issuance of the Notice to Proceed and continuing throughout the Contract on a monthly basis, actual adverse weather days will be recorded by Contractor on a calendar day basis (include weekends and holidays) and compared to the monthly anticipated adverse weather days set forth below.

   a. For purposes of this clause, the term "actual adverse weather days" shall include days that can be demonstrated to have been impacted by adverse weather.
   b. Monthly Anticipated Adverse Weather Calendar Days:

      1) January - 7.
      2) February - 5.
      3) March - 6.
      4) April - 6.
      5) May - 8.
      6) June - 6.
      7) July - 6.
      8) August - 7.
      9) September - 5.
     10) October - 5.
     11) November - 5.
     12) December - 6.

   c. The number of actual adverse weather days shall be calculated chronologically from the first to the last day in each month. Contractor shall not be entitled to any claim for time extension based on adverse weather unless the number of actual adverse weather days exceeds the number of anticipated adverse weather days, and unless such adverse weather days prevent work for 50 percent or more of Contractor's workday. In preparing the Contract Schedule, Contractor shall reflect
the above anticipated adverse weather days on all weather-dependent activities. Weather-caused delays shall not result in any additional compensation to Contractor.

3. On days where adverse weather is encountered, Contractor shall list all critical activities under progress and shall indicate the impact adverse weather had, if any, on the progress of such activities. This information shall be presented at the end of the adverse weather day to COTR or its authorized representative for its review and approval.

4. If Contractor is found eligible for an extension of the Contract Time, the Contracting Officer will issue a modification extending the time for Contract completion. The extension of time will be made on a calendar day basis.

D. Required Submittals:

1. Provide time-impact analysis that illustrates impact during update period in which event occurred, that event has been mitigated to greatest possible extent, and that event still impacts overall completion of Project.

2. Include with request, electronic submittal of impacted schedule and all relevant documents that support the claim.

3. Submit all required items within the following time periods:
   a. 10 calendar days of event occurrence.
   b. 10 calendar days of Contractor's knowledge of impact.
   c. 14 calendar days of written request by COTR.

4. Expiration of time periods without submittal shall constitute forfeiture of rights for these specific impacts.

3.9 RECORD SCHEDULE

After all Contract work items are complete, and as a condition of final payment, Contractor shall submit three copies of a Record, As-Built CPM Schedule showing actual start and finish dates for all work activities and milestones, based on the accepted monthly updates. These schedule submittals shall be in tabular and in time-scaled PDM plot formats.

PART 4 – MEASUREMENT (Not Used)

PART 5 - PAYMENT (Not Used)

END OF SECTION 013200
SECTION 013233 - PHOTOGRAPHIC AND VIDEO RECORDING DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs and video recordings.
   2. Photographic and video recordings of key construction activities.
   3. Video recording of Demonstration and Training.
   4. Final Completion construction photographs.

B. Related Sections include the following:
   1. Division 01 Section 01 "Submittals" for submitting construction photographs.
   2. Division 01 Section 01 “Quality Requirements” for photographic and video-recording of daily site activities and key construction activities.
   3. Division 01 Section 01 "Project Closeout" for submitting photographic documentation as Project Record Documents at Project closeout.
   4. Division 01 Section 01 “Demonstration and Training” for submitting videotapes of demonstration of equipment and training of Authority’s personnel.

C. All costs incurred by the Contractor to acceptably implement, as determined by the COTR, the requirements of this Section shall be borne by the Contractor, performed at no additional cost to the Airports Authority, and are considered a part of this Contract.

1.3 SUBMITTALS

A. Digital Photographs

   1. Submit all digital photographic image files within five (5) business days of taking photographs via the Authority’s web-based Program Management software, or other delivery and storage format as approved by the COTR.
   2. Required photographic documentation: The minimum requirements for photographic documentation is:
      a. Pre-construction conditions for each work area
      b. Key construction activities
      c. Conditions at the time of final completion or portion thereof.
B. Video Recordings

1. Submit all video recording documentation within five (5) business days of taking video recordings via the Authority’s web-based Program Management software, or other delivery and storage format as approved by the COTR.

2. Required video recording documentation: The minimum requirements for video recording documentation is:
   a. Pre-construction conditions for each work area
   b. Demonstration and training provided for the Airports Authority operations and maintenance personnel

1.4 USAGE RIGHTS

Transfer copyright usage rights from the photographers and video recorders to the Airports Authority for unlimited reproduction of photographic and video recording documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC AND VIDEO RECORDING DOCUMENTATION

A. Digital Images

1. Digital Camera: Minimum sensor resolution of eight (8) megapixels.
2. Format: Provide color images in JPG format with minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped.
   Date and Time Stamp: Each photographic is to be date and time stamped to show when the photograph was created.

B. Video Recordings: Provide high-resolution, color, digital video recordings.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. The Contractor shall be responsible for the provision of the required photographic and video recording documentation. Key construction activities that require photographic and or video recording are to be identified and included in the Submittals log for approval by the COTR.

B. Key Construction Activities: Key construction activities to be documented using photographs and or video recording include, but are not limited to activities such as: foundations; structural steel; concrete placement; plumbing; electrical wiring and equipment; glass and curtain-walls; roofing and waterproofing; maintenance of traffic; temporary facilities; and other activities of major significance, as required by the COTR.
3.2 PHOTOGRAPHIC DOCUMENTATION

A. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

B. Preconstruction Photographs: Before starting mobilization, demolition or construction, take color photographs of each work area and surrounding properties from a variety of vantage points.
   1. Provide photographs to adequately show existing conditions at each work area before starting the work.
   2. Provide photographs of all existing buildings and facilities adjacent to the work area to accurately record the physical conditions before starting work.

C. Photographs of Key Construction Activities: Provide photographs for each key construction activity showing all aspects of the work.

D. Final Completion Construction Photographs
   1. Provide photographs upon Final Completion or portion thereof to show final conditions.
   2. Provide photographs of existing buildings and facilities adjacent to the work area to accurately record the physical conditions upon completion of the work.

3.3 VIDEO RECORDINGS

A. Recording: Use a video recorder to document site conditions and demonstration and training. At the start of each video recording, record the date, time, the location, the activity, the person performing the video recording, the name of the Contractor, the contract number, and the weather conditions to include the temperature reading at the jobsite.

B. Narration: Describe scenes on video recording by audio narration as the video recording is recorded. Include a description of items being viewed, recent events, and planned activities. Describe the vantage point, indicating location, direction (by compass point), and elevation or story of construction.

C. Preconstruction Video Recording: Before starting mobilization, demolition or construction record video for each work site and surrounding facilities from a variety of vantage points.
   1. Show existing conditions adjacent to the work site before starting the work.
   2. Show existing buildings either on or adjoining the jobsite to accurately record the physical conditions prior to the start of demolition and construction.

D. Video Recording for Demonstration and Training: Provide video recording of the demonstration and training of the Airports Authority’s operations and maintenance personnel as required by Specification Section 017900.
PART 4 - MEASUREMENT (Not Used)

PART 5 - PAYMENT (Not Used)

END OF SECTION 013233
SECTION 013300 - SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

B. Related Sections include the following:

1. Division 01 Section “Application for Payment”
2. Division 01 Section “Construction Progress Documentation”
3. Division 01 Section “Photographic Documentation”
4. Division 01 Section “Quality Requirements”
5. Division 01 Section "Project Closeout" for submitting warranties.
6. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data
7. Divisions 02 through 33 Sections for specific requirements for submittals in those Sections.

C. All costs incurred by the Contractor to acceptably implement, as determined by the COTR, the requirements of this Section shall be borne by the Contractor, performed at no additional cost to the Airports Authority, and are considered a part of this Contract.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires the COTR's responsive action.

B. Informational Submittals: Written information that does not require the COTR's approval. Submittals may be rejected for not complying with requirements.

C. Oracle Primavera Unifier: Oracle Primavera Unifier is a Web-based software service that the Airports Authority requires the Contractor and the Architect-Engineer to use on this contract. Oracle Primavera Unifier is to be used for Submittals, to include the transmittal, distribution, log, and management of the submittals process.
1.4 SUBMITTAL PROCEDURES

A. General: The COTR will arrange for delivery of an electronic copy of the Contract requirements CADD drawing files to the Contractor at the Pre-Construction Conference for use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities as follows:

1. Coordinate each submittal with coordination drawings, purchasing, fabrication, testing, delivery, other submittals, and related activities.
2. Coordinate and package submittals together for related parts of the work so processing will not be delayed where submittals must be reviewed concurrently.
3. The Airports Authority reserves the right to withhold action on any submittal that requires coordination with other submittals until related submittals are received. Withholding action in this manner shall not warrant a claim by the Contractor for additional time or cost.

C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for the submittals and time requirements for scheduled performance of related construction activities.

D. Contractor Responsibilities: The Contractor is responsible for the scheduling and submission of all submittals to the COTR as follows:

1. Utilize the Program Management Software system designated by the COTR.
2. A submittal response from the COTR should not result in a change to the Contract; however, if the Contractor believes a submittal response warrants an increase or decrease in the Contractor’s cost of, or the time required for, the performance of any part of the work under the Contract, the Contractor shall notify the Contracting Officer in writing, with a copy to the COTR, within seven (7) calendar days stating (1) the date, circumstances, and source of the order and (2) that the Contractor regards the order as a change order. Direction from the Contracting Officer is required before proceeding with any work that involves a change to the Contract scope, price, time, terms or conditions.

E. Processing Time: The Contractor is to allow adequate time for submittal review, including time for re-submittals, as listed below. Time for review shall commence on the date submitted in the Oracle Primavera Unifier system by the Contractor. Late transmittal of submittals shall not warrant a claim by the Contractor for additional time or cost.

1. Initial Review: Allow 15 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. The COTR will advise the Contractor when a submittal must be delayed for coordination. Allow an additional 45 calendar days for submittals related to fire-detection systems and fire-protection systems.
2. Re-submittal Review: Allow 15 calendar days for review of each re-submittal.
3. Sequential Review: Where sequential review of submittals by the COTR, or other parties is indicated, allow 21 calendar days for the initial review of each submittal.
4. Processing of incomplete or unacceptable submissions by the COTR shall not reduce the number of calendar days specified above for the COTR's review. Resubmissions shall be treated the same as initial submissions relative to review time.

G. Resubmissions: The re-submittal procedure shall follow the same procedures and same number as the initial submittal with the following exceptions:

1. The transmittal shall contain the same information as the first transmittal and the submission number shall indicate second, third, etc., submission. The drawing number/description shall be identical to the initial submission.
2. No new material shall be included on the same transmittal for a resubmission.
3. COTR rejection shall not warrant a claim by the Contractor for additional time or cost.

H. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the contract requirements on submittals. Where significant deviations from the contract requirements exist, follow the guidelines set forth in Division 01 Section "Product Requirements" for substitutions.

I. Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the COTR using the Oracle Primavera Unifier Web services. The Contractor must use the Airports Authority provided web-based Oracle Primavera Unifier project management system (Unifier) to transmit each submittal to the COTR. Response of the COTR’s submittal review and action will be transmitted to the Contractor through Unifier. The COTR will return submittals, without review, when received from sources other than the Contractor.

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Bear all costs incurred for such reproduction and distribution. Prints of all reviewed Shop Drawings may be made from transparencies that carry the appropriate review stamps.

L. Use for Construction: Use only final submittals with mark indicating “Reviewed – No Exceptions Taken” by COTR in connection with construction.

1.5 SUBMITTAL LOG

A. Prepare a log that contains a complete listing of all submittals required by Contract. Submit the log at the preconstruction meeting along with the Contractor's construction schedule specified in Division 01 Section "Construction Progress Documentation." Organize the submittal log by Specification Section number. Assign each submittal a sequential number for identification and tracking purposes.

B. Coordinate the submittal log with Division 01 Section "Construction Progress Documentation." The submittal log shall be submitted for the COTR's review and information. Include the following information:

1. Contract Name and Number
2. Contractor Name
3. Submittal unique identifier
4. Title of submittal/description.
5. Scheduled date of the initial submission for each submittal.
6. Required Date for Approval for each Submittal.
7. Submittal Status
8. Review / Response Code
9. Drawing number reference, if applicable.
10. Subcontractor/vendor reference.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections

1. Certification by the Quality Control Manager: The Quality Control Manager is to certify each action submittal verifying that the submittal complies with the contract requirements.
2. Number of Copies: Submit using the Program Management software, unless otherwise directed by the COTR.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's written recommendations.
   b. Manufacturer's product specifications.
   c. Manufacturer's installation instructions.
   d. Standard color charts.
   e. Manufacturer's catalog cuts.
   f. Wiring diagrams showing factory-installed wiring.
   g. Printed performance curves.
   h. Operational range diagrams.
   i. Mill reports.
   j. Standard product operating and maintenance manuals.
   k. Compliance with recognized trade association standards.
   l. Compliance with recognized testing agency standards.
   m. Application of testing agency labels and seals.
   n. Notation of coordination requirements.
4. Submit Product Data before or concurrent with Samples.
5. Number of Copies: Submit all Product Data submittals electronically using the Oracle Primavera Unifier system. In addition, provide three hard copies to the COTR for submittals related to fire-detection systems and fire-protection systems.

6. Do not submit Product Data until compliance with requirements of the Contract requirements has been confirmed.

C. Shop Drawings: Prepare contract-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract requirements or standard printed data.

1. Preparation: Include the following information, as applicable:
   a. Dimensions.
   b. Identification of products.
   c. Fabrication and installation drawings.
   d. Roughing-in and setting diagrams.
   e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
   f. Shop-work manufacturing instructions.
   g. Templates and patterns.
   h. Schedules.
   i. Design calculations.
   j. Compliance with specified standards.
   k. Notation of coordination requirements.
   l. Notation of dimensions established by field measurement.
   m. Relationship to adjoining construction clearly indicated.
   n. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.

3. Number of Copies: Submit all Shop Drawing submittals electronically using the Program Management Software system. The Shop Drawing submittal shall bear the Contractor's approval stamp on each sheet.

D. Samples: Submit samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed. All sample submittals must be electronically documented with a photograph accompanying the electronic submittal.

1. Deliver all Samples to the COTR. Samples that contain multiple, related components such as accessories are to be submitted in one package.

2. Identification: Attach a label on the unexposed side of Samples that includes the following:
   a. Contract Name and Number
   b. Sample Submittal Unique Identifier
   c. Generic description of Sample / Product name and name of manufacturer.
   d. Date and Transmittal Number
e. Name and Address of the Contractor
f. Name and Address of Subcontractor or Supplier, as applicable
g. Drawing number and detail references, as applicable
h. Location(s) where product is to be installed, as applicable

3. Disposition: Maintain sets of approved samples at the project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the work are indicated in individual Specification Sections. Such samples must be in an undamaged condition at time of use.

b. Samples not incorporated into the work, or otherwise designated as the Airports Authority’s property, are the property of the Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

Number of Samples: Submit three full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. The COTR will return submittal with options selected.

5. Samples for Verification: Submit full-size units or samples of size indicated, prepared from same material to be used for the work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

Number of Samples: Submit two sets of samples. The COTR will retain one sample set; and the remainder will be returned to the Contractor.

a. Submit a single sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

b. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a sample, submit at least three sets of paired units that show approximate limits of variations.

E. Products Schedule: For all Products, as detailed in individual Specification Sections, prepare a written summary identifying the specified products required for the work, their intended location, and the estimated quantity required. Submit the product schedule via the Oracle Primavera Unifier system. Include the following information in tabular form:

1. Contract Name and Number
2. Contractor Name
3. Specification Section Reference and cross-reference to the submittal log
4. Specified Product
5. Location(s) for installation or use
6. Estimated Quantity Required

F. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation."

G. Application for Payment: Comply with requirements in Division 01 Section "Application for Payment."

H. Schedule of Values: Comply with requirements in Division 01 Section "Application for Payment."

I. Contractor Warranty Letter: Comply with requirements in Contract Provision "Warranty of Construction." Provide the dates of warranty coverage and provide point of contact information for warranty service.

J. Special Warranty Letters: Provide dates of warranty coverage and provide point of contact information for warranty service for special warranties required in Division 02 through 33 Sections.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Certification by the Quality Control Manager: The Quality Control Manager is to certify each informational submittal verifying that the submittal complies with the contract requirements.
2. Number of Copies: Submit using the Oracle Primavera Unifier software, unless otherwise indicated.
3. Test and Inspection Reports: Comply with requirements in Division 01 Section "Quality Requirements."

B. Contractor's Construction Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation."

C. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
E. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

F. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

G. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific project.

H. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

K. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.

L. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

M. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

N. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

O. Research/Evaluation Reports: Prepare written evidence from a model code organization acceptable to the Airports Authority that product complies with USBC. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

P. Operations and Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 01 Section "Operation and Maintenance Data." Additional copies submitted for Operations and Maintenance manuals will be marked with action taken and will be returned.

Q. Design Data: Prepare written and graphic information, including, but are not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
   1. Preparation of substrates.
   2. Required substrate tolerances.
   3. Sequence of installation or erection.
   4. Required installation tolerances.
   5. Required adjustments.
   6. Recommendations for cleaning and protection.

S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
   1. Name, address, and telephone number of factory-authorized service representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at the project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement on whether conditions, products, and installation will affect warranty.
   7. Other required items indicated in individual Specification Sections.

T. Bonds: Prepare written information indicating current status of bonding coverage. Include name of entity covered by insurance or bond, limits of the coverage, amounts of deductibles, if any and term of coverage.

U. Manufacturers' warranties.

V. Construction Photographs and Video-recordings: Comply with requirements in Division 01 Section "Photographic Documentation."

W. Safety Data Sheets: Submit information directly to COTR.
PART 3 - EXECUTION

3.1 CONTRACTOR’S REVIEW

A. Review each submittal and check for compliance with the Contract requirements. Note corrections and field dimensions. The Contractor is to mark each submittal with an approval stamp before submitting to the COTR.

B. In checking Shop Drawings and Product Data, verify all dimensions and field conditions and check and coordinate Shop Drawings and Product Data of any Section or trade with the requirements of other sections or trades as related thereto, as required for proper and complete installation of the work.

C. Approval: Stamp each submittal with a uniform, approval stamp. Include contract name and number, location, submittal number, section title and number, name of reviewer, date of the Contractor's approval, and a statement certifying that the submittal has been reviewed, checked, and approved for compliance with the Contract requirements, which shall include dimensions, clearances, compatibility, and coordination with Shop Drawings and Product Data submitted for other work. The Quality Control Manager is to verify that each submittal complies with the contract requirements.

D. If the Contractor has not checked the submittals carefully, even though stamped as checked and approved, submittals shall be returned to the Contractor for proper checking before further processing or review by the COTR regardless of any urgency claimed by the Contractor. In such a situation, the Contractor will be responsible for any resulting delays. Furthermore, the Contracting Officer may hold the Contractor responsible for increased Airports Authority costs resulting from the Contractor's failure to comply with the requirements set forth herein.

3.2 COTR’S ACTION

A. General: The COTR will not review submittals that do not bear the Contractor's approval stamp and will return them without action.

B. COTR Responsibilities: The review of Shop Drawings and other submittals by the COTR will be for general conformance with the Contract only, and the review shall not be interpreted as a checking of detailed dimensions, quantities, or approval of deviations from the Contract requirements. The COTR review shall not relieve the Contractor of its responsibility for accuracy of Shop Drawings nor for the furnishing and installation of materials or equipment according to the Contract requirements.

C. Approval of Shop Drawings or other submittals is not to be interpreted as approval of a substitute material. Approval of substitutions will be accomplished according to requirements set forth in Division 01 Section "Product Requirements."

D. Action Submittals: The COTR will review each submittal, make marks to indicate corrections or modifications required, and return the submittal to the Contractor. The COTR will annotate each submittal with the action taken, as listed below. Do not permit submittals marked "Revise and Resubmit" or "Rejected" to be used at the Jobsite, or elsewhere where work is in progress.
1. “Reviewed – No Exceptions Taken”: Means no corrections or resubmissions are required and fabrication/installation may be undertaken. This action does not authorize changes to the Contract time or price or relieve the contractor from complying with Contract Requirements.

2. “Reviewed – Make Corrections Noted”: Same as "Reviewed – No Exceptions Taken," providing Contractor complies with corrections noted on submittal. If for any reason the Contractor cannot comply with the noted corrections, fabrication shall not be undertaken and Contractor shall resubmit, following procedures outlined hereinbefore.

3. “Revise and Resubmit”: Fabrication and/or installation shall not be undertaken. Make appropriate revisions and resubmit, limiting corrections to items marked.

4. “Rejected”: Submittal does not comply with requirements. Fabrication and/or installation shall not be undertaken. Prepare a new submittal according to requirements and submit without delay.

5. “For Record Only”: Submittal has been received and will be retained for record keeping purposes.

E. Informational Submittals: The COTR will annotate informational submittals with “No Action Taken”, or “Rejected” if deviations from contract requirements are noted.

F. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

G. Submittals not required by the Contract Documents will not be reviewed.

PART 4 - MEASUREMENT (Not Used)

PART 5 - PAYMENT (Not Used)

END OF SECTION 013300
SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

B. Related Sections:
   1. Division 00 Section “Supplementary Conditions”.
   2. Division 01 Section “Project Management and Coordination”.
   3. Division 01 Section “Construction Progress Documentation” for developing a schedule of required tests and inspections.
   4. Division 01 Section “Submittals” for process required to submit the Contractor’s Quality Control Plan.
   5. Division 01 Section “Execution”.
   6. Division 01 Section “Cutting and Patching” for repair and restoration of construction disturbed by testing and inspecting activities.
   7. Division 01 Section “Project Closeout”.
   8. Division 01 Section “Operation and Maintenance Data”.
   9. Division 01 Section “Project Record Documentation”.
   10. Division 01 Section “Demonstration and Training”.
   11. Divisions 02 through 34 Technical Specification Sections

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality control.

B. Quality control shall be the sole responsibility of the Contractor, unless specifically noted otherwise. The Contractor shall be responsible for all testing, coordination, start-up, operational checkout and commissioning of all items of work included in the project. All costs for these services shall be included in the Contractor’s cost of work and general conditions.

C. The Contractor is responsible for controlling the quality of all the Work of the Project, including subcontractors, as set forth in the Construction Documents. The Contractor shall provide qualified personnel to perform daily supervision, reviews and inspections of all work to insure quality, accuracy, completeness and compliance.

D. When requested by the Airports Authority or COTR, the Contractor will demonstrate a material’s compliance with the specifications in one of the following ways:
   1. Manufacturer’s Certificate of Compliance
   2. Mill Certificate
   3. Testing Laboratory Certifications
4. Report of actual test results from an ASTM E329 and ASTM C1077 compliant laboratory. Materials so tested shall be provided by the Contractor and the method of testing shall comply with the professional societies’ standard specifications.

E. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality control services required by the Airports Authority or authorities having jurisdiction are not limited by provisions of this Section.
4. Contractor is not responsible for Special Inspections according to requirements of the current Virginia Uniform Statewide Building Code (VUSBC). The Airports Authority’s agent shall provide these Special Inspection services. However, the Contractor is responsible for establishing a Special Inspection schedule. This schedule shall be discussed at COTR’s weekly Progress Meetings. The Contractor shall be responsible for all coordination and notification of requests for Code and Special Inspections with the Airports Authority. Special Inspections are required as identified by the Engineer of Record.
5. Contractor shall include all test and inspection activities in its CPM Schedule on a Section-by-Section basis.
6. The provisions of this Section shall not limit requirements for Contractor to provide quality control services required by the Airports Authority or other agencies having jurisdiction.

1.3 REFERENCES

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

1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)


1.4 DEFINITIONS

A. Quality: Conformance to the requirements established by the contract specifications and drawings.

B. Quality Assurance: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

C. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Airports Authority’s agent(s) providing Special Inspection services.

D. Control: To guide and have influence over.

E. Contractor Quality Control (CQC): The construction contractor’s system to establish, manage, control, and document their own, their supplier’s, and their subcontractor’s activities to ensure Quality compliance with the contract requirements.

F. Contracting Officers Technical Representative (COTR). Primary on-site representative of the Contracting Officer for technical matters. Duties and responsibilities of the COTR will be transmitted to the contractor via letter from the Contracting Officer.

G. Definable Feature of Work or Element of Work: A definable feature of work (DFOW) or Element of Work is a task that is separate and distinct from other tasks and has control requirements and work crews unique to that task.

H. QC Management System: The management and implementation of processes, procedures, and requirements that establish quality as mandated in the contract specifications.

I. Experienced: When used with an entity, “experienced” means having successfully completed a minimum of five (5) projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction. Specific experience requirements enumerated in these specifications supersede this requirement.

1.5 CONFLICTING REQUIREMENTS

A. Reference Standards: If compliance with two (2) or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the COTR for a decision before proceeding. This paragraph refers to industry and government standards. In cases of a difference between drawings and the specifications, the specifications shall govern.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the
minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to COTR for a decision before proceeding.

1.6 SUBMITTALS

A. Informational Submittals:

1. Contractor's Quality Control Plan: For quality control activities and responsibilities.
2. Qualification Data: For Contractor's quality control personnel.
3. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
4. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   a. Specification Section number and title.
   b. Entity responsible for performing tests and inspections.
   c. Description of test and inspection.
   d. Identification of applicable standards.
   e. Identification of test and inspection methods.
   f. Number of tests and inspections required.
   g. Time schedule or time span for tests and inspections.
   h. Requirements for obtaining samples.
   i. Unique characteristics of each quality control service.

B. Coordinate the submittal requirement dates with the submittal dates in Division 01 Section “Construction Progress Documentation”.

1.7 CONTRACTOR’S QUALITY CONTROL PLAN

A. Submit quality control plan within 15 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to the COTR. Identify personnel, procedures, controls, instructions, tests, records to be used to carry out Contractor's quality control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality control procedures similar in nature and extent to those required for Project. Project Quality Control Manager (QCM) may also serve as Project superintendent.

C. Testing and Inspection: In the quality control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by the Airports Authority or other authorities having jurisdiction and indicated on the "Statement of Special Inspections."

3. Airports Authority performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.

D. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

E. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Airports Authority has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 PERMITS, LICENSES, AND CERTIFICATES

A. The Contractor shall obtain, maintain and pay for all applications, permits, filings, and licenses necessary for the execution of the Work and for the use of such Work when completed as required by any and all authorities having jurisdiction.

B. For Airports Authority's records, submit via the Authority’s web-based Program Management Software, copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work, or as requested by the COTR.

C. The Contractor shall promptly assist the Airports Authority in securing all approvals from authorities having jurisdiction. Without limitation, the Contractor shall assist the Airports Authority in making application for Project approval, variances or other approvals, Letters of Completion, Temporary Certificates of Occupancy, and Certificates of Occupancy, including completion of all necessary applications and supporting documentation.

D. The Contractor shall comply with all regulations governing conduct, access to the premises, operation of equipment and systems and conduct while in or near the premises and shall perform the Work in such a manner as not to unreasonably interrupt or interfere with the conduct of business of the Airport.

1.9 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory- Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.10 TESTING

A. Comply with all testing and inspection requirements as outlined in the technical specification sections of this contract, to include compliance with all applicable provisions and requirements of Division 1.

B. Independent Testing and Inspection Laboratory: When codes or requirements of the contract require tests or inspections by civil, mechanical, electrical, VUSBC, or other entities, a corporately and financially independent testing or inspection organization shall be contracted by the Contractor to perform these contractually required tests and inspections. These testing and inspection agencies shall function as an unbiased testing and inspection authority;
professionally independent of the contractor, subcontractors, manufacturers, suppliers, and installers of equipment; or systems evaluated by the testing and inspection organizations for this contract. The various types of independent accrediting agencies and requirements are listed below:

C. Accreditation Requirements: Construction materials testing and inspection laboratories performing work on Authority construction contracts shall be accredited by one of the laboratory accreditation authorities and meet all ASTM E329 and ASTM C1077 requirements. The laboratory's scope of accreditation shall include the ASTM standards listed in the paragraph titled "Construction Materials Testing Laboratory Requirements" as appropriate to the testing field. The policy applies to the specific laboratory performing the actual testing or inspection and the testing technicians performing the tests and inspections, not just the "Corporate Office".

D. Electrical testing of components, equipment, and systems: The testing firm shall be regularly engaged in the testing of electrical equipment, devices, installations, and systems. The testing firm shall have at least five (5) years’ experience in the testing of electrical equipment of the type, rating, and voltage used on this Project. The testing laboratories shall be a current full-member company of the International Electrical Testing Association (http://www.netaworld.org/). This independent testing firm shall perform testing and inspections as required under the terms of this Contract.

E. Construction Materials Testing Laboratory Requirements: Provide an independent construction material testing laboratory accredited by an acceptable laboratory accreditation authority to perform sampling, inspections, and tests required by this Contract. Testing laboratories that have obtained accreditation by an acceptable laboratory accreditation authority listed in the paragraph entitled "Laboratory Accreditation Authorities" shall submit with the Quality Control Plan, a copy of the Certificate of Accreditation and Scope of Accreditation. The scope of the laboratory's accreditation shall include the test or inspection methods and certifications required by the Contract. On and Off-site testing and inspection facilities shall submit a certified statement by the Supervising Professional Engineer, licensed in the Commonwealth of Virginia, as meeting the specification requirements and the following minimum ASTM standards listed below as appropriate to field and laboratory testing and inspection. Include all Testing Technician qualifications per accredited Laboratory and specification requirements.

1. Laboratories engaged in testing of construction materials shall meet the requirements of ASTM E 329.
2. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C 1077.
3. Laboratories engaged in testing of bituminous paving materials shall meet the requirements of ASTM D 3666.
4. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D 3740.
5. Laboratories engaged in nondestructive testing (NDT) shall meet the requirements of ASTM E 543.
6. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA.
F. Laboratory Accreditation Authorities: Laboratory Accreditation Authorities are the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology, the American Association of State Highway and Transportation Officials (AASHTO) program, ICBO Evaluation Service, Inc. (ICBO ES), and the American Association for Laboratory Accreditation (A2LA) program and the Washington Area Council of Engineering Laboratories (WACEL). Furnish to the COTR, a copy of the current Certificate of Accreditation and Scope of Accreditation. The scope of the laboratory's accreditation shall include the test and inspection methods required by the Contract.

G. Capability Check: The COTR retains the right to examine the laboratory equipment in the proposed laboratory, the laboratory’s managers and testing technicians’ qualifications, procedures, techniques, and other items for compliance with the standards set forth in this Contract.

H. Capability Recheck: If non-conformities are discovered during the capability check or any succeeding recheck, Contractor shall be assessed a charge of $750.00 to reimburse the Airports Authority for each recheck of the laboratory or the checking of a subsequently selected laboratory. These charges shall be deducted from the total amount due Contractor.

I. Test and Inspection Report Results: Cite applicable Contract requirements, tests, inspections, or analytical procedures used. Provide actual results and include a statement that the item tested, inspected, or analyzed conforms or fails to conform to specified requirements. IF THE ITEM FAILS TO CONFORM, NOTIFY COTR IMMEDIATELY. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. A certified testing laboratory manager performing all laboratory tests shall sign all test results. A certified technician performing all field tests and inspections shall sign all inspection reports. Submit within two (2) workdays after the tests or inspections are performed.

J. Control Tests: Outlines those tests and inspections conducted by the Contractor that assist in maintaining the standard of quality for all operations and procedures, for each Definable Feature or Element of Work, as identified in the Quality Control Plan and the Specifications. As described above, the Contractor shall procure the services of an independent commercial laboratory to perform the required control tests and inspections. The contractor shall identify these minimum Control Test and Inspection requirements:

1. Procedures, requirements, analytical procedures used, and criteria for all Testing and Inspections.
3. Number of control tests, inspections, and frequency of tests and inspections to be made for each Definable Feature or Element of Work.
4. Provide actual results and include a statement that the item tested, inspected, or analyzed conforms or fails to conform to specified requirements.
5. Identify testing or inspection agency performing testing and inspections.
6. Ensure proper certification and sign-off of all tests and inspections conducted and reviewed by Contractor Independent testing and inspecting Technicians, Managers, and Professional Engineers.
7. The QC Manager will ensure only accredited laboratories and certified technicians are performing testing and inspections as outlined in the contract specifications.
8. Notify COTR a minimum of two (2) workdays in advance of contractor performing any testing and inspections.

K. Acceptance or Validation Testing by the Airports Authority: Contractor shall furnish to COTR the quantities of materials to be used for Acceptance or Validation testing as required in the Specifications. Acceptance or Validation testing shall be performed by the Airports Authority at an independent laboratory at no cost to Contractor. No direct payment shall be made to Contractor for the furnishing of materials used for Acceptance or Validation testing. The Authorities Acceptance and Validation program does not relieve the contractor of its responsibility to fully comply with all regulations, standards, codes, and quality requirements of the contract specifications.

L. Staffing: All laboratory, inspection, and testing technician personnel shall work in an accredited laboratory under the supervision of a Professional Engineer licensed in the Commonwealth of Virginia.

1.11 COMPLETION INSPECTIONS

A. Punch-Out Inspection: Near the completion of all work or any increment thereof established by a completion time stated in the Contract Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the QCM shall conduct an inspection of the work and develop a "punch-list" of items which do not conform to the approved drawings and specifications. Include in the punch-list any remaining items on the "Deficiency Log" which were not corrected prior to the Punch-Out Inspection. The punch-list shall include the estimated date by which the deficiencies will be corrected. A copy of the punch-list shall be provided to the COTR. The QCM and staff shall make follow-on inspections to ascertain that all deficiencies have been corrected before requesting a Pre-Final Inspection. Once all deficiencies are corrected the Contractor shall notify the COTR that the facility or item is ready for the Airports Authority’s "Pre-Final Inspection."

B. Pre-Final Inspection: the Airports Authority or Authority’s Representative will perform this inspection to verify that the facility is complete and ready to be inspected. An Authority "Pre-Final Punch-List" may be developed as a result of this inspection. Any items noted on the "Pre-Final" inspection shall be corrected in timely manner and shall be accomplished before the contract completion date for the work or any particular increment thereof if the project is divided into increments by separate completion dates. The QCM shall ensure that all items on the Punch-list are corrected prior to notifying the Airports Authority of a request for a "Final" Acceptance Inspection.

C. Final Acceptance Inspection: The COTR, The Authorities Representatives, the QCM, the superintendent, and other personnel as deemed necessary by the COTR shall be in attendance for this inspection. The Contracting Officer based on corrections to the punch-lists on the "Pre-Final" inspection will formally schedule the Final Acceptance Inspection. The contractor shall give Written Notice to the COTR and CO, at least fourteen (14) calendar days prior to the Final Acceptance Inspection, stating that all contract work is completed and all items previously identified on the Punch-Out and Pre-Final Inspections have been corrected and are accepted by the Airports Authority’s Representatives and COTR. The contractor will also furnish a Certification Letter, from the QC Manager to the COTR and CO, stating and attesting “that all work required of the contract has been completed, inspected, tested and is in full compliance with the Contract Documents.” Failure of the
Contractor to give this Written Notice and Certification Letter to the COTR and CO shall be reason and grounds for the Contracting Officer to bill the Contractor for the Airports Authority's additional inspection costs in accordance with the clause in the Contract Provisions entitled "Inspection of Construction." When the Contracting Officer takes possession of partially completed work, it shall be in accordance with clause in the Contract Provisions entitled "Use and Possession Prior to Completion".

1.12 DOCUMENTATION

A. Contractor shall maintain current quality control records of all control activities, production, tests, and inspections performed. These records shall include factual evidence that required tests and/or inspections have been performed, including type and number of tests and/or inspections involved; results of tests and/or inspections; nature of defects, causes for rejection, etc.; proposed remedial action; and corrective actions taken. These records shall cover both conforming and defective or deficient features (non-conforming work) and shall include a statement that all supplies and materials incorporated into the work are in full compliance with terms of the Contract as documented in the Contractor's materials receiving inspection program. These documents shall be provided to the COTR upon request. Only Legible copies of these records shall be furnished, submitted, and delivered to COTR. The records shall cover all work placed subsequent to the previously furnished records and shall be verified by Contractor's QCM. Contractor shall document all tests and inspections as specified in the technical provisions of the Specifications. All specified records shall be readily available for review by COTR throughout the life of the Contract.

B. Maintain current and complete records of on-site and off-site QC Program operations and activities. Establish and maintain the following records to the COTR upon request:
   1. All milestone and required inspections, arranged by Activity/Event Number.
   2. Special Inspection Control Log, arranged by Definable Feature or Element of Work and Trade.
   3. A current up-to-date copy of the approved Testing and Inspection Plan, and supporting documentation that accounts for all testing and inspection requirements as listed in the specifications and the Monthly Summary Report of Tests and Inspections that documents all field tests, inspections, reports, and supporting documentation, arranged by date for each Definable Feature or Element of Work as identified in each specification section.
   4. A current up-to-date copy of the Superintendent’s inspection logs and sign-off sheets for each Definable Feature or Element of Work.
   5. A current up-to-date comprehensive copy of the Deficiency Log and Noncompliance Log.

C. Testing Log: As tests are performed, the QCM shall record, as a tracking device, all tests on the "Testing Log", the dates that tests were performed, remarks and acknowledgement that an accredited or Contracting Officer approved testing laboratory was used, the dates that all failing or nonconforming tests were corrected, accepted, or approved. Provide a copy of the updated “Test Log” upon request of the COTR. Log shall be used as a management tool by the QCM to account and track all tests requirements of the QC Plan and contract specifications.

D. Deficiency Log: The QCM shall maintain a comprehensive list of all work that does not comply with the contract, identifying what items need to be reworked, the date the item was originally discovered, the date the item shall be corrected by, and the date the item was
corrected. All failed or nonconforming work, tests, and inspections will be documented in this Log. There is no requirement to report on the Deficiency Log a rework or deficient item that is corrected the same day it was discovered. Provide a copy of the comprehensive deficiency log weekly to the COTR at the weekly progress meeting. The Contractor shall be responsible for including on this log all items needing rework including those identified by the COTR and their staff.

E. Code and Special Inspection Control Log: The Contractor will maintain a Code and Special Inspection Control Log, chronologically recording each Code and Special Inspection notification to the COTR, tests and/or inspections performed under the VUSBC, or other agencies having jurisdiction on-site, including the nature of the test or inspection, the date performed, the results, approval or causes for rejection, corrective action taken, and dates of subsequent tests, inspections, and final acceptance. Provide a copy of the comprehensive deficiency log weekly to the COTR at the weekly progress meeting.

F. Test and Inspection Reports: Contractor shall be responsible for establishing a system that shall record all tests, and inspection results. Information on test and/or inspection designation, location, date of test and/or inspection, specification requirements, results and retest results, causes for rejection and recommended remedial actions shall be documented. The COTR will be notified “IMMEDIATELY” of any failing tests and/or inspections. A certified technician performing all field tests and inspections shall sign all inspection reports. A certified testing laboratory manager performing all laboratory tests shall sign all test results. Provide a copy of the comprehensive deficiency log weekly to the COTR at the weekly progress meeting.

G. Record Drawings: The QCM is required to ensure the record drawings, required by Division 01 Section "Project Record Documents," are kept current on a daily basis and marked to show deviations which have been made from the construction drawings. Ensure each deviation has been identified with the appropriate modifying documentation (e.g. CN No., Modification No., Request for Information No., etc.). Upon completion of work, the QCM shall furnish a certificate attesting to the accuracy of the record drawings prior to submission to the COTR.

1.13 NOTIFICATION ON NON-COMPLIANCE

A. The COTR will notify the contractor of any detected non-compliance with the foregoing requirements. The Contractor shall take immediate corrective action after the receipt of such notice. Such notice, when delivered to the Contractor via the Airports Authority provided Oracle Primavera Unifier project management system shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly the Contracting Officer may:

1. Issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall make no part of the time lost, due to such stop orders, the subject of a claim for extension of time for excess costs or damages.
2. Repair, replace, or otherwise remedy the defective work at the Contractor’s expense. Cost incurred by the Airports Authority to correct defective work shall be deducted from the total amount due the Contractor.
3. Withhold an amount from the payment due the Contractor as may be deemed necessary at the discretion of the Contracting Officer.
4. Terminate the Contractor’s right to proceed for Default after providing required notice.

B. In cases where implementation of the Quality Control Program does not comply with the Contractor’s Quality Control Plan, the contract provisions, or the Contractor fails to properly operate and maintain an effective Quality Control Program, the Contracting Officer may:

1. Order the Contractor to replace ineffective or unqualified Quality Control Personnel or subcontractors.
2. Issue an order stopping all or part of the work until acceptable personnel are on site and a new Quality Control Plan is approved by the COTR. The Contractor shall make no part of the time lost due to such stop orders the subject of claim for extension of time for excess costs or damages.
3. Take a credit from the contract for Quality Control Activities not performed.
4. Terminate the Contractors right to proceed for Default after providing required notice.

C. The Authority considers all aspects of the services to be performed under this contract to be subject to the Quality Control requirements set forth above. This includes compliance with the Authority directed Safety Program and all administrative efforts related to the completion of the contract. Failure to meet contract requirements in any aspect of the work will subject the contractor to a Notification of Non-Compliance. If the Contractor fails to promptly take the necessary corrective action or repeats the non-compliant action/inaction, the Contracting Officer may by contract or otherwise, perform the services and charge to the Contractor any cost incurred by the Airports Authority that is directly related to the performance or oversight of such work.

D. The Contractor shall maintain a detailed record of every non-compliance and corrective action taken.

E. Non-Compliance Notification: The COTR will use the Airports Authority provided web-based Oracle Primavera Unifier project management system (Unifier) to notify the Contractor on Non-Compliance work or material. Acknowledgement and corrective action by the Contractor shall be transmitted to the COTR through Unifier. The Airports Authority will provide the Contractor a Unifier license(s) and training.
SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section defines many of the terms used elsewhere in the Construction Documents and lists complete names and telephone numbers for many of the associations and agencies identified elsewhere in the Construction Documents by their acronym.

B. Abbreviations, where not defined in the Contract Documents, will be interpreted by the Contracting Officer to mean the normal construction industry terminology.

C. Plural words will be interpreted as singular and singular words will be interpreted as plural where applicable for context of the Contract Documents.

1.3 DEFINITIONS

A. General: Basic Contract definitions are included in Sections I and II of the Airports Authority Solicitation Offer and Award. Certain terms used in the Contract Documents are defined generally in this Article. Definitions and explanations contained in this Section are not necessarily either complete or exclusive, but are general for the Work to the extent that they may not be stated more explicitly in another element of the Contract Documents.

B. Approve: The term "approved," where used in regard to COTR's action on Contractor's submittals, applications, and requests, is limited to COTR's duties and responsibilities as delegated by the Contracting Officer in the Contract and Special Provisions.

C. Architect/Engineer: For the purpose of this Project, the "Design Professional of Record." To distinguish from the Contracting Officer and Contracting Officer's Technical Representative (COTR).

D. Authority: Metropolitan Washington Airports Authority

E. Award: The acceptance, by the Airports Authority, of the successful offeror's proposal.

F. Award Date: The date on which the Airports Authority gives notice of acceptance to the successful offeror.

G. AOA (or A.O.A.): Air Operations Area. The area of the Airport used or intended to be used for landing, taking off, surface maneuvering, loading, unloading, or servicing aircraft. This security
area requires security badging. Workers in this area are required to obtain and display an AOA photo I.D. credential. Drivers in this area are required to obtain an Airport Vehicle Operator's Permit for the Air Operations Area.

H. Beneficial Use: Use by the Airports Authority prior to 100 percent completion and final acceptance.

I. Contract Documents: Documents containing requirements of the Work. These include all Contract provisions and attachments made thereto or referenced therein.

J. Contract Provisions: The administrative and procedural requirements starting at Award Date and ending at Final Acceptance, as provided for in Section VII, "Contract Provisions."

K. Contract Time or Duration (Time Limit): The number of calendar days established in Section III, "Schedule," indicating the time allowed for the completion of all physical and administrative work contemplated in the Contract, including any authorized extensions thereto.

L. Contracting Officer's Technical Representative (COTR): The Contracting Officer's designated representative, as defined in Section VII, "Contract Provisions."

M. Contractor: Individual, partnership, corporation or joint venture under Contract to the Airports Authority for performance of prescribed Work.

N. Drawings: Erection/installation/construction plans, or any other supplementary plans or similar graphic data, illustrating work to be performed that are provided to Contractor as part of the Contract Documents.

O. Directed: A command or instruction by the Airports Authority. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

P. Final Acceptance: Refer to Division 01 Section "Project Closeout."

Q. "Indicated": Requirements expressed by graphic representations or in written form on drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

R. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

S. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

T. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

U. "Provide": Furnish and install, complete and ready for the intended use.
V. "Installer": Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.

W. "Experienced": When used with an entity, "experienced" means having successfully completed a minimum of ten previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

X. "Project Site": Space available for performing construction activities. The extent of Project site is indicated.

Y. Punch list Work: Minor corrective actions required to achieve "Final Acceptance." Occurs after "Substantial Completion" of the Work in strict compliance with quality-control requirements.

Z. Roadway: General term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

AA. Special Provisions: For the purpose of this Contract, the directions and requirements provided for in Section VI of the Contract Documents.

BB. Shop Drawings: Refer to Division 01 Section "Submittals."

CC. Specifications: General term comprising all directions, provisions and requirements contained herein, together with any other contractual requirements such as may be added or adopted as the Contract Provisions, Special Provisions, or Supplementary Conditions, all of which are necessary for the proper performance of the Contract.

DD. Substantial Completion: Refer to Division 01 Section "Project Closeout."

EE. Factory-Authorized Service Representative: An authorized representative of a manufacturer who is trained and approved by the manufacturer to inspect and approve the installation of manufacturer’s products and that are similar in material, design, and extent to those indicated for this Project and who is authorized by the manufacturer to confirm the issuance of appropriate warranties.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
C. Conflicting Requirements: Refer to Division 01 Section "Quality Requirements" for additional information regarding conflicting requirements.

D. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to COTR for a decision before proceeding.

E. Copies of Standards: Each entity engaged in construction on Project shall be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source and make them available on request.

F. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

**ADAAG** Americans with Disabilities Act (ADA)  
Accessibility Guidelines for Buildings and Facilities  
(800) 872-2253  
Available from Access Board  
www.access-board.gov

**CFR** Code of Federal Regulations  
(888) 293-6498  
Available from Government Printing Office  
www.access.gpo.gov/nara/cfr

**CRD** Handbook for Concrete and Cement  
Available from Army Corps of Engineers Waterways Experiment Station  
(601) 634-2355  
www.wes.army.mil

**FED-STD** Federal Standard  
(See FS)

**FS** Federal Specification  
(215) 697-6257  
Available from Department of Defense Single Stock Point.  
www.dodssp.daps.mil

Available from General Services Administration  
www.fss.gsa.gov

Available from National Institute of Building Sciences  
(202) 289-7800  
www.nibs.org

**FTMS** Federal Test Method Standard
ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA Aluminum Association, Inc. (The) (202) 862-5100
www.aluminum.org

AASHTO American Association of State Highway and Transportation Officials (202) 624-5800
http://www.transportation.org

ACI ACI International (American Concrete Institute) (248) 848-3700
www.aci-int.org

ACPA American Concrete Pipe Association (972) 506-7216
http://www.concrete-pipe.org

AEIC Association of Edison Illuminating Companies, Inc. (The) (205) 257-2530
www.aeic.org

AGC Associated General Contractors of America (The) (703) 548-3118
www.agc.org

AI Asphalt Institute (859) 288-4960
http://www.asphaltinstitute.org

AISC American Institute of Steel Construction (800) 644-2400
www.aisc.org

AISI American Iron and Steel Institute (202) 452-7100
www.steel.org

REFERENCES
ANSI American National Standards Institute
www.ansi.org (202) 293-8020
AOSA Association of Official Seed Analysts
Http://www.aosaseed.com (505) 522-1437
ASCE American Society of Civil Engineers
www.asce.org (800) 548-2723 (703) 295-6300
ASME ASME International
(The American Society of Mechanical Engineers International)
www.asme.org (800) 843-2763 (212) 591-7722
ASTM ASTM International
(American Society for Testing and Materials International)
www.astm.org (610) 832-9585
AWS American Welding Society
www.aws.org (800) 443-9353 (305) 443-9353
CLFMI Chain Link Fence Manufacturers Institute
http://www.asphaltroofing.org (301) 596-2583
CPPA Corrugated Polyethylene Pipe Association
http://www.cppa-info.org (800) 510-2772 (202) 462-9607
CRSI Concrete Reinforcing Steel Institute
www.crsi.org (847) 517-1200
CSA CSA International
(Formerly: IAS - International Approval Services)
http://www.csa-international.org (800) 463-6727 (416) 747-4000
CSI Construction Specifications Institute (The)
www.csinet.org (800) 689-2900 (703) 684-0300
EIA Electronic Industries Alliance
www.eia.org (703) 907-7500
ESD ESD Association
www.esda.org (315) 339-6937
FMG FM Global
(Formerly: FM - Factory Mutual System)
www.fmglobal.com (401) 275-3000
GSI Geosynthetic Institute
www.geosynthetic-institute.org (610) 522-8440
<table>
<thead>
<tr>
<th>Organization</th>
<th>Website</th>
<th>Phone numbers</th>
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| ICEA                          | Insulated Cable Engineers Association, Inc. | (770) 830-0369  
|                               | [www.icea.net](http://www.icea.net) |               |
| IEC                           | International Electrotechnical Commission | 41 22 919 02 11  
|                               | [www.iec.ch](http://www.iec.ch) |               |
| IEEE                          | Institute of Electrical and Electronics Engineers, Inc. (The) | (212) 419-7900  
|                               | [www.ieee.org](http://www.ieee.org) |               |
| IESNA                         | Illuminating Engineering Society of North America | (212) 248-5000  
|                               | [www.iesna.org](http://www.iesna.org) |               |
| ISO                           | International Organization for Standardization | 41 22 749 01 11  
|                               | [www.iso.ch](http://www.iso.ch) |               |
| ITS                           | Intertek                         | (800) 345-3851  
|                               | [www.intertek.com](http://www.intertek.com) | (607) 753-6711  |
| LPI                           | Lightning Protection Institute   | (800) 488-6864  
|                               | [www.lightning.org](http://www.lightning.org) | (847) 577-7200  |
| NECA                          | National Electrical Contractors Association | (301) 657-3110  
|                               | [http://www.necanet.org/](http://www.necanet.org/) |               |
| NEMA                          | National Electrical Manufacturers Association | (703) 841-3200  
|                               | [www.nema.org](http://www.nema.org) |               |
| NETA                          | InterNational Electrical Testing Association | (303) 697-8441  
|                               | [www.netaworld.org](http://www.netaworld.org) |               |
| NFPA                          | NFPA                            | (800) 344-3555  
|                               | [www.nfpa.org](http://www.nfpa.org) | (617) 770-3000  |
| NRMCA                         | National Ready Mixed Concrete Association | (888) 846-7622  
|                               | [www.nrmca.org](http://www.nrmca.org) | (301) 587-1400  |
| NSF                           | NSF International               | (800) 673-6275  
|                               | (National Sanitation Foundation International) | (734) 769-8010  
|                               | [www.nsf.org](http://www.nsf.org) |               |
| NSSGA                         | National Stone, Sand & Gravel Association | (800) 342-1415  
|                               | [www.nssga.org](http://www.nssga.org) | (703) 525-8788  |
| SAE                           | SAE International               | (724) 776-4841  
|                               | [www.sae.org](http://www.sae.org) |               |
| TIA/EIA                       | Telecommunications Industry Association/Electronic Industries Alliance | (703) 907-7700  
|                               |                                |               |

REFERENCES
B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ICBO International Conference of Building Officials
(See ICC)

ICBO ES ICBO Evaluation Service, Inc.
(See ICC-ES)

ICC International Code Council
(Formerly: CABO - Council of American Building Officials)
www.iccsafe.org

ICC-ES ICC Evaluation Service, Inc.
www.icc-es.org

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE Army Corps of Engineers
www.usace.army.mil

CPSC Consumer Product Safety Commission
www.cpsc.gov

EPA Environmental Protection Agency
www.epa.gov

FAA Federal Aviation Administration
www.faa.gov

FCC Federal Communications Commission
www.fcc.gov

www.tiaonline.org
TPI Turfgrass Producers International
www.turfgrasssod.org

UL Underwriters Laboratories Inc.
www.ul.com

UNI Uni-Bell PVC Pipe Association
www.uni-bell.org

(800) 405-8873
(847) 705-9898
(800) 285-4476
(847) 272-8800
(972) 243-3902
(703) 931-4533
(800) 423-6587
(562) 699-0543
(800) 638-2772
(301) 504-0990
(202) 260-2090
(202) 366-4000
(202) 225-5322
D. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

1.6 GOVERNING REGULATIONS/AUTHORITIES

A. Contact authorities having jurisdiction directly for information and decisions having a bearing on the work. Names and addresses are subject to change; they are believed to be but are not assured to be accurate and up to date as of the date of the Contract Documents.

B. Codes: The contractor shall adhere to all applicable portions of code standards and specifications in the construction of the work. Unless otherwise noted (reference Division 01 Section “Quality Requirements”), the Airports Authority will review the Contractor’s submittals.
and construction of the work for code compliance. The Airports Authority’s acceptance of completed construction does not relieve the Contractor from strict compliance with all applicable regulations and codes.

1. Definition: The Metropolitan Washington Airports Authority has a “building department” recognized by the Commonwealth of Virginia. This department is charged with enforcing the Virginia Uniform Statewide Building Code (VUSBC). Where the words “code official”, “department having jurisdiction” or “agency having jurisdiction” is referenced in any code, including the VUSBC or its adopted model codes (ICC), those terms shall mean the Airports Authority Building Official and/or his designated representative.

2. Standards that influence the construction of the project include, but are not limited to, all applicable federal and Commonwealth laws, all applicable codes, rules, regulations and standards applicable to this project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - MEASUREMENT (Not Used)

PART 5 - PAYMENT (Not Used)

END OF SECTION 014200
SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, security, and protection facilities for Contractor staging area, if required.

B. Temporary utilities include, but are not limited to, the following:
   1. Water service and distribution.
   2. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
   3. Heating and cooling facilities.
   4. Ventilation.
   5. Electric power service.
   6. Telephone and other communication services.

C. Support facilities include, but are not limited to, the following:
   1. Dewatering facilities and drains.
   2. Project identification and temporary signs.
   3. Waste disposal facilities.
   4. Field offices.
   5. Storage and fabrication sheds.
   6. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:
   1. Environmental protection.
   2. Storm water control.
   3. Site enclosure fence.
   5. Barricades, warning signs, and lights.
   6. Fire protection.

E. Related Sections include the following:
   1. Division 01 Section "Submittals" for procedures for submitting copies of implementation and termination schedule and utility reports.
1.3 USE CHARGES

A. General: Temporary utilities are available from the Airports Authority at no charge unless otherwise noted. If permanent enclosures are being utilized by Contractor, provide necessary labor and materials to connect to the Airports Authority's utilities at points designated by COTR and extend utilities to trailers, offices, sheds, etc.

1. Provide COTR approved meters for water, natural gas, electricity, and each other utility used for Project. Supply utilities to Subcontractors' temporary facilities, if utilized, through Contractor's meters. The requirement to provide meters for utilities does not imply that the Contractor will be charged for these utilities, except under provisions outlined in this and other Sections.

2. Report consumption of each utility to COTR each month. Contractor is expected to consume reasonable amounts of each utility. Should Contractor, in COTR's opinion, use excessive amounts of any utility or waste a utility, Contractor may be required to pay for temporary utilities.

B. Allow other entities to use temporary services and facilities without cost, including, but are not limited to, the following:

1. The Airports Authority's construction forces.
2. Occupants of Project.
3. COTR.
5. Testing agencies.

1.4 SUBMITTALS

A. Shop Drawings: Submit drawing, compliant with all applicable codes, to COTR, for the Airports Authority's review and approval, site plans indicating all temporary facilities, support and security; utility connections and traffic flows. Provide detailed drawings of utility connections and special facilities.

B. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities at both staging area and the Project site. Make all structures weather proof when heated and air-conditioned. Should Contractor, in COTR's opinion fail to keep the heated and cooled structures sealed and weather proof, Contractor may be required to pay for temporary utilities.

1.5 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, that include but are not limited to, the following:

1. Building Code requirements.
2. Health and safety regulations.
3. Police and Fire Department regulations.
4. Environmental protection regulations.
5. ADA Compliance: All temporary facilities shall be ADA compliant.

   1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
   2. Electrical Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electrical service. Install service to comply with NFPA 70.

C. Tests and Inspections: Arrange for the Airports Authority's Building Codes/Environmental Department to test and inspect each temporary utility before use. Coordinate with the Airports Authority's Building Codes/Environmental Department for requirements for certifications, permits, and inspections. Obtain permits from the Airports Authority's Building Codes/Environmental Department for temporary construction and temporary utilities.

D. Fire-retardant and Flame Spread Requirements: Unless otherwise noted, fire – retardant treat all wood and wood composition products utilized in the Project and preservative treat all wood utilized on the exterior of any building. Preservative treat all wood utilized on other items indicated or specified with preservative treatment. Provide lumber and plywood with an Underwriters' Laboratory (UL) stamp certifying a value of 25 or less flame spread and a value of 200 or less smoke development. Fire retardant lumber shall not be ripped or milled.

1.6 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to COTR, change over from use of temporary service to use of permanent service.

B. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before the Airports Authority's acceptance, regardless of previously assigned responsibilities.

C. Conditions of Use: The following conditions apply to use of temporary services, permanent services, and facilities by all parties engaged in the Work:
   1. Keep temporary services and facilities clean and neat.
   2. Relocate temporary services and facilities as required by progress of the Work.
   3. Take necessary fire-prevention measures.
   4. Do not overload facilities.
   5. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

1.7 CONTRACTOR PERSONNEL PARKING

A. The Contractor's personnel will be allowed to park their personal vehicles in staging areas or in areas designated by COTR. Such designated parking areas are not necessarily fenced or otherwise protected and temporary fencing for such parking areas is a requirement of this Contract.
B. Display a Vehicle special, non-transferable parking permit available from the Airports Authority on all vehicles parked in such area. Each employee will be required to obtain and pay for their own parking permit and shall be responsible for fines for not displaying permit or for parking in other than designated contractor parking areas. The COTR will provide application forms and explain method of obtaining parking permits at the Pre-Construction Conference.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by COTR. Provide materials suitable for use intended.

B. Pavement: Comply with Division 32 Section “Asphalt Paving.”

C. Tarpaulins: Fire-resistive labeled with flame-spread index of 15 or less.

D. Water: Potable.

E. Temporary Fuel Tanks: For requirements for temporary fuel tanks see Division 31 Section “Storm Water Pollution Protection Plan.” Comply with applicable safety and environmental regulations for temporary surface fuel tanks. Location and installation of tanks will be subject to review and approval of COTR and the Airports Authority’s Fire Marshal.

2.2 EQUIPMENT

A. General: Provide new equipment suitable for use intended. If acceptable to COTR, undamaged, previously used equipment in serviceable condition may be used.

B. Field Offices: Mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading, and provided with proper tie-downs.

C. Self-Contained Toilet Units: Single-occupant units of chemical, aerated re-circulation or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

D. Drinking-Water Fixtures: [Drinking-water fountains] [Containerized, tap-dispenser, bottled-water drinking-water units], including paper cup supply. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F.

E. Heating Equipment: Unless COTR authorizes use of permanent heating system, provide temporary heating units with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.
F. Electrical Outlets: Properly configured, NEMA-polarized outlets that will prevent insertion of 110v or 120v plugs into higher-voltage outlets, and equipped with ground-fault circuit interrupters with reset button.

G. Power Distribution System Circuits: Where permitted, overhead, and visible wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic-sheathed cable.

H. Electrical Power Cords: Provide grounded extension cords; use hard-service as defined by NFPA 70, Article 400, where exposed to abrasion and traffic. If single lengths of extension cords will not reach areas where construction activities are in progress provide waterproof connectors to connect separate lengths of electrical extension cords.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. If temporary facilities and utilities are being utilized by the Contractor, prior to installation, submit to the COTR a site layout providing locations and details of the facilities and utilities.

B. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

C. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 CONTRACTOR STAGING AREA - GENERAL

A. Contractor will be allowed to store and stage his materials in a staging area located on Airport property as indicated or as designated by the COTR for such purposes. Space is limited to area indicated. COTR and Contractor will make a joint site visit to document condition of staging area prior to occupancy. Take photos for the record.

B. Erect and maintain an 8-foot high chain link fence topped with 3-strands of barbed wire around perimeter of staging area when the fence serves as an AOA barrier as required by the FAA/TSA. A 6-foot high fence as described above, including barbed wire will be acceptable for all other applications. Protect all stored equipment from the weather. The Airports Authority accepts no responsibility for items stored in this area.

C. Upon completion of Construction, remove all temporary staging area facilities and return the areas to their original condition.

D. Park construction equipment in the storage site or storage area identified by the COTR when equipment is not engaged in construction activity. Equipment must be stored a minimum 20 feet off AOA fence and in a manner that does not interfere with Airport security systems or airfield operations.
E. Do not stockpile construction materials, spoils, debris or refuse in any area other than that specifically approved for such purpose by the COTR and as shown on plans.

F. Constrain stockpiled material in a manner to prevent its movement by wind, jet blast or propeller wash.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Provide temporary service for each utility required. Comply with requirements of the Airports Authority's Building Codes Manual, the Airports Authority's Construction Safety Manual, and the requirements of all Sections of these specifications.

1. Arrange with COTR for time when service can be interrupted, if necessary, to make connections for temporary services. For additional information on utility outages see Division 01 Section, "Summary."

2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.

3. Perform work associated with utilities owned by the Airports Authority as approved by the Airports Authority.


B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

C. When using Authority sewers:

1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.

2. Connect temporary sewers to the Airports Authority's system as directed by COTR.

3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.

4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.

D. Water Service: Provide temporary water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping and provide results of bacteria and other Code required tests prior to use. Provide Badger Recordall, Turbo II Utility type water meter to meter all water usage for 2-inch water feed lines and above. Provide Badger Recordall bronze disc water meter for to meter all water usage for water feed lines under 2-inches. COTR will approve water meters, in writing prior to installation of water meters. Do not install water meters until written approval has been received from COTR. Provide Watts Model 909, Type RPZ backflow preventers. Do not install backflow preventers until written approval of backflow preventers has been received from the COTR. Comply with all Code required inspections.
E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.

2. Toilets: Install self-contained toilet units, located as approved by COTR. Shield toilets to ensure privacy. Provide separate facilities for male and female personnel. Use of the Airports Authority's existing toilet facilities will not be permitted.

3. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.

4. Drinking-Water Facilities: Provide bottled-water, drinking-water units.
   a. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F.

5. Locate toilets and drinking-water fixtures so personnel need not walk more than or 200 feet horizontally to facilities.

F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that would not have a harmful effect on completed installations or elements being installed.

G. Ventilation and Humidity Control: Provide temporary ventilation and humidity control required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption. Provide and operate either exhaust or supply fans/blowers, or both, sufficient to ventilate work areas adequately.

H. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear. Provide kilowatt-hour meters with demand capability.

1. Install electric power service underground, unless overhead service is authorized by COTR.

2. Connect temporary service to the Airports Authority's existing power source, as directed by COTR.

3. Install power distribution wiring overhead and rise vertically where least exposed to damage.
I. Electrical Distribution: Provide GFCI receptacle outlets adequate for connection of power tools and equipment, compliant with the current Authority Construction Safety Manual.

1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
2. Provide warning signs at power outlets other than 110 to 120 V.
3. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.
4. Provide metal conduit enclosures or boxes for wiring devices.
5. Provide 4-gang outlets, spaced so 100-foot extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet. Provide GFCI protection.

J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.

1. Provide and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Provide exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed. Provide exterior yard and site lighting aligned as directed by the COTR. Provide lighting so as not to interfere with ground, air traffic and air traffic control.

K. Telephone Service: Provide temporary telephone service for key personnel engaged in construction activities, throughout the construction period. Install telephones on separate lines for each temporary office and first aid station. Where an office has more than two occupants, install a telephone for each additional occupant or pair of occupants. Provide telephones with exchanges within the Metropolitan Washington service area. The Airports Authority owns and operates an airport-wide Airport Communication System (ACS). This system accommodates all normal telecommunications service requirements, i.e., local, long distance, fax, data, etc. The Contractor may obtain information about and choose to utilize this service by contacting the ACS Help Desk at (703) 417-8300.

1. At each telephone, post a list of emergency telephone numbers approved by COTR.
2. Provide a portable cellular telephone for superintendent's use in making and receiving telephone calls when away from field office.

3.4 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. If required by the Contract/Contractor, locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241 and USBC.
B. Dewatering Facilities and Drains: Comply with requirements in applicable Division 31 and Division 32 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

C. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated or where directed by COTR to inform public and persons seeking entrance to Project. Provide two Project signs.

1. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with details indicated.
2. Prepare temporary signs to provide directional information to construction personnel and visitors.
3. Construct signs of exterior-type, Grade B-B, high-density concrete form overlay plywood in sizes and thickness indicated. Support on nominal 4-inch-by-4-inch-by-10-foot-long posts or framing of preservative-treated wood or steel.
4. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.
5. The following signs will be allowed on the Project:
   a. Identifying captions over offices.
   b. Other signs as required by the Contract Documents.
6. Take necessary steps to prevent installation of unauthorized signs and, should any appear, remove them immediately. Repair and repaint damage caused thereby at no additional cost to the Airports Authority.
7. No more that two Project Identification Signs will be permitted. Project identification signs are the only signs on which the Contractors name and logo will be permitted.

D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 01 Section "Execution" for progress cleaning requirements.

1. If required by COTR, provide separate containers, clearly labeled, for each type of waste material to be deposited.
2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

E. Janitorial Services: Provide janitorial services on a daily basis for temporary offices, first-aid stations, toilets, wash facilities, lunchrooms, and similar areas.
3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours of 11:00 p.m. to 5:00 a.m., unless directed otherwise by the COTR, which will minimize complaints from persons or firms near Project site.

B. Storm water Control: Provide earthen embankments and similar barriers in and around excavations and sub grade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

C. Site Enclosure Fence: Before construction operations begin, provide portable chain-link site enclosure fence. Minimum 2-inch, 9-gage, galvanized steel, chain-link fabric fencing; minimum 8 feet high with galvanized steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete bases for supporting posts. Contractor is responsible for providing support to protect against wind damage and meeting safety requirements.

1. Entrance into the site: Only through the lockable entrance gates.
2. Set fence posts in compacted mixture of gravel and earth.
3. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
4. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide COTR with three set of keys.
5. Ensure gate installation/operation does not conflict with area grade.

D. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

E. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights. See the Airports Authority's Construction Safety Manual for additional requirements.

F. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241 and VUSBC.

1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
   a. Field Offices: Class A, stored-pressure, water-type extinguishers.
   b. Other Locations: Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
c. Locate fire extinguishers per NFPA 10 and where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.

2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
7. Provide temporary standpipes with fire hose valve connections for fire protection.

G. Storage: Where materials and equipment are stored, and are of value or attractive for theft, provide secure lockup. Enforce discipline in connection with installation and release of material to minimize opportunity for theft and vandalism.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Properly recondition and restore those portions of the site occupied by temporary facilities and controls to condition acceptable to COTR, at least equal to condition at time of start of Work, unless otherwise authorized in writing by COTR.
2. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
3. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace roadway paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

4. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 01 Section "Project Closeout."

PART 4 - MEASUREMENT (Not Used)

PART 5 - PAYMENT

All costs incurred by the Contractor to acceptably implement the requirements of this Section shall be performed at no additional cost to the Airports Authority and are part of and incidental to this Contract.

END OF SECTION 015000
SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. This Section includes substitutions made for "or as approved by the Airports Authority" items.

C. Related Sections include the following:

1. Division 01 Section "Alternates" for products selected under an alternate.

2. Division 01 Section "References" for applicable industry standards for products specified.

3. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.

2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.

3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. The Airports Authority reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," COTR will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is COTR’s.
7. "Or as approved by the Airports Authority": Note that products submitted under an "or as approved by the Airports Authority" provision are considered to be substitutions. Substitutions shall follow the requirements of Paragraph VII-42 of Contract Provisions and provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part - 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies
with requirements. Comply with provisions in Part - 2 "Comparable Products" Article for consideration of an unnamed product.

7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.

8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.

9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches COTR's sample. COTR's decision will be final on whether a proposed product matches.

   a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, and textures" or a similar phrase, select a product that complies with other specified requirements.

   a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, COTR will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.

   b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, COTR will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: COTR will consider requests for substitution if received within 60 calendar days after issuance of the Notice to Proceed. Requests received after that time may be considered or rejected at the sole discretion of the Contracting Officer.

B. Conditions: COTR will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, COTR will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution does not require extensive revisions to the Contract Documents.
2. Requested substitution is consistent with the Contract Documents and will produce indicated results.
3. Substitution request is fully documented and properly submitted.
4. Requested substitution will not adversely affect Contractor's Construction Schedule.
5. Requested substitution has received necessary approvals of authorities having jurisdiction.
6. Requested substitution is compatible with other portions of the Work.
7. Requested substitution has been coordinated with other portions of the Work.
8. Requested substitution provides specified warranty.
9. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

C. Contractor's submittal and COTR's review or approval of Shop Drawings, Product Data, or Samples that relate to a substitute does not by itself constitute a final approval of the requested substitution, nor does it relieve Contractor from fulfilling existing Contract requirements.

D. If a substitution offers a substantial advantage to the Airports Authority, in terms of cost, time, energy conservation, or other considerations of merit, after deducting offsetting responsibilities the Airports Authority may be required to bear, the substitution shall be submitted as a Value Engineering Change Proposal.

2.3 COMPARABLE PRODUCTS

A. Conditions: COTR will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, COTR will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, it is consistent with the Contract Documents, it will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION

3.1 SUBMITTALS

A. Product List: Submit a list, in tabular form acceptable to COTR, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:
a. Specification Section number and title.
b. Generic name used in the Contract Documents.
c. Proprietary name, model number, and similar designations.
d. Manufacturer's name and address.
e. Supplier's name and address.
f. Installer's name and address.
g. Projected delivery date or time span of delivery period.
h. Identification of items that require early submittal approval for scheduled delivery date.
i. Item Tag Number or similar ID if identified in the drawings
j. Location (room number from the drawings)
k. Serial Number (once available)

3. Initial Submittal: Within 90 calendar days after the Notice to Proceed, submit initial product list. Include a written explanation for omissions of data and for variations from the Contract requirements.

4. COTR's Action: COTR will respond via the Authority’s web-based Program Management System, Unifier, to Contractor within 15 calendar days of receipt of initial product list. COTR's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. COTR's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.

5. Updated submittal: Submit updated product list every 90 days following initial submittal. The updated list shall be submitted in approved electronic spreadsheet format with additional fields as required by COTR.

6. Completed List: Submit an electronic copy of the completed product list 90 calendar days before requesting inspection for substantial completion. Include a written explanation for omissions of data and for variations from the Contract requirements.

B. Substitution Requests: Submit an electronic copy of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Submit requests in the form and according to procedures required for Contract Modification proposals supplied to Contractor at the pre-construction meeting or as directed by COTR and at no additional cost to the contract. Do not submit requests for substitutions as "Requests for Information" (RFIs).

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

   a. Statement indicating why specified material or product cannot be provided.
   b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Airports Authority and separate contractors that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

e. Samples, where applicable or requested.

f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.

j. Cost information, including a proposal of change, if any, in the Contract Price.

k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.

l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

m. Failure by Contractor to include the above requirements in the submittal may cause rejection of the submittal in its entirety.

3. COTR's Action: If necessary, COTR will request additional information or documentation for evaluation within 15 calendar days of receipt of a request for substitution. COTR will notify Contractor of acceptance or rejection of proposed substitution within 15 calendar days of receipt of request, or two weeks of receipt of additional information or documentation, whichever is later.

   a. Form of Acceptance: Change notice.

   b. Use product specified if COTR couldn’t make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit an electronic copy of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. COTR’s Action: If necessary, COTR will request additional information or documentation for evaluation within 7 working days of receipt of a comparable product request. COTR will notify Contractor of approval or rejection of proposed comparable product request within 15 calendar days of receipt of request, or 7 calendar days of receipt of additional information or documentation, whichever is later.

   a. Form of Approval: As specified in Division 01 Section "Submittals."

   b. Use product specified if COTR couldn’t make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittals." Show compliance with requirements.
3.2 QUALITY ASSURANCE

Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

3.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements, under cover in a weather tight enclosure above ground, with ventilation adequate to prevent condensation.
   4. Comply with product manufacturers written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   5. Store foam plastic away from exposure to sunlight, except to extent necessary for period of installation and concealment.
   6. Store cementitious products and materials on elevated platforms.
   7. Protect stored products from damage.
   8. Replace products and materials damaged by the elements due to improper storage at no additional cost to the Airports Authority. This damage can be, but not limited to, oxidization, mold, mildew, warping, and rust.

3.4 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Authority.

2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Authority.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.

3. Refer to Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Project Closeout."

PART 4 - MEASUREMENT (Not Used)

PART 5 - PAYMENT (Not Used)

END OF SECTION 016000
SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

2. Field engineering and surveying.
4. Coordination of Authority-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Sections include the following:

1. Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.

1.3 SUBMITTALS

A. Qualification Data: Submit qualification data for land surveyors.

B. Certificates: Submit certificate signed and sealed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Certified Surveys: Submit one (1) electronic copy signed and sealed by land surveyor.

D. Project Record Documents: Submit a record of Work performed (materials tests, inspections, acceptance tests, etc.) and record survey data as required under provisions in Division 01 Sections "Submittals" "Project Closeout" and "Project Record Documents."

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is licensed in the Commonwealth of Virginia with a minimum of five (5) years of experience, and who is experienced in providing land-surveying services of the kind indicated.
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work, including all site utility systems.

B. Before construction, verify the location and points of connection of utility services.

C. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of storm sewer and underground electrical and services.

2. For additional requirements for locating and marking existing utilities, see Division 01 Section "Summary."

D. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to COTR that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information (RFI) to COTR. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.
3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify COTR promptly.

B. General: Engage a Registered Surveyor to layout the Work using accepted surveying practices.

1. Establish Benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every Definable Feature and Element of Work as the work progresses.
5. Notify COTR when deviations from required lines and levels exceed allowable tolerances.
6. Conduct closed site surveys with an error of closure equal to or greater accuracy than 1 part in 10,000; 3rd Order Class 1 accuracy, (e.g. 1:10,000) and \((10')/n\), where “n” equals the number of angles in the closed traverse.
7. Perform field survey work with sufficient precision to ensure the required accuracy of the specifications is achieved. The computed coordinate position of each horizontal control point used in compiling the plan shall be correct within the limits of 3rd Order Class 1 accuracy (that is, the horizontal error of closure shall not exceed 10 seconds times the square root of the number of instrument motions in the traverse, all before adjustment. The vertical error of closure of the control level circuit for the control Benchmarks shall not exceed plus or minus 12 millimeters times the square root of the length of the circuit in kilometers, before adjustment.). Both the horizontal and vertical measurements shall be expressed to the nearest millimeter.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by COTR.

3.4 FIELD ENGINEERING

A. Identification: Existing Horizontal Control points and Benchmarks are as identified on the Contract Documents.
B. Reference Points: Locate existing permanent Benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent Benchmarks and control points during construction operations.

1. Do not change or relocate existing Benchmarks or control points without prior written approval of COTR. Report lost or destroyed permanent Benchmarks or control points promptly. Report the need to relocate permanent Benchmarks or control points to COTR before proceeding.

2. Replace lost or destroyed permanent Benchmarks and control points promptly with the approval of COTR. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent Benchmarks on Project site, referenced to data established by survey control points. Comply with the Airports Authority for type and size of Benchmark.

1. Record Benchmark locations, with horizontal and vertical data, on Project Record Documents.

2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.

3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, including utilities, prepare a certified survey showing coordinates, dimensions, locations, angles, and elevations of construction and site work. Coordinates shall be VA State Plane North Zone (NAD 83) and elevations shall be (NAVD 88).

3.5 INSTALLATION

A. Inspection of Conditions: Require Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Proceed only after unsatisfactory conditions have been corrected in a manner acceptable to COTR. Coordinate this requirement with Division 01 Section "Quality Requirements."

B. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.

2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

C. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

D. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

E. Conduct construction operations so no part of the Work is subjected to damaging operations.
F. Tools and Equipment: Do not use tools or equipment that produces harmful noise levels. For additional requirements see Section "Supplementary Conditions."

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by COTR.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints as directed by COTR. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 AUTHORITY-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for the Airports Authority's construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by the Airports Authority's construction forces.

1. Construction Schedule: Inform COTR of Contractor's preferred construction schedule for the Airports Authority's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify COTR if changes to schedule are required due to differences in actual construction progress.

2. Pre-installation Conferences: Include the Airports Authority's construction forces at pre-installation conferences covering portions of the Work that are to receive the Airports Authority's work. Attend pre-installation conferences conducted by the Airports Authority's construction forces if portions of the Work depend on the Airports Authority's construction.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.


2. Remove combustible debris from the site daily.

3. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.

4. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.
C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
   1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. Waste Disposal: Burying or burning waste materials on-airport property will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to ensure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

L. Grass Mowing: Mow grass areas contained in Project site, or made inaccessible to the Airports Authority's mowing contractors.

3.8 STARTING AND ADJUSTING

A. Follow equipment manufacturer's startup procedures, unless otherwise directed by COTR.

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure that installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."

B. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

PART 4 - MEASUREMENT (Not Used)

PART 5 - PAYMENT

All costs incurred by the Contractor to acceptably implement the requirements of this Section shall be performed at no additional cost to the Airports Authority and are part of and incidental to this Contract.

END OF SECTION 017300
SECTION 017329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Division 02 Section "Selective Structure Demolition" for demolition and removal of selected site elements.
2. Divisions 02 through 33 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

Cutting and Patching Proposal: Submit a proposal, requesting approval from COTR to proceed, describing procedures at least 10 days before the time cutting and patching will be performed. Include the following information:

A. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.

B. Changes to Existing Construction: Describe anticipated results as well as changes in significant visual elements.

C. Products: List products to be used and firms or entities that will perform the Work.

D. Dates: Indicate when cutting and patching will be performed.

E. Utility Services and Mechanical/Electrical Systems: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted. Refer to Division 01 Section “Summary” for utility outage requirements.
G. COTR's Approval: Obtain COTR’s approval in writing of cutting and patching proposal before cutting and patching. Approval does not waive COTR’s right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Obtain COTR’s written approval of the cutting and patching of the following operating elements or safety related items:

1. Primary operational systems and equipment.
4. Control systems.
5. Communication systems.
7. Electrical wiring systems.
9. Security systems including CCTV.

B. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:

1. Equipment supports.
2. Piping and equipment.
3. Noise- and vibration-control elements and systems.

C. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

D. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.
B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

C. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned; bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

C. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Excavating and Backfilling: Should excavating and backfilling be required by cutting and patching operations comply with requirements in applicable Division 31 Sections.

6. Proceed with patching after construction operations requiring cutting are complete.

D. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

PART 4 - MEASUREMENT (Not Used)

PART 5 - PAYMENT

Work covered by this Section shall be considered incidental to items specified in other Sections of the specifications. No direct payment will be made therefor.

END OF SECTION 017329
SECTION 017700 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Warranties.
3. Final cleaning.

B. Related Sections include the following:

1. Division 01 Section “Quality Requirements” for final requirements of the Warranty Manual.
2. Division 01 Section "Photographic Documentation" for submitting Final Acceptance construction photographs and negatives.
3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, Record Product Data, and other Record Documents.
4. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
5. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for products of those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Definition: "Substantial Completion" is the stage in progress of Work when COTR recommends to the Contracting Officer that all the Work, or a designated portion thereof, is sufficiently complete and functional according to the Contract Documents such that the Airports Authority can occupy and/or utilize the Work for its intended beneficial use. Subsequent to Substantial Completion the only remaining physical Work shall be completion of punch list items prior to Final Acceptance.

B. Preliminary Procedures: Before requesting Authority inspection for determining date of Substantial Completion, complete the following; list items below that are incomplete in request:

1. Prepare a list of items to be completed and corrected (punch list), the contract value of items on the punch list, explanation why the Work is incomplete, and a schedule for completing punch list work according to Section III of the Contract.
2. Complete any previously delinquent technical submittals and/or Shop Drawings for approval and project as-builts records.
3. Advise COTR of any pending insurance changeover requirements, including status of OCIP-related claims.
4. Submit Warranties and Owners Manuals as required by Contract Documents, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
5. Submit Contractor Warranty Letter, for review and approval, a minimum of 60 days before requesting inspection for determining date of Substantial Completion. After date of Substantial Completion has been determined revise the Contractor’s Warranty Letter(s) to include that date as start of Warranty period for each portion of the Work upon which Substantial Completion is achieved.
6. Obtain and submit Release of Liens permitting the Airports Authority unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar Releases.
7. Prepare and submit Project Record Documents (As-Builts) except Record Contract CPM Schedule; also prepare and submit Operation and Maintenance manuals, Final Completion construction photographs in digital format, damage or settlement surveys, and similar final record information.
8. Prepare and submit written evidence that specified testing and code inspections have been performed, accepted and certified, including, but not limited to, structural work, sprinkler piping systems, fire alarm and Fire Protection System (FPS) systems, bacteriological testing of domestic lines, back-flow prevention, electrical system testing, and hydrostatic pressure testing of sanitary lines. Submit approvals of Health Department or the FDA as applicable.
9. Deliver tools, spare parts, extra materials, and similar items to location designated by COTR. Label with manufacturer's name and model number with manifest of deliverable.
10. Make final changeover of permanent locks and deliver original keys to COTR. Advise the Airports Authority Airport Operations and Locksmith, of changeover in security provisions.
11. Complete startup testing and commissioning of systems to demonstrate completion of Work.
12. Submit test/adjust/balance records as part of Quality documentation.
13. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements; provide restoration to original conditions as directed by COTR.
14. Request transfer of utilities back to the Airports Authority.
15. Submit transfer of utilities and any temporary facilities changeover information related to the Airports Authority's occupancy, use, operation, and maintenance.
16. Provide demonstration and training to the Airports Authority's personnel in operation, adjustment, and maintenance of products, equipment, and systems, as required by Division 01 Section "Demonstration and Training."
17. Complete final cleaning requirements, including touchup painting as directed by COTR.
18. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects as directed by COTR.

C. Inspection: Submit a written request via the Authority’s web-based Program Management software (Unifier) for inspection for Substantial Completion. On receipt of request, COTR will either proceed with inspection or notify Contractor of unfulfilled requirements. COTR will prepare the Certificate of Substantial Completion on behalf of the Contracting Officer after
inspection or will notify Contractor of items, either on Contractor's list or additional items identified by COTR, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Punch list work must be completed within the duration specified in Section III, "Schedule." Failure to complete punch list work within the contract duration specified may result in Liquidated Damages; and may result in the Contracting Officer ordering the work to be completed by others at the cost to Contractor.

1.4 FINAL COMPLETION AND ACCEPTANCE

A. Definition: "Final Completion" is the stage in the Contract when the Contracting Officer determines that all Work has been 100 percent completed according to the terms and conditions of the Contract Documents, including physical completion of Work, administrative requirements for closeout, and financial requirements for closeout. The date of Final Acceptance is the date of execution by the Contracting Officer of a Certificate of Final Acceptance.

B. Preliminary Procedures: Before requesting Final Inspection for determining date of Final Completion, complete the following:

1. Submit a Final Application for Payment according to Division 01 Section "Application for Payment."
2. Submit certified copy of Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by COTR. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit a Contractor/COTR joint statement evidencing that all Record Documents, Operation and Maintenance Manuals, warranties, and similar required submittals have been approved.
4. Complete demobilization and removal of temporary facilities from the site including construction equipment and facilities, mockups, and other similar elements. Restore areas to previously existing condition, if applicable.
5. Execute final Contract Modification and submit final Subcontractor Payment Form.
6. Return all AOA badging and all Authority IDs.
7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
8. Submit Record Contract CPM Schedule.

C. Inspection: Submit a written request via the Authority’s web-based Program Management software (Unifier) for Final Inspection for acceptance. On receipt of request, COTR will either proceed with inspection or notify Contractor of unfulfilled requirements. COTR will prepare a final Certificate for Payment after inspection or will notify Contractor of Work that must be completed or corrected before certificate will be issued.
1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Prepare submittal of Punch List. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, areas disturbed by Contractor outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Contract name and number.
   b. Date.
   c. Name of COTR.
   d. Name of Architect/Engineer.
   e. Name of Contractor.
   f. Page number.

1.6 WARRANTIES

A. Submittal Time: Submit one draft copy of proposed Warranty Manual Specified below within 90 days of Notice to Proceed.

1. Provide Manufacturer’s Standard Warranties, made out to the Airports Authority, and statement of willingness to provide any applicable Special Warranties required by the Contract Documents 14 calendar days prior to shipping of materials and equipment. Products and Equipment shall not be considered delivered (for payment purposes) until the approved warranties have been received.
2. All warranties commence on date of acceptance of Substantial Completion for designated portions of the Work.

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

C. Warranty Manual: Organize warranty documents into an orderly sequence based on the table of contents of the Contract Specifications. Warranty documents include Contractor and major subcontractors warranty letters, special warranty documents, and manufacturer's warranties.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents. Binders shall not be filled beyond 75 percent of their rated capacity. Binders shall also have boomerang plastic sheet lifters, metal backbone, concealed rivet construction, and three-trigger position locking mechanism (lock, unlock, open) on top and bottom. Binder color shall be black unless another color is selected by COTR.
   a. Provide maximum 3-inch binder thickness.
   b. Identify each binder on front and spine, with printed title "PROJECT WARRANTIES," Contract number and name, and subject matter of contents. If
identification cannot be attached to the front include it as the first page in the manual. Indicate volume number for multiple-volume sets. The use of business labels is prohibited.

2. Dividers: Provide three-hole, heavyweight, plastic tabbed dividers, (, or as approved by the Airports Authority) for each separate section. Provide laser printed description for each tabbed section on the front and back of tabs. Tabs shall indicate the appropriate Specification Section. Provide a description of the warranty or heading for sub tabs using the same laser printed format on the dividers. Provide an index of the contents in each section on the first page behind each section divider. The index shall be generated using a word processor and printed on a laser printer. Include a matching master table of contents for each volume using the same indexing system. Install a colored sheet between each different warranty within a tabbed section.

3. Provide a digital version of the warranty manual. This version shall consist of a scanned Adobe® PDF file of each warranty document in the manual.

D. Provide additional copies of each warranty that shall be included in Operation and Maintenance Manuals upon request of COTR.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with Authority requirements, local laws and ordinances and Federal and local environmental and antipollution regulations. General cleaning during construction is included in Division 01 Section "Execution."

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

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

   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove labels that are not permanent.
h. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
i. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
j. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Airports Authority's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

D. Where extra materials of value remaining after completion of associated Work have become the Airports Authority's property, arrange for disposition of these materials as directed by COTR.

PART 4 - MEASUREMENT (Not Used)

PART 5 - PAYMENT

All costs incurred by the Contractor to acceptably implement the requirements of this Section shall be performed at no additional cost to the Airports Authority and are part of and incidental to this Contract.

END OF SECTION 017700
SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

   2. Manuals, General and formatting
   3. Emergency Information Manuals and formatting.
   4. Operation Information Manuals and formatting for systems, subsystems, and equipment.
   5. Maintenance Information Manuals and formatting for the care and maintenance of products, materials, finishes, systems, and equipment.

B. Related Sections include the following:

   1. Division 01 Section “Application for Payment” for values assigned to Operation and Maintenance Manuals
   2. Division 01 Section “Quality Requirements” for ensuring the development and continuing update of the Operation and Maintenance Documentation Directory and Operation and Maintenance Manual.
   3. Division 01 Section “Submittals” for submitting copies of submittals for operation and maintenance manuals.
   4. Division 01 Section “Project Closeout” for submitting operation and maintenance manuals.
   5. Division 01 Section “Project Record Documents” for preparing Record Drawings for operation and maintenance manuals.
   6. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for products in those Sections.

C. For purposes of payment, “Operation and Maintenance (O & M)” and “Material and Finishes” Manuals are to be valued at 5% of Contract.

D. Payment for materials and equipment will be withheld if complete O & M Manual is not received from Contractor at time of material or equipment delivery; namely, instruction sheets, operation manuals, installation instructions, and other documents received from the manufacturer at the time of delivery.

E. All costs incurred by the Contractor to acceptably implement, as determined by the COTR, the requirements of this Section shall be borne by the Contractor, performed at no additional cost to the Airports Authority, and are considered a part of this Contract.
1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

C. Equipment: An instrument or appliance designed for a specific operation.

D. Product: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

E. Location: A defined area such as roof, room, hallway, ceiling, pavement, wall, or floor that has special maintenance requirements that are documented in the Operation and Maintenance Data.

1.4 SUBMITTALS

A. Operation and Maintenance Manual Format: Submit to COTR, via Airports Authority Program Management Software system, within 90 calendar days of Notice to Proceed an electronic copy of the proposed Operation and Maintenance Manual Format. Format shall include a Table of Contents as specified in Part 2 of this Section. COTR will return comments regarding the Operation and Maintenance Manual Format and planned contents of the completed manual within 30 calendar days of receipt. Throughout the construction period of the project, Operation and Maintenance data shall be continually inserted in the appropriate sections/parts of the Manual as it is approved.

B. Operation and Maintenance Documentation Directory: Submit to COTR, via Airports Authority Program Management Software system, within 90 calendar days of Notice to Proceed an electronic draft copy of the Operation and Maintenance Documentation Directory. Format shall be as specified in Part 2 of this section. COTR will return comments regarding the Directory and planned contents of the completed manual set within 30 calendar days of receipt of submittal. Throughout the construction period of the project, the Directory shall be updated to reflect changes resulting from other submittal approvals.

C. Operation and Maintenance Manuals Initial Submittal: Submit a draft copy of each Manual via the Airports Authority Program Management Software system, at least 90 calendar days before requesting inspection for Substantial Completion. Include a copy of the complete Operations and Maintenance Directory. COTR will provide comments within 30 calendar days of receipt, and mark whether general scope and content of Manuals are acceptable.

D. Operation and Maintenance Manuals Pre-final Submittals: Submit an electronic copy of each manual in final form, transmitted using the Airports Authority Program Management Software system, at least 45 calendar days before substantial completion or training, whichever occurs first. COTR will provide comments within 15 calendar days after receipt.

E. Operation and Maintenance Manuals Final Submittal: Correct or modify each manual to comply with COTR’s comments. Submit six (6) printed copies of the Document Directory and six (6) printed copies of each corrected manual at least 15 calendar days before substantial completion or training, whichever occurs first. Also:
1. Provide an electronic copy of all Operation and Maintenance Data via the Authority’s web-based Program Management software (Unifier) consistent with the organization and format in the “Manuals, General” section. All electronic files shall be in Adobe PDF format.
2. All information must be legible in the digital versions. Instead of scanned images, Original files are required.

1.5 COORDINATION

Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, the General Contractor shall assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Provide the Operation and Maintenance Documentation Directory in separate binder from operation and maintenance information. Binders, dividers and all portions of the Directory shall comply with requirements of “Manuals, General” as applicable. Size of binder for directory shall be appropriate for quantity of contents. Information in O & M Directory shall be in alphabetical order with references to contract Division and Specification Section.

B. Organization: Include a section in the directory for each of the following:

1. General Information.
2. Table of Contents
3. List of systems and subsystems.
4. List of equipment.
5. List of Products

C. General Information: Include documents that are pertinent to the project, including, but not limited to, a detailed description of the facility or project, general safety information and a users guide to the project operation and maintenance manuals.

D. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

E. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list. Include references to operation and maintenance manuals that contain information about each system.

F. List of Products: List products alphabetically to include all products not part of a system, subsystem, or component of equipment. Include references to operation and maintenance manuals that contain information about each product.

G. Tables of Contents: Include a complete table of contents for each volume of the Operation and Maintenance Manuals.
H. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment and products with the same designation used by the Airports Authority. If no designation is provided for equipment, systems, sub-systems, or equipment assign a designation according to ASHRAE Guideline 4, “Preparation of Operating and Maintenance Documentation for Building Systems.”

I. Provide a draft of the proposed “Operation and Maintenance Documentation Directory” at least 90 calendar days before requesting inspection for Substantial Completion. Submit draft to COTR for approval in writing.

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize information by Division and then into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following in the order listed:

1. Title page.
2. Table of contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information on the title page:

1. Specific subject matter included in manual such as Division number and title, Specification Section number and title, equipment, systems and subsystems.
2. Name and number of the Contract.
3. Date of submittal.
4. Name, address, telephone number, and contact person of Contractor, Subcontractor, and supplier.
5. Name and address of Architect/Engineer.
6. Cross-reference to related systems in other portions of the Operation and Maintenance Manuals.

C. Table of Contents: Include a Table of Contents, printed by a laser printer, for each volume, arranged according to the specification sections. List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in the Contract Documents.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents by Division then by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring metal hinged loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents. Binders shall not be filled beyond 75 percent of their rated capacity. Binders shall also have boomerang plastic sheet lifters, concealed
rivet construction, and three-trigger position Dublock mechanism (lock, unlock, open) on top and bottom of binders. Binder color shall be black unless another color is selected by COTR.

a. Provide maximum 3 inch binder thickness. Smaller binders are acceptable as long as 75 percent rated binder capacity is not exceeded.

b. If two or more binders are necessary to accommodate data for a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

c. Identify each binder on front (If Identification cannot be placed on the front provide as the first page) and spine of binder, with printed title “OPERATION AND MAINTENANCE MANUAL,” Contract number and name, and specific subject matter of contents, such as “Division 23 Heating Ventilating and Air Conditioning”. Indicate volume number for multiple-volume sets. The use of business labels is prohibited.

2. Dividers: Provide three-hole, heavyweight, and plastic tabbed dividers for each separate section. Provide laser printed description for each tab section (front and back of tabs), to indicate the appropriate Specification Section. Provide a description of the product or heading for sub tabs using the same laser printed format on the dividers.

3. Provide a typed index describing each product, equipment, and subject addressed in each section on the first page behind each section divider. Include a matching master table of contents for each volume using the same indexing system. Install a colored sheet between major topics and each different device within a tabbed section.

4. Protective Plastic Sleeves: Provide protective transparent plastic sheet protectors to enclose the Title Page, all Table of Content pages, and photographs.

5. Text: Prepared on 8-1/2-by-11-inch, 20-lb/sq. ft. white bond paper. Copies of faxed materials may be rejected. Two-sided text shall be provided on 24-lb/sq. ft. white bond paper to eliminate “bleed through” of text with a minimum brightness of 96.

6. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

b. If drawings are too large to be used as foldouts, fold and place drawings in transparent envelopes and bind envelopes with text. Insert typewritten pages indicating drawing titles, descriptions of contents, in the transparent envelopes along with drawings. Drawings shall cross-reference the appropriate manual volume and Specification Section. Drawing holding envelopes are not acceptable.

2.3 EMERGENCY INFORMATION

A. Content: Organize information by Division into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
4. System, subsystem, or equipment failure.
5. Weather related events, thunderstorms, hurricanes, tornados, etc.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of the Airports Authority’s operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

E. Provide a draft of the proposed Emergency Information Manual. Submit draft at least 90 calendar days before requesting inspection for Substantial Completion to COTR for approval in writing.

2.4 OPERATION INFORMATION

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information. Organize manuals into separate and distinct volumes by Division.

1. System, subsystem, and equipment descriptions.
2. Safety instruction and related issues.
3. Operating standards.
4. Operating procedures.
5. Wiring diagrams, including color-coding and terminal designations. Include all factory preset or field-set dip switch and jumper settings for all electronic equipment.
6. Control diagrams.
7. Precautions against improper use.
8. License requirements including inspection and renewal dates.
9. Safety Data Sheets.

B. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
7. Required sequences for electric or electronic systems.
8. Special operating instructions and procedures.
9. Procedures or operations that may void warranty.

C. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

D. Piped Systems: Diagram piping as installed and color-coding shall be used where required for identification.

E. Provide a draft of the proposed Operation Information Manual. Submit draft at least 90 calendar days before requesting inspection for Substantial Completion to COTR for approval in writing.

2.5 PRODUCT MAINTENANCE INFORMATION

A. This Section shall contain information for all products with the exception of Systems and Equipment, which shall be provided as indicated elsewhere in this Section.

B. Content: Organize information into a separate section for each product, material, and finish. Provide one section for architectural products, including applied materials and finishes, and a second for products designed for moisture protection and products exposed to the weather. Include source information, product information, maintenance procedures, repair materials and sources, schedule of products, location of products and warranties and bonds, as described below.

C. Source Information: List each product included in manual identified by product name and arranged to match manual’s table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer’s name.
3. Color.
5. Reordering information for specially manufactured products.
7. Material Safety Data Sheets.

E. Maintenance Procedures: Include manufacturer’s written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.
F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Schedule of Products and Locations: Provide complete information, including reference drawings, in the materials and finishes manual on all products specified in Divisions 02 through 33.

H. Warranties and Bonds: Provide copies of all applicable warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.
   2. Clearly indicate commencement and expiration dates.

I. Provide a draft of the proposed Product Maintenance Information Manual. Submit draft at least 90 calendar days before requesting inspection for Substantial Completion to COTR for approval in writing.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE INFORMATION

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers’ maintenance documentation, preventative maintenance program, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below. Organize information into separate and distinct volumes by Division, and further divided into separate volumes by system (for example, HVAC systems and plumbing systems).

B. Source Information: List each system, subsystem, and piece of equipment included in manual identified by product name and arranged to match manual’s table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Descriptions: Include the following:
   1. Product name, model number, and location.
   2. Manufacturer’s name.
   3. Equipment identification with serial number of each component.
   4. Equipment function.
   5. Operating characteristics.
   6. Limiting conditions.
   7. Performance curves.
   8. Engineering data and tests.
   9. Complete nomenclature and number of replacement parts.

D. Manufacturers’ Maintenance Documentation: Manufacturers’ maintenance documentation including the following information for each component part or piece of equipment:
   1. Safety information.
   2. Standard printed maintenance instructions and bulletins.
3. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
4. Identification and nomenclature of parts and components.
5. List of items recommended to be stocked as spare parts.

E. Preventative Maintenance Plan: Provide an annual preventative maintenance plan indicating when maintenance tasks should be performed, such that work is spread evenly as possible throughout the year. Preventative Maintenance should not be misconstrued as reconditioning, or major repairs or replacement of components, but designed to reveal through certain procedures and inspection the need for such actions in time to prevent malfunctions during operation.

F. Preventative Maintenance and Maintenance and Repair Procedures: Include the following information and items that detail essential preventative maintenance and maintenance and repair procedures:

1. Preventative Maintenance:
   a. Provide instructions and location diagrams for the following:
      1) Checking general condition of System and Components.
      2) Inspecting for accumulation of dust, dirt or any foreign matter, and clean as needed.
      3) Examining indicating lamps, gauges, etc., and replace as required.
      4) 
      5) Lubricating mechanisms, contacts, and other moving component parts.
      6) Specific procedures applicable to specialized equipment and systems.

2. Maintenance and Repairs:
   a. Include information and detailed diagnostic testing and inspection instructions, and procedures that detail essential system and equipment maintenance procedures including but not limited to:
      1) Examination of shaft seal for excessive leakage.
      2) Monitoring of systems for excessive bearing noise.
      3) Checking equipment motor housing for excessive heat buildup.
      4) Verifying lubrication requirements.
      5) Realignment of shaft coupling.
      6) Checking motor amperes drawn at full load.
      7) Checking motor shaft run-out
      8) Performing thermographic scanning of motor starters, motors, pumps, and all mechanical and electrical equipment that requires a connection.
      9) Proper cleaning and corrosion control of drip pan and drainage lines.
     10) Inspection of internal equipment components for unusual wear or failure. 
     11) Procedures for maintenance including precautions against improper maintenance.

   b. Include the following information and items that detail essential system and equipment repair procedures:
1) Complete troubleshooting guide.
2) Complete repair instructions including equipment and component removal, disassembly, repair, and replacement; and reassembly instructions.
3) Aligning, adjusting, and checking instructions including noise, vibration, and efficiency adjustments.
4) Demonstration and training video, if such video, CD-ROM or DVD is provided by the manufacturer.

G. Maintenance Service Schedules

1. Provide recommended frequencies, inspections, service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and maintenance and service with standard time allotment.
   a. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   b. Maintenance and Service Record: Include manufacturers’ forms for recording maintenance.

H. Spare Parts List, Recommended Inventory Requirements, and Source Information: Include lists of replacement and repair parts, with parts identified, and cross-referenced to manufacturers’ maintenance documentation and local sources of maintenance materials and related services.

I. Schedule of Products and Locations: Provide complete information, including reference drawings if necessary, in the Equipment and Systems manual on all products specified in Divisions 02 through 33.

J. Warranties and Bonds: Include copies of all applicable warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.
   2. Clearly indicate commencement and expiration dates.

K. Provide a draft of the proposed Product Maintenance Information Manual. Submit draft at least 90 calendar days before requesting inspection for Substantial Completion to COTR for approval in writing.

2.7 WARRANTY MANUAL

A. Organize warranty documents into an orderly sequence based on the table of contents of the Contract Specifications. Warranty documents include Contractor and Major Subcontractors warranty letters, special warranty documents, and manufacturer's warranties.

B. Binders: Heavy-duty, 3-ring metal hinged loose-leaf binders in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents. Binders shall not be filled beyond 75 percent of their rated capacity. Binders shall also have boomerang plastic sheet lifters, metal backbone, concealed rivet construction, and three-trigger position DublLock mechanism (lock, unlock, open) on top and bottom. Binder color shall be black unless another color is selected by COTR.
C. Identify each binder on front (If identification can not be attached to the front include it as the first page in the manual) and spine, with printed title "PROJECT WARRANTIES," Contract number and name. The use of business labels is prohibited.

D. Dividers: Provide three-hole, heavyweight, and tabbed dividers for each separate section. Provide laser printed description front and back of tabs, to indicate the appropriate Specification Section. Provide a typed index of the contents in each section on the first page behind each section divider. Include a matching master table of contents for the manual using the same indexing system. Install a colored sheet between each different warranty within a tabbed section.

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

F. Provide a draft of the proposed Warranty Manual. Submit draft at least 90 calendar days before requesting inspection for Substantial Completion to COTR for approval in writing.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Compile all required information, as it is approved, grouped first by specification Division and then by Section in accordance with the information requirements outlined in Part 2 of this specification section and the approved Operation and Maintenance Manual Format.

B. For the first Directory Submittal, prepare a separate manual that provides an organized reference to the complete manual set. Subsequent submittals of the Directory shall integrate this information by Division.

C. Emergency Information: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by the Airports Authority’s operating personnel for types of emergencies indicated. Include the emergency information in the volume of the manual set to which it applies.

D. Product Maintenance Information: For Divisions that specify products (refer to definitions) assemble a complete set of maintenance data indicating manufacturer’s product information, part numbers, description, and care and maintenance instructions for each product, material, and finish incorporated into the Work. Provide sufficient information, and when applicable color samples, for all products to enable repair or replacement of matching products or finishes.

E. Operation and Maintenance Information: For Divisions that specify systems, sub-systems, and equipment (refer to definitions) assemble a complete set of operation and maintenance and repair data providing complete information for each system, subsystem, and piece of equipment. Include complete operation, preventative maintenance, maintenance and repair instructions, and parts listing with sources indicated; recommended parts inventory listing, and similar information. Include all diagnostic and repair information available to manufacturer’s and Installer’s maintenance personnel.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by the Airports Authority’s operating personnel.

F. Manufacturers’ Data: Where manuals contain manufacturers’ standard printed data, include only sheets pertinent to product or component installed. Mark each sheet with black arrows to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Provide supplementary text if manufacturers’ standard printed data is not provided by the manufacturer. Provide supplementary text where the information is necessary for proper operation and maintenance of equipment or systems.

G. Drawings: Prepare drawings supplementing manufacturers’ printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams and their relation to the structure or facility. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation. Prepare floor plans that show the location of equipment in the building.

1. Do not use original Project Record Documents as part of Operation and Maintenance Manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 01 Section “Project Record Documents.”

H. Comply with Division 01 Section “Project Closeout” for a schedule for submitting operation and maintenance documentation.

PART 4 - MEASUREMENT (Not Used)

PART 5 - PAYMENT (Not Used)

END OF SECTION 017823
SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, Contract Provisions, Special Provisions, Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings, including CADD & GIS submittals.
2. Record Specifications.
3. Record Product Data.
4. Record Samples.
5. Record Schedule.
6. Miscellaneous Record Submittals.

B. Related Sections include the following:

1. Division 01 Section “Construction Progress Documentation” for construction schedules as basis for Record Schedule.
2. Division 01 Section “Quality Requirements” for ensuring the record drawings and specifications are kept current on a daily basis and marked to show deviations which have been made from the original Contract documents
3. Division 01 Section "Project Closeout " for general closeout procedures
4. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
5. Divisions 02 through 33 Sections for specific requirements for Project Record Documents of products in those Sections.

C. For purposes of payment, “Operation and Maintenance (O & M)” and “Material and Finishes” Manuals are to be valued at 5% of Contract.

D. All costs incurred by the Contractor to acceptably implement, as determined by the COTR, the requirements of this Section shall be borne by the Contractor, performed at no additional cost to the Airports Authority, and are considered a part of this Contract.

1.3 SUBMITTALS

A. Record Drawings

1. Record Prints: Comply with Paragraph 2.1.A below.
2. CADD Record Drawings. The Contractor shall submit copies of CADD Record Drawings as follows:

a. Initial Submittal: Submit one set of complete, full-sized, CADD Record Drawings. Additional sets of drawings are not to be copied and submitted until after substantial completion to insure all changes are shown on the drawings. The COTR will facilitate review of drawings and indicate whether the CADD Record Drawings are acceptable. The COTR will return review comments indicating any corrections that need to be made to the drawings. The corrected CADD Record Drawings may then be reproduced, and organized into sets, printed, bound, and submitted as final submittal.

b. Final Submittal: After construction is complete and changes are recorded, submit one (1) complete, full-sized, printed set of CADD Record Drawings. Include each sheet, whether or not changes and additional information were recorded. Submit one (1) electronic set of CADD Record drawing files in the approved electronic format via the Authority’s web-based Program Management software (Unifier). In addition, submit the original set of marked-up record drawings onto which the mark-ups were made.

3. Geographic Information Systems (GIS) Submittal. The Contractor shall submit copies of the GIS Submittal as follows:

a. Initial Submittal: Submit all GIS data in ESRI Geodatabase version 10.0 or higher. The GIS deliverable will be submitted for each required GIS layer/feature class. The COTR will facilitate review with the GIS Division of the GIS submittal and indicate whether the ESRI GIS deliverable is acceptable. The COTR will return review comments indicating any corrections that need to be made.

b. Final Submittal: After construction is complete and changes are recorded, submit one electronic copy, via the Authority’s web-based Program Management software (Unifier), of each of the following:

1) GIS deliverable inventory report;
2) QA/QC Report;
3) All approved ESRI datasets of CADD Record Drawings.

B. Record Specifications: Submit electronic copy of Project Specifications, including addenda and contract modifications.

C. Record Product Data: Submit an electronic copy of each Product Data submittal unless directed otherwise by the COTR.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as Record Product Data.

D. Record Samples: Submit Record Samples as specified.

E. Record Schedule: Submit an electronic copy of Record Schedule.

F. Miscellaneous Record Submittals: Submit miscellaneous Record Submittals as specified.
G. At the discretion of the COTR, the requirement for hard copy record submittals may be waived. The Contractor must request, in writing from the COTR, a waiver of the hard copy submittals. The COTR may waive all or part of the required hard copy submittals.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: During construction, maintain one complete, full sized, set of blue- or black-line prints of the Drawings, applicable shop drawings, and coordination drawings for record purposes. These drawings shall be updated periodically, by the contractor, in CADD to replace the hand mark-ups. The mark-ups shall be preserved for the record. A complete set of Conformed Drawings in CADD will be provided to the Contractor for his use in maintaining the CADD Record Drawings. The CADD files will be provided in Autodesk AutoCAD

1. Maintenance of Drawings: Maintain the drawings in a clean, dry, legible condition. Keep drawings available during normal working hours for inspection by the COTR.

2. Preparation: Routinely mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the mark-ups on the record set.

   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later especially underground structures.

   b. Record information in an understandable drawing technique. Ensure mark-ups are legible and reproducible.

   c. Record data as soon as possible after obtaining it. Record and check markups before enclosing concealed installations.

3. Content: Types of items requiring marking include, but are not limited to, the following:

   a. Dimensional changes to Drawings.

   b. Revisions to details shown on Drawings.

   c. Depths of foundations below first floor.

   d. Locations and depths of underground utilities.

   e. Revisions to routing of piping and conduits.

   f. Revisions to electrical circuitry.

   g. Actual equipment locations.

   h. Duct size and routing.

   i. Locations of concealed internal utilities.

   j. Changes made by Change Notice and RFI.

   k. Changes made following COTR's written orders.

   l. Details not on the original Drawings.

   m. Field records for variable and concealed conditions.

   n. Record information on the Work that is shown only schematically.

4. Mark the Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, insert them into drawing set and assign an appropriate sheet number (one that follows the
number sequence of the contract drawings). Show cross-references to the new sheets on the Drawings. Update drawing index as needed to reflect new sheets.

5. Mark record drawings with red pen that will reproduce clearly. Use different colors to distinguish between changes for different categories of the Work at the same location.

6. Mark important additional information that was either shown schematically or not indicated on the original Drawings.

7. Note applicable Construction Change Notices, Requests for Information, Technical Support Requests, and similar identification numbers, where applicable. Copies of change documentation shall be inserted into the set for clarification but are not a substitute for mark-ups. If identification numbers for documentation are marked on the drawing when no change resulted, indicate "No Change".

B. Newly Prepared Project Record Drawing Sheets: The contractor may add new sheets with supporting sketches and change documentation instead of marking original sheets when neither the original Drawings nor Shop Drawings are suitable to show actual installation or if the new sheets can show the changes more clearly or additional space is required for markup information.

1. Assign a number to each new sheet and cross-reference on the appropriate related sheets.

2. Consult with COTR for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction.

3. Integrate newly prepared sheets into Record Drawing sets and update drawing index to reflect new sheets.

C. Format:

1. Identify and date each Record Drawing. Include the designation “PROJECT RECORD DRAWING” in a prominent location on each sheet.

2. Cover Sheet shall have the designation “PROJECT RECORD DRAWINGS”, Date, Name of Contractor, and signature.

3. Record CADD Drawings:

   a. CADD files provided by COTR and utilized for recording of record mark-ups shall maintain the format of the files provided. Place electronic mark-ups in a newly created layer on each drawing.

   b. CADD files created by Contractor: Organize CADD information into separate electronic files that correspond to each sheet of the Record Drawing set. Name each file with the sheet identification. Include identification in each CADD file.

4. Include the following identification on newly prepared Project Record Drawing Sheets:

   a. Project name.

   b. Date.

   c. Designation "PROJECT RECORD DRAWING."

   d. Name of Architect/Engineer (if applicable).

   e. Name of Contractor.

   f. Initials of person incorporating the change.

   g. Drawing identification number. (Ixx/Dxx)

5. Organization of Newly Prepared Project Record Drawing Prints: Organize newly prepared Record Drawings into manageable sets. Include any contract required
coordination drawings and applicable shop drawings. Bind each set with durable paper cover sheets. Include identification on cover sheets.

D. ADDITIONAL REQUIREMENTS FOR RECORD DRAWINGS

1. When there are multiple copies of the same sheet with different mark-ups on each copy, the General Contractor is responsible for consolidating all mark-ups onto a single copy of each individual sheet.

2. The information from all RFI’s, Change Notices, Design Clarifications, field adjustments, or any other changes, must be noted on the appropriate drawing. These mark-ups must include enough information to clearly show the actual constructed conditions resulting from the change. The information may be drawn onto the drawing, copied onto the drawing or copied onto a new full size sheet. Every change in construction must have RFI’s, Change Orders or similar supplementary documents; therefore they must be copied in original size and attached to the back of the preceding drawing or at the end of the drawing set, as an appendix, as a full size sheet, same in size as the drawing set. Multiple RFI’s, CN’s and other supplemental documents may be copied in each single sheet.

3. All changes made on the drawings shall reference the appropriate RFI, Change Notices, Design Clarification, or details from the contractor prepared shop drawings. If the mark-up is due to a field adjustment, it shall be indicated as such.

4. Additional Sheets such as shop drawings and sheets showing copies of applicable change documentation must be inserted into the set as necessary. Such sheets shall have a title block.

5. Notes and sketches printed by hand are acceptable but shall be neat, legible, and reproducible. Hand lettering shall be 3/8" high minimum.

6. All shop drawings showing information not on the construction drawings (with the exception of concrete embedded steel reinforcement bending drawings and steel reaction and fabrication drawings) shall be marked up and included in the record drawing set. They shall be the same size (changes in scale noted) as all other drawings, include a title block, and clearly indicate that they are record shop drawings. When the shop drawings more accurately show locations and conditions, they may be marked in lieu of referenced on the original drawings. This does not relieve the contractor from the shop drawing inclusion requirements in the Operation and Maintenance Manuals that are a separate item.

7. Include contract required coordination drawings in the record drawing set.

2.2 GIS SUBMITTAL

A. The contractor is required to provide a GIS submittal matching the CADD record drawings.

B. GIS deliverables shall follow the MWAA GIS standard template which will be provided to the contractor by the COTR upon request.

C. When providing a GIS submittal, the Contractor shall provide spatial data matching the features as rendered in the CADD drawing model files (containing the physical facility or asset components; buildings, aprons, runways, roads, fences, etc.), in real-world coordinates.

1. All GIS data shall be submitted in Virginia State Plane feet coordinate system using North American Datum (NAD) 83 and Geographic Reference System (GRS) 80 ellipsoid.
All vertical measurements in the GIS submittals should be recorded based on the North American Vertical Datum (NAVD) 88.

D. All deliverables must have project files associated with them.

E. GIS layers, or feature classes, are analogous to overlays in manual drafting systems and to layer/levels within a CADD drawing. Each GIS layer/feature class contains a logical grouping of features within a common feature type (e.g., buildings, roads, aprons, etc.).

F. The Authority GIS Database Dictionary and Metadata Specification and MWAA GIS Schema will be provided to the Contractor upon contract award, and can be provided in advance of award upon request.

G. Each feature in each layer/level of the GIS submittal will contain a number of associated attributes (stored in the ESRI File Geodatabase). The following attributes are required as part of each GIS submittal:

1. GIS Submittals organized using the Authority GIS Database Dictionary: For all GIS submittals accompanying record drawings at the end of the construction phase where no FAA submittal is required, each layer/feature class will include required attributes as per the Authority GIS Database Dictionary. The Authority GIS Database Dictionary indicates required attributes, optional attributes and in some cases valid attribute values.

H. Each feature class shall have a metadata file that contains the contents defined in the Authority metadata standard.

I. Final Data Dictionary shall be delivered in MS Excel format and include contents that are defined in MWAA GIS data dictionary template and new data not defined in the MWAA GIS data dictionary.

J. GIS Data Format: GIS Submittals shall be provided in the following formats:

1. ArcGIS 10.2 compatible File Geodatabase
2. ArcGIS map documents
3. MrSID and TIFF with projection files

K. GIS Data Content

1. Data content should include feature classes, attributes, and geometry information that are defined in existing MWAA GIS schema. Feature dataset structure should match with MWAA GIS schema. Deliverable will follow GIS standards in the latest Design Manual. Data that is not in the existing MWAA GIS schema should be included in a miscellaneous dataset if it is required for maintaining and managing the project area.

2. Map documents should be delivered for each feature dataset. Layer level Description/metadata should be included. Map Layer name must match with source file name.

2.3 RECORD SPECIFICATIONS
A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications. Print marked specifications, addenda, and contract modifications on paper any color but white and ensure that black font is clearly legible on the color chosen. Use the same paper color throughout the project. Use black font for these changes.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the brand name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of the manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Drawings, and Product Data where applicable.

2.4 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Drawings, and Product Data where applicable.
4. Upon completion of mark-up, submit a complete set of record Product Data to COTR for the Airports Authority's records.
5. Where Record Product Data is required as part of maintenance manuals, submit marked-up product data as an insert in the manual.

2.5 RECORD SAMPLE SUBMITTAL

A. Prior to date of Substantial Completion, the Contractor shall meet the Airports Authority's personnel at the site to determine which of the samples maintained during the construction period shall be transmitted to the Airports Authority for record purposes. Comply with the COTR's instructions for packaging, identification marking, and delivery to the Airports Authority's sample storage space. Dispose of other samples in manner specified for disposal of surplus and waste materials.

2.6 RECORD SCHEDULE

A. Record Schedule Submittal: Immediately prior to date of inspection for Final Acceptance, submit a copy of the As-built Contract CPM Schedule (if applicable) to the COTR.

B. Mark the Contractor’s Construction Schedule to show actual start and finish dates for all work activities and milestones, based on the accepted monthly updates. This Record Schedule shall
be in same format as Contractor’s Construction Schedule. This Record Schedule shall be in tabular and in time-scaled PDM plot formats.

2.7 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference. Submit to COTR.

1. Categories of requirements resulting in miscellaneous records include, but are not limited to the following:

   a. Field records on excavations and foundations.
   b. Field records on underground construction and similar Work.
   c. Survey showing locations and elevations of underground lines.
   d. Invert elevations of drainage piping.
   e. Surveys establishing building lines and levels.
   f. Authorized measurements utilizing unit prices or allowances.
   g. Records of plant treatment.
   h. Ambient and substrate condition tests.
   i. Certifications received in lieu of labels on bulk products.
   j. Batch mixing and bulk delivery records.
   k. Testing and qualification of tradesmen.
   l. Documented qualification of installation firms.
   m. Load and performance testing.
   n. Inspections and certifications by governing authorities.
   o. Leakage and water-penetration tests.
   p. Fire resistance and flame spread test results.
   q. Final inspection and correction procedures.
   r. Summary letter from Special Inspector indicating structural work was completed in accordance with applicable standards.
   s. Report of potable water testing.
   t. Backflow prevention certificates.
   u. Final inspections of all trades.
   v. Certificates for piping for fire protection systems and FPS supervisory systems.
   w. Approvals of Health Department or FDA as applicable.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project
Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Repair or reproduce torn or dirty sheets. Provide access to Project Record Documents for COTR's reference during normal working hours.

PART 4 - MEASUREMENT (Not Used)

PART 5 - PAYMENT (Not Used)

END OF SECTION 017839
SECTION 024116 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Demolition and removal of buildings and site improvements.
   2. Removing below-grade construction.
   3. Disconnecting, capping or sealing, and abandoning in-place site utilities.

B. Related Requirements:
   1. Division 01 Section "Summary" for use of the premises.
   2. Division 01 Section "Photographic Documentation" for preconstruction photographs taken before building demolition and other demolition operations.
   3. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
   4. Division 01 Section “Quality Requirements” for professional engineer qualifications
   5. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.
   6. Division 26 Sections for demolishing, cutting, patching, or relocating electrical items.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

B. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and reinstalled.

D. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store. Include fasteners or brackets needed for reattachment elsewhere.
1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of the Authority.

   1. Carefully salvage in a manner to prevent damage and promptly return to Authority.

1.5 PREINSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

   1. Inspect and discuss condition of construction to be demolished.
   2. Review structural load limitations of existing structures.
   3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review and finalize protection requirements.
   5. Review procedures for noise control and dust control.
   6. Review procedures for protection of adjacent site elements.
   7. Review items to be removed and reinstalled.

1.6 INFORMATIONAL SUBMITTALS

A. Retain "Engineering Survey" Paragraph below if survey is Contractor's responsibility.


C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

D. Schedule of Building Demolition Activities: Indicate the following:

   1. Detailed sequence of demolition work, with starting and ending dates for each activity.
   2. Temporary interruption of utility services.
   3. Shutoff and capping of utility services.

E. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Division 01 Section "Photographic Documentation." Submit before the Work begins.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.
1.8 FIELD CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. The Authority will occupy buildings immediately adjacent to selective demolition area. Conduct selective demolition so the Authority's operations will not be disrupted. Provide not less than 72 hours' notice to COTR of activities that will affect the Authority's operations.

C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
   1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from COTR.

D. The Authority assumes no responsibility for condition of areas to be selectively demolished.
   1. The Authority as far as practical will maintain conditions existing at time of inspection for proposal purposes.

E. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify COTR. Hazardous materials will be removed by Authority under a separate contract. For additional information refer to Section “Supplementary Conditions”.

F. On-site storage or sale of removed items or materials is not permitted.

1.9 COORDINATION

A. Arrange demolition schedule so as not to interfere with Authority’s on-site operations or operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving."
PART 3 - EXECUTION

3.1 EXAMINATION
A. Review Project Record Documents of existing construction or other existing condition information provided by Authority. The Authority does not guarantee that existing conditions are same as those indicated in Project Record Documents.

B. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

C. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

D. Inventory and record the condition of items to be removed and reinstalled.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
   1. Comply with requirements for existing services/systems interruptions specified in Division 1 Section “Summary”.

B. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
   1. COTR will arrange to shut off utilities when requested by Contractor. For additional information concerning utility outages refer to “Supplementary Conditions.
   2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
   3. Cut off pipe or conduit a minimum of 36 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
   4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PROTECTION
A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of demolition.
C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by the Airports Authority. Comply with requirements for existing services/systems interruptions specified in Division 1 Section "Summary.
2. Provide temporary services during interruptions to existing utilities, as acceptable the Airports Authority.

D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by the Authority and as indicated. Comply with requirements in Division 01 Section "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
4. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.

E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 DEMOLITION, GENERAL

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Obtain written approval from COTR before use of open flame. Obtain a welding/cutting permit from the Code Enforcement Division of the Metropolitan Washington Airports Authority Fire and Rescue Department before use of open flame.
3. Maintain fire watch and portable fire suppression devices during flame-cutting operations.
4. Maintain adequate ventilation when using cutting torches.
5. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from the Authority. Provide alternate routes around closed or obstructed trafficways if required by the Authority.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage
adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

D. Removed and Reinstalled Items: Comply with the following:
   1. Clean and repair items to functional condition adequate for intended reuse.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated

3.5 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

   1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet outside footprint indicated for new construction. Abandon below-grade construction outside this area.

   1. Remove below-grade construction, including basements, foundation walls, and footings, to at least 36 inches below grade.

D. Existing Utilities: Demolish existing utilities and below-grade utility structures for new construction as indicated on the Construction Drawings.

   1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Section 312000 "Earth Moving."

3.6 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

B. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 312000 "Earth Moving."
C. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.7 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reinstalled or otherwise indicated to remain Authority's property, remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.9 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116
SECTION 033053 - MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
   1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
   2. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture.

1.4 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. Comply with the following sections of ACI 301 unless modified by requirements in the Contract Documents:
   1. "General Requirements."
   2. "Formwork and Formwork Accessories."
   3. "Reinforcement and Reinforcement Supports."
   4. "Concrete Mixtures."
   5. "Handling, Placing, and Constructing."
B. Comply with ACI 117.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A1064/A1064M, as drawn.

C. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 CONCRETE MATERIALS

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

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.


D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water: ASTM C94/C94M.

2.4 RELATED MATERIALS

A. Vapor Retarder: Plastic sheet, ASTM E1745, Class A or B.

B. Vapor Retarder: Polyethylene sheet, ASTM D4397, not less than 10 mils thick; or plastic sheet, ASTM E1745, Class C.
C. Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber, or ASTM D1752, cork or self-expanding cork.

2.5 CURING MATERIALS
A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
B. Absorbptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.
C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
D. Water: Potable.
E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B.
F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.6 CONCRETE MIXTURES
A. Comply with ACI 301.
B. Normal-Weight Concrete:
   1. Minimum Compressive Strength: 4000 psi or as indicated on Construction Drawings at 28 days.
   2. Maximum W/C Ratio: 0.50.
   3. Cementitious Materials: Use fly ash, pozzolan, slag cement, and blended hydraulic cement as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
   4. Slump Limit: 4 inches, plus or minus 1 inch.
   5. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of trowel-finished floor slabs to exceed 3 percent.

2.7 CONCRETE MIXING
A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.
   1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION
A. Design, construct, erect, brace, and maintain formwork according to ACI 301.
3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR-RETARDER INSTALLATION

A. Install, protect, and repair vapor retarders according to ASTM E1643; place sheets in position with longest dimension parallel with direction of pour.

1. Lap joints 6 inches and seal with manufacturer's recommended adhesive or joint tape.

3.4 STEEL REINFORCEMENT INSTALLATION

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
3.6 CONCRETE PLACEMENT

A. Comply with ACI 301 for placing concrete.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Do not add water to concrete during delivery, at Project site, or during placement.

D. Consolidate concrete with mechanical vibrating equipment according to ACI 301.

E. Equipment Bases and Foundations:
   1. Coordinate sizes and locations of concrete bases with actual equipment provided.
   2. Construct concrete bases 6 inches high unless otherwise indicated; and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
   3. Minimum Compressive Strength: 4000 psi or as indicated at 28 days.
   4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor them into structural concrete substrate.
   6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.7 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch.

   1. Apply to concrete surfaces exposed to public view.

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

3.8 FINISHING UNFORMED SURFACES

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

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.
1. Do not further disturb surfaces before starting finishing operations.

C. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

D. Slip-Resistive Broom Finish: Apply a slip-resistant finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.9 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 305.1 for hot-weather protection during curing.

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

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorbive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorbive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
3.10 FIELD QUALITY CONTROL

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

B. Tests: Perform according to ACI 301.
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
   2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

END OF SECTION 033053
SECTION 110513 - COMMON MOTOR REQUIREMENTS FOR EQUIPMENT

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, alternating-current, small and medium, squirrel-cage induction motors, installed at equipment manufacturer's factory, and motors shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION
A. Coordinate features of motors, installed units, and accessory devices and features to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS
A. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
B. Comply with NEMA MG 1 unless otherwise indicated.
C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS
A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 110513
SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grout.
2. Common electrical installation requirements.

PART 2 - PRODUCTS

2.1 GROUT

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

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

END OF SECTION 26 05 00
SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

B. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

C. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

D. Class 1 Control Circuits: Type THHN-THWN, in raceway.

E. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

D. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."

E. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

G. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

H. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.


C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19
SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Multimode optical-fiber cabling.
   2. UTP cabling.
   3. RS-422 cabling.
   4. Low-voltage control cabling.
   5. Identification products.

1.3 DEFINITIONS
A. EMI: Electromagnetic interference.
B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
C. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.
D. RCDD: Registered Communications Distribution Designer.
E. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Wiring diagrams to show wiring schematics.

1.5 INFORMATIONAL SUBMITTALS
A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
B. Source quality-control reports.
C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS
A. Software and firmware operational documentation.
   1. Software operation and upgrade manuals.
   2. Program Software Backup: On magnetic media or compact disc, complete with data files.
   3. Device address list.
   4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE
A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS
A. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262 by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
   1. Flame Travel Distance: 60 inches or less.
   2. Peak Optical Smoke Density: 0.5 or less.
   3. Average Optical Smoke Density: 0.15 or less.

B. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.

C. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.3 OPTICAL-FIBER CABLE
A. Description: Multimode, 62.5/125-micrometer, min. 6-fiber, tight-buffer, optical-fiber cable.
1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA-568-C.3 for performance specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
   a. General Purpose, Nonconductive: Type OFN or Type OFNG.
   b. General Purpose, Conductive: Type OFC or Type OFCG.
5. Conductive cable shall be steel-armored type.
6. Maximum Attenuation: 3.5 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

2.4 OPTICAL-FIBER CABLE HARDWARE
A. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
   1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
B. Patch Cords: Factory-made, dual-fiber cables in 36-inchlengths.
C. Cable Connecting Hardware:
   2. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss of not more than 0.75 dB.
   3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.5 UTP CABLE
A. Description: 100-ohm, four-pair UTP, 24-pair UTP, formed into four-pair binder groups with no overall jacket, 25-pair UTP covered with a thermoplastic jacket.
   1. Comply with ICEA S-90-661 for mechanical properties of Category 5e cables.
   2. Comply with TIA-568-C.1 for performance specifications.
   3. Comply with TIA-568-C.2, Category 5e.
   4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with NEMA WC 66 and NFPA 70 for the following types:
Communications, Plenum Rated: Type CMP complying with UL 1685.

Communications, Plenum Rated: Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed per NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

Communications, General Purpose: Type CM or Type CMG.

Communications, General Purpose: Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed per NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

Communications, Limited Purpose: Type CMX.

2.6 UTP CABLE HARDWARE

A. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-C.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

B. Connecting Blocks: 110-style IDC for Category 5e. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

C. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

E. Jacks and Jack Assemblies: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-C.1.

F. Patch Cords: Factory-made, four-pair cables in 36-inch lengths; terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

2.7 RS-422 CABLE

A. Standard Cable: NFPA 70, Type CMG.

1. Paired, min three pair, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. PVC insulation.
3. Shielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

2.8 SOURCE QUALITY CONTROL
   A. Testing Agency: Engage a qualified testing agency to evaluate cables.
   B. Factory test UTP cables according to TIA-568-C.2.
   C. Factory test optical-fiber cables according to TIA-568-C.3.
   D. Cable will be considered defective if it does not pass tests and inspections.
   E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Test cables on receipt at Project site.
      1. Test optical-fiber cable to determine the continuity of the strand end to end. Use optical loss test set.
      2. Test optical-fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
      3. Test each pair of UTP cable for open and short circuits.

3.2 INSTALLATION OF RACEWAYS AND BOXES
   A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
      1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
      2. Outlet boxes for optical-fiber cables shall be no smaller than 4 inches square by 2-1/8 inches deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
      3. Flexible metal conduit shall not be used.
   B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.
   C. Install manufactured conduit sweeps and long-radius elbows if possible.

3.3 INSTALLATION OF CONDUCTORS AND CABLES
   A. Comply with NECA 1 and NFPA 70.
B. General Requirements for Cabling:

2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems."
3. Terminate all conductors and optical fibers; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced.
5. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
10. Support: Do not allow cables to lay on removable ceiling tiles.
11. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.

C. UTP Cable Installation:

2. Install termination hardware as specified in Section 271500 "Communications Horizontal Cabling" unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

E. Optical-Fiber Cable Installation:

2. Terminate cable on connecting hardware that is rack or cabinet mounted.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 REMOVAL OF CONDUCTORS AND CABLES
   A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified for future use with a tag.

3.5 FIRESTOPPING
   A. Comply with TIA-569-B, Annex A, "Firestopping."
   B. Comply with BICSI TDMM, "Firestopping" Chapter.
3.6 GROUNDING

A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For low-voltage control wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Identify data and communications system components, wiring, and cabling according to TIA-606-A; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. Visually inspect UTP and optical-fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test UTP cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross-connection.

   a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. Optical-Fiber Cable Tests:

   a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.0. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

   b. Link End-to-End Attenuation Tests:
1) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.

2) Attenuation test results for links shall be less than 2.0 dB that calculated according to equation in TIA-568-C.0.

D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 260523
SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.
C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad, 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, size as indicated. Bury at least 24 inches below grade.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.

B. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

C. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in
raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3. INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
   a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 750 kVA and Less: 50 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26
SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 SUBMITTALS

A. Product Data: For steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapezoidal hangers. Include Product Data for components.
   2. Steel slotted channel systems. Include Product Data for components.
   3. Equipment supports.

C. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
   3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
   4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To New Concrete: Bolt to concrete inserts.
2. To Existing Concrete: Expansion anchor fasteners.
3. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
4. To Steel: Spring-tension clamps.
5. To Light Steel: Sheet metal screws.

3.3 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Clean and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29
SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. See Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks and manholes, and underground handholes, boxes, and utility construction.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. LFMC: Flexible steel conduit with PVC jacket.

C. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.


2.2 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

B. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.
2.3 METAL WIREWAYS
   A. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 3R, unless otherwise indicated.
   B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
   C. Wireway Covers: As indicated.
   D. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALIC WIREWAYS
   A. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
   B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.5 BOXES, ENCLOSURES, AND CABINETS
   A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
   B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
   C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
   D. Nonmetallic Floor Boxes: Nonadjustable, round.
   E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
   F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum or galvanized cast iron with gasketed cover.
   G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
      1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   H. Cabinets:
      1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
      2. Hinged door in front cover with flush latch and concealed hinge.
      3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
   1. Exposed Conduit: Rigid steel conduit.
   2. Concealed Conduit, Aboveground: Rigid steel conduit.
   3. Underground Conduit: RNC, Type EPC-40-PVC.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed, Not Subject to Physical Damage: EMT.
   2. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
      a. Mechanical rooms.
   3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
   5. Damp or Wet Locations: GRC.
   6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250.

C. Minimum Raceway Size: 3/4 inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, before rising above the floor.

H. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

I. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

J. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70.

K. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations.

END OF SECTION 26 05 33
SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
   A. This Section includes the following:
      1. Conduit, ducts, and duct accessories for concrete-encased duct banks.
      2. Handholes and boxes.

1.2 SUBMITTALS
   A. Product Data: For accessories for handholes and boxes.
   B. Shop Drawings for Factory-Fabricated Handholes and Boxes: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
      1. Duct entry provisions, including locations and duct sizes.
      2. Cover design.
      4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
   C. Field quality-control test reports.

1.3 QUALITY ASSURANCE
   A. Comply with ANSI C2.
   B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUIT
   B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES
   A. Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
B. Duct Accessories:
   1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
   2. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."
   3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.
      b. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch- deep letters.

2.3 HANDHOLES AND BOXES

A. Description: Comply with SCTE 77.
   2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
   3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
   4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   5. Cover Legend: Molded lettering, "ELECTRIC".
   7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and Backfill: Comply with Division 31 but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32.

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."
3.2 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward handholes and away from buildings and equipment. Slope ducts from a high point in runs between two handholes to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
   2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
   3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

F. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.

G. Concrete-Encased Ducts: Support ducts on duct separators.
   1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
   2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
      a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
      b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
   3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank
assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

4. **Reinforcement:** Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

5. **Forms:** Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

6. **Minimum Space between Ducts:** 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.

7. **Depth:** Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.

8. **Stub-Ups:** Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
   
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encaise coupling with 3 inches of concrete.
   
   b. **Stub-Ups to Equipment:** For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

9. **Warning Tape:** Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

**H. Direct-Buried Duct Banks:**

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.

2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.

3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 for pipes less than 6 inches in nominal diameter.

4. Install backfill as specified in Division 31.

5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31.

6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
   b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
11. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

3.3 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below the frost line, 30 inches below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.4 GROUNDING

A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.6 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 26 05 43
SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Identification for conductors and communication and control cable.
2. Warning labels and signs.
3. Equipment identification labels.

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

1.4 COORDINATION


PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Marker Tape: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 WARNING LABELS AND SIGNS

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

E. Fasteners for Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.3 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

PART 3 - EXECUTION

3.1 APPLICATION

A. Auxiliary Electrical Systems Conductor and Cable Identification: Use marker tape to identify field-installed alarm, control, signal, sound, intercommunications, voice, and data wiring connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and cable pull points. Identify by system and circuit designation.

2. Use system of designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

B. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

C. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control
panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
   a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where 2 lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment.
   c. Elevated Components: Increase sizes of labels and legend to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:
   a. Panelboards, electrical cabinets, and enclosures.
   b. Disconnect switches.
   c. Motor starters.
   d. Push-button stations.
   e. Contactors.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied.
2. Colors for 208/120-V Circuits:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.
3. Colors for 480/277-V Circuits:
b. Phase B: Orange.
c. Phase C: Yellow.

END OF SECTION 26 05 53
SECTION 260850 APPARATUS INSPECTION AND TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes procedures for acceptance and testing of electrical equipment.

B. Related Requirements:
   1. Section 26 05 19 Low-Voltage Electrical Power Conductors and Cables
   2. Section 26 22 00 Low-Voltage Transformers
   3. Section 26 24 16 Panelboards
   4. Section 26 28 16 Enclosed Switches and Circuit Breakers

1.3 DEFINITIONS

A. NETA ATS: Acceptance testing specification.

1.4 INFORMATIONAL SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

B. Test Reports

   Acceptance tests and inspections

C. Certificates

   Qualifications of organization, and lead engineering technician
   Acceptance test and inspections procedure

1.5 QUALITY ASSURANCE

A. Qualifications:

   Contractor shall engage the services of a qualified testing organization to provide inspection, testing, calibration, and adjustment of the electrical distribution system and generation
equipment listed in paragraph entitled "Acceptance Tests and Inspections" herein. Organization shall be independent of the supplier, manufacturer, and installer of the equipment. The organization shall be a first tier subcontractor. No work required by this section of the specification shall be performed by a second tier subcontractor.

1. Submit name and qualifications of organization. Organization shall have been regularly engaged in the testing of electrical materials, devices, installations, and systems for a minimum of 5 years. The organization shall have a calibration program, and test instruments used shall be calibrated in accordance with NETA ATS.

2. Submit name and qualifications of the lead engineering technician performing the required testing services. Include a list of three comparable jobs performed by the technician with specific names and telephone numbers for reference. Testing, inspection, calibration, and adjustments shall be performed by an engineering technician, certified by NETA or the National Institute for Certification in Engineering Technologies (NICET) with a minimum of 5 years' experience inspecting, testing, and calibrating electrical distribution and generation equipment, systems, and devices.

B. Acceptance Tests and Inspections Reports

Submit certified copies of inspection reports and test reports. Reports shall include certification of compliance with specified requirements, identify deficiencies, and recommend corrective action when appropriate. Type and neatly bind test reports to form a part of the final record. Submit test reports documenting the results of each test not more than 10 days after test is completed.

C. Acceptance Test and Inspections Procedure

Submit test procedure reports for each item of equipment to be field tested at least 45 days prior to planned testing date. Do not perform testing until after test procedure has been approved.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 ACCEPTANCE TESTS AND INSPECTIONS

Testing organization shall perform acceptance tests and inspections. Test methods, procedures, and test values shall be performed and evaluated in accordance with NETA ATS, the manufacturer's recommendations, and paragraph entitled "Field Quality Control" of each applicable specification section. Tests identified as optional in NETA ATS are not
required unless otherwise specified. Equipment shall be placed in service only after completion of required tests and evaluation of the test results have been completed. Contractor shall supply to the testing organization complete sets of shop drawings, settings of adjustable devices, and other information necessary for an accurate test and inspection of the system prior to the performance of any final testing. Contracting Officer shall be notified at least 14 days in advance of when tests will be conducted by the testing organization. Perform acceptance tests and inspections on applicable equipment and systems specified in the following sections:

A. Section 26 05 19 Low-Voltage Electrical Power Conductors and Cables
B. Section 26 22 00 Low-Voltage Transformers
C. Section 26 24 16 Panelboards
D. Section 26 28 16 Enclosed Switches and Circuit Breakers

3.2 SYSTEM ACCEPTANCE

Final acceptance of the system is contingent upon satisfactory completion of acceptance tests and inspections.

3.3 PLACING EQUIPMENT IN SERVICE

A representative of the approved testing organization shall be present when equipment tested by the organization is initially energized and placed in service.

END OF SECTION 260850
SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

   1. Distribution transformers.

1.3 ACTION SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.


1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Source quality-control test reports.

C. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.
1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

B. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.8 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Copper.

2.2 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
B. Cores: One leg per phase.

C. Enclosure: Ventilated, NEMA 250, Type 2.
   1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

D. Transformer Enclosure Finish: Comply with NEMA 250.
   1. Finish Color: Gray

E. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

F. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

G. Energy Efficiency for Transformers Rated 15 kVA and Larger:
   1. Complying with NEMA TP 1, Class 1 efficiency levels.
   2. Tested according to NEMA TP 2.

H. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
   1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
   2. Include special terminal for grounding the shield.
   3. Shield Effectiveness:
      a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
      b. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.
      c. Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.

I. Wall Brackets: Manufacturer's standard brackets.

J. Fungus Proofing: Permanent fungicidal treatment for coil and core.

2.3 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.4 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.
B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

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

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

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

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
C. Perform tests and inspections and prepare test reports.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

E. Remove and replace units that do not pass tests or inspections and retest as specified above.

F. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING
   A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

   B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING
   A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 22 00
SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 SUBMITTALS

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

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types and details for types other than NEMA 250, Type 1.

3. Detail bus configuration, current, and voltage ratings.

4. Short-circuit current rating of panelboards and overcurrent protective devices.

5. Include evidence of NRTL listing for series rating of installed devices.

6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

7. Include wiring diagrams for power, signal, and control wiring.

8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

C. Field quality-control reports.

D. Panelboard schedules for installation in panelboards.

E. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344.

B. Enclosures: Flush-mounted cabinets.

1. Rated for environmental conditions at installed location.
   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   b. Outdoor Locations: NEMA 250, Type 3R.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.


C. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

D. Conductor Connectors: Suitable for use with conductor material and sizes.


2. Main and Neutral Lugs: Mechanical type.

3. Ground Lugs and Bus Configured Terminators: Mechanical type.

4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: As indicated.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
   1. External Control-Power Source: 120-V branch circuit.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
   2. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
      a. Standard frame sizes, trip ratings, and number of poles.
      b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
      c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
      d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
      e. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 90 inches above finished floor unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
D. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

G. Comply with NECA 1.

### 3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### 3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
END OF SECTION 26 24 16
SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.

1.2 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

2.2 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
2.3 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed
      and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-
   resistant, die-cast aluminum with lockable cover.

2.4 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.
   1. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated
      or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise
   noted.

B. Coordination with Other Trades:
   1. Take steps to insure that devices and their boxes are protected. Do not place wall finish
      materials over device boxes and do not cut holes for boxes with routers that are guided by
      riding against outside of the boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust,
      paint, and other material that may contaminate the raceway system, conductors, and
      cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint
      unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
   1. Do not strip insulation from conductors until just before they are spliced or terminated on
      devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid
      scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70,
      Article 300, without pigtails.
   4. Existing Conductors:
a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailling existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 110 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 3 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

END OF SECTION 26 27 26
SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
   1. Nonfusible switches.
   3. Enclosures.

1.2 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 NONFUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.2 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
   3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.

B. Molded-Case Circuit-Breaker Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
   3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.3 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
   1. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.

B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 03.
C. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

D. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

E. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

G. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.
2. Verify switch and relay type and labeling verification.
3. Verify rating of installed fuses.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION 26 28 16
SECTION 265619 - LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.
4. Poles and accessories for support of luminaires

1.2 DEFINITIONS

A. CCT: Correlated color temperature.
B. CRI: Color rendering index.
C. Fixture: See "Luminaire."
D. IP: International Protection or Ingress Protection Rating
E. Lumen: Measured output of lamp and luminaire, or both.
F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.
G. Pole: Luminaire-supporting structure, including tower used for large-area illumination.
H. Standard: See "Pole."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.
B. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.
C. Delegated-Design Submittal: For luminaire supports.
   1. Include design calculations for luminaire supports.
1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale and coordinated.

B. Product Certificates: For each type of the following:
   1. Luminaire.
   2. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.

C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
   1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
   2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.6 FIELD CONDITIONS

A. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.7 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 1598 and listed for wet location.

C. Lamp base complying with ANSI C81.61.

D. CRI of minimum 80. CCT of 3000 K.
E. L70 lamp life of 50,000 hours.

F. Lamps dimmable from 100 percent to 0 percent of maximum light output.

G. Nominal Operating Voltage: As indicated.

H. Lamp Rating: Lamp marked for outdoor use.

I. Source Limitations: Obtain luminaires from single source from a single manufacturer.

J. Provide inline fuse holder located within pole base.

2.2 LUMINAIRE TYPES

A. Area and Site:
   1. Luminaire Shape: Square.
   2. Mounting: Pole with extruded-aluminum rectangular
   3. Luminaire-Mounting Height: As indicated.
   4. Distribution: Type I.

2.3 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:
   1. Glass: Annealed crystal glass unless otherwise indicated.
   2. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

G. Housings:
1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

2.4 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Color: Black with K-61 Finish

2.5 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

2.6 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 221, Alloy 6063-T6, with access handhole in pole wall.

B. Mast Arms: Aluminum Single-arm type, continuously welded to pole attachment plate. Material and finish same as plate.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Bolted 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Fasteners: Stainless steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.
   1. Materials: Compatible with poles and standards as well as to substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
F. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

G. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

H. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   2. Color: Black with K-61 Finish

2.7 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.

B. Transformer-Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and to accept drivers. Include removable flanged access cover secured with bolts or screws.

2.8 MOUNTING HARDWARE

A. Anchor Bolts: Manufactured to ASTM F 1554, Grade 55, with a minimum yield strength of 55,000 psi.

B. Nuts: ASTM A 563, Grade A, Heavy-Hex

C. Washers: ASTM F 436, Type 1.

D.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Install lamps in each luminaire.

C. Fasten luminaire to structural support.

D. Supports:
   1. Sized and rated for luminaire weight.
   2. Able to maintain luminaire position after cleaning and relamping.
   3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.


F. Coordinate layout and installation of luminaires with other construction.

G. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

H. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

I. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.

3.2 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

   1. Install grounding electrode for each pole unless otherwise indicated.
   2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground Nonmetallic Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

   1. Install grounding electrode for each pole.
   2. Install grounding conductor and conductor protector.
   3. Ground metallic components of pole accessories and foundation.

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
3.5 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:
   
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

   2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

C. Luminaire will be considered defective if it does not pass tests and inspections.

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265619
SECTION 271005 - STRUCTURED CABLEING FOR VOICE AND DATA

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Communications pathways.
B. Copper cable and terminations.
C. Fiber optic cable and interconnecting devices.
D. Communications identification.

1.2 RELATED REQUIREMENTS

A. Section 260533 - Raceway and Boxes for Electrical Systems.

1.3 REFERENCE STANDARDS

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
J. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; Rev C, 2009 (with Addenda; 2016).
L. TIA-569-D - Telecommunications Pathways and Spaces; Rev D, 2015.
M. TIA-598-D - Optical Fiber Cable Color Coding; Rev D, 2014.


P. UL 444 - Communications Cables; Current Edition, Including All Revisions.

Q. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.

R. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
   2. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate locations of existing utilities. Hand trench to expose existing utilities at all crossings.
   4. Land telecommunication, security, and camera cables within IT closet in Police Station as indicated.

1.5 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Field Test Reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep stored products clean and dry.

PART 2 PRODUCTS

2.1 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for video, security, and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
1. Comply with TIA-568 (SET) (cabling) and TIA-569-D (pathways), latest editions (commercial standards).
2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607-C and are UL listed or third party independent testing laboratory certified.
3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F (0 to 60 degrees C) at relative humidity of 0 to 95 percent, noncondensing.

2.2 PATHWAYS
A. Conduit: As specified in Section 260533; provide pull cords in all conduit.

2.3 COPPER CABLE AND TERMINATIONS
A. Copper Horizontal Cable:
   1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568-C.2 and listed and labeled as complying with UL 444.
   2. Cable Type: Security, Voice, and Data: TIA-568-C.2 Category 6 UTP (unshielded twisted pair); 23 AWG.
   3. Cable Capacity: 4-pair.

   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. CAT6 Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

2.4 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES
A. Provide cables with lead content less than 300 parts per million.

   B. Fiber Optic Backbone Cable:
   1. Description: Tight buffered, non-conductive fiber optic cable complying with TIA-568-C.3, TIA-598-D, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.
   2. Cable Type: Single-mode, 8.3/125 um (OS2) complying with TIA-492CAAB.
   3. Cable Capacity: 6-fiber.

   C. Fiber Optic Interconnecting Devices:
   1. Connector Type: Type SC.
   2. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.
3. Maximum Attenuation/Insertion Loss: 0.3 dB.

2.5 IDENTIFICATION PRODUCTS
A. Comply with TIA-606-B and MWAA Facility standard.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL
A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569-D (pathways), TIA-607-C (grounding and bonding), NECA/BICSI 568, 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-C and NFPA 70.

3.2 INSTALLATION OF PATHWAYS
A. Conduit, in Addition to Requirements of Section 260534:
   1. Arrange conduit to provide no more than the equivalent of two 90 degree bend(s) between pull points.
   2. Conduit Bends: Inside radius not less than 10 times conduit internal diameter.

3.3 INSTALLATION OF EQUIPMENT AND CABLELING
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 Outlets or Devices- Copper: 12 inches (305 mm).
   2. At Outlets or Devices - Optical Fiber: 39 inches (1000 mm).
C. Copper Cabling:
   1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch (12 mm) from point of termination.
   2. For 4-pair cables in conduit, do not exceed 25 pounds (110 N) pull tension.
3. 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.

3.4 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. Category 5e and Above Backbone: Perform near end cross talk (NEXT) and attenuation tests.

D. Testing - Fiber Optic Cabling:
   1. Multimode Backbone: Perform tests in accordance with TIA-526-14.
   3. Links: Perform optical fiber end-to-end attenuation tests and field reel tests.

END OF SECTION
SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Removing existing vegetation.
   2. Clearing and grubbing.
   3. Stripping and stockpiling topsoil.
   4. Removing above- and below-grade site improvements.
   5. Temporary erosion and sedimentation control.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.
1.6 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or video recordings.

B. Topsoil stripping and stockpiling program.

C. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.7 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Authority.
   2. Provide alternate routes around closed or obstructed trafficways if required by the Authority.

B. Utility Locator Service: Employ an underground utilities location subcontractor to locate and mark the location of all utility lines that might be impacted by construction activities.
   1. Contractor shall contact the Authority’s Airport Communication System (ACS) Help Desk at (703) 417-8300 a minimum of 72 hours prior to starting activities that disturb the ground.
   2. Contractor shall contact the International Airport Dulles (IAD) Engineering & Maintenance Utilities Service Division at (703) 572-2830 a minimum of 72 hours prior to starting activities that disturb the ground.

C. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

D. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to the Authority.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
   1. COTR will arrange to shut off indicated utilities when requested by Contractor. For additional information concerning utility outages refer to “Supplementary Conditions.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted by the Authority in compliance with the requirements for existing services/systems interruptions specified in Division 1 Section "Summary".
C. Removal of underground electrical utilities is included in applicable electrical sections. Disconnecting, capping, or sealing and abandoning utilities in place is included in Section 024116 “Structure Demolition” and 334200 “Stormwater Conveyance” for closing abandoned storm drainage systems.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain.
   2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 24 inches below exposed subgrade. Where existing trees are to be removed within the proposed roadway, curb and gutter, or other hardscape areas, remove stumps completely.
   3. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Limit height of topsoil stockpiles to 72 inches.
   2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

END OF SECTION 311000
SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for walks, pavements and turf and grasses.
3. Excavating and backfilling for buildings and structures.
4. Subbase course for concrete walks.
5. Subbase course and base course for asphalt paving.
6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

1. Section 013233 "Photographic And Video Recording Documentation" for recording preexcavation and earth-moving progress.
2. Section 024116 “Structure Demolition” for disconnecting, capping, or sealing and abandoning utilities in place.
3. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements.
4. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
5. Section 334200 “Stormwater Conveyance” for materials and trench excavation for stormwater storage systems.

1.3 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by COTR. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
   2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by COTR. Unauthorized excavation, as well as remedial work directed by COTR, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
   1. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.
   2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and a cement concrete walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at Project site.
   1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
a. Personnel and equipment needed to make progress and avoid delays.
b. Coordination of Work with utility locator service.
c. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
   1. Geotextiles.
   2. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:
   2. Warning Tape: 12 inches long; of each color.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

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

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.7 QUALITY ASSURANCE

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

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Authority.
   2. Provide alternate routes around closed or obstructed traffic ways if required by the Authority.

B. Utility Locator Service: Employ an underground utilities location subcontractor to locate and mark the location of all utility lines that might be impacted by construction activities.
1. Contractor shall contact the Authority’s Airport Communication System (ACS) Help Desk at (703) 417-8300 a minimum of 72 hours prior to starting activities that disturb the ground.

2. Contractor shall contact the International Airport Dulles (IAD) Engineering & Maintenance Utilities Service Division at (703) 572-2830 a minimum of 72 hours prior to starting activities that disturb the ground.

C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 015000 "Temporary Facilities and Controls" and Section 311000 "Site Clearing" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Sand: ASTM C33/C33M; fine aggregate.

2.2 GEOTEXTILES

A. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2; AASHTO M 288.
2. Survivability: As follows:
   a. Grab Tensile Strength: 247 lbf; ASTM D4632.
   b. Sewn Seam Strength: 222 lbf; ASTM D4632.
   c. Tear Strength: 90 lbf; ASTM D4533.
   d. Puncture Strength: 90 lbf; ASTM D4833.
3. Apparent Opening Size: No. 60 sieve, maximum; ASTM D4751.
4. Permittivity: 0.02 per second, minimum; ASTM D4491.
5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

2.3 ACCESSORIES

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

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

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

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

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavation for Underground Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.
3.6 EXCAVATION FOR WALKS AND PAVEMENTS
   A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES
   A. Excavate trenches to indicated gradients, lines, depths, and elevations.
      1. Excavate trenches to allow installation of top of pipe below frost line.
   B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
      1. Clearance: 12 inches each side of pipe or conduit.
   C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
      1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

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

3.9 UNAUTHORIZED EXCAVATION
   A. Fill unauthorized excavation as directed by COTR.
3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill voids with satisfactory soil while removing shoring and bracing.

D. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
   a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:

1. Under pavements, scarify and recom pact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recom pact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recom pact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.
3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D698.

3.18 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:
1. **Paved Areas**: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.

2. **Trench Backfill**: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

### 3.19 PROTECTION

A. **Protecting Graded Areas**: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. **Repair and reestablish grades to specified tolerances** where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by COTR; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000
SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt overlay.
3. Cold milling of existing asphalt pavement.
5. Asphalt curbs.
6. Asphalt traffic-calming devices.
7. Asphalt surface treatments.

B. Related Requirements:

1. Section 024116 "Structure Demolition" for demolition and removal of existing asphalt pavement.
2. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
3. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.
4. Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

   a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
   b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
1.4 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.
   1. Paving geotextile.
   2. Joint sealant.

B. Hot-Mix Asphalt Designs:
   1. Certification, by authorities having jurisdiction, of approval of each hot-mix asphalt design proposed for the Work.
   2. For each hot-mix asphalt design proposed for the Work.

C. Samples for Verification: For the following product, in manufacturer's standard sizes unless otherwise indicated:
   1. Paving Geotextile: 12 by 12 inches minimum.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For paving-mix manufacturer and testing agency.

B. Material Certificates: Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.
   1. Aggregates.
   2. Asphalt binder.
   3. Asphalt cement.
   4. Cutback prime coat.
   5. Emulsified asphalt prime coat.
   6. Tack coat.
   7. Fog seal.
   8. Undersealing asphalt.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

B. Testing Agency Qualifications: Qualified in accordance with ASTM D3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Virginia Department of Transportation (VDOT) for asphalt paving work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Tack Coat: Minimum surface temperature of 60 deg F.
4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS


D. Emulsified Asphalt Prime Coat: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

E. Tack Coat: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
F. Fog Seal: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

G. Water: Potable.


2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Sand: AASHTO M 29, Grade No. 2 or No. 3.

C. Joint Sealant: ASTM D6690, Type I, hot-applied, single-component, polymer-modified bituminous sealant.

2.4 MIXES

A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Base Course: Superpave BM-25.0

B. Emulsified-Asphalt Slurry: ASTM D3910, Type 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

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

3.2 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
   1. Mill to a depth of a minimum depth of 1-1/2 inches or as indicated on the drawings.
   2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
   3. Control rate of milling to prevent tearing of existing asphalt course.
   4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling.
   5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
   6. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.
   7. Handle milled asphalt material in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."
   8. Keep milled pavement surface free of loose material and dust.
   9. Do not allow milled materials to accumulate on-site.

3.4 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
   1. Undersealing: Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
   2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd..
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
D. Placing Single-Course Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E. Placing Two-Course Patch Material: Partially fill excavated pavements with hot-mix asphalt base course mix and, while still hot, compact. Cover asphalt base course with compacted layer of hot-mix asphalt surface course, finished flush with adjacent surfaces.

3.5 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

   1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

   1. Clean cracks and joints in existing hot-mix asphalt pavement.
   2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
   3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.6 SURFACE PREPARATION

A. Ensure that prepared subgrade has been proof-rolled and is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

B. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
   2. Protect primed substrate from damage until ready to receive paving.

C. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
   2. Protect primed substrate from damage until ready to receive paving.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.,
1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

### 3.7 HOT-MIX ASPHALT PLACEMENT

#### A. Machine placing hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

#### B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

#### C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.8 JOINTS

#### A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method in accordance with AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.
3.9 COMPACTED

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

   1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

   1. Average Density, Marshall Test Method: 96 percent of reference laboratory density in accordance with AASHTO T 245, but not less than 94 percent or greater than 100 percent.
   2. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:

   1. Base Course: Plus or minus 1/2 inch.
   2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Asphalt Traffic-Calming Devices: Compact and form asphalt to the shapes indicated and within a tolerance of plus or minus 1/8 inch of height indicated above pavement surface.

3.11 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry coat in a uniform thickness in accordance with ASTM D3910 and allow to cure.
   1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined in accordance with ASTM D3549/D3549M.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with AASHTO T 168.
   1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared in accordance with ASTM D2041/D2041M, and compacted in accordance with job-mix specifications.
   2. In-place density of compacted pavement will be determined by testing core samples in accordance with ASTM D1188 or ASTM D2726/D2726M.
      a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method in accordance with ASTM D2950/D2950M and coordinated with ASTM D1188 or ASTM D2726/D2726M.

F. Replace and compact hot-mix asphalt where core tests were taken.
G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 WASTE HANDLING

A. General: Handle asphalt-paving waste in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 321216
SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes Concrete Paving. Including the Following:
   1. Curbs and gutters.
   2. Sidewalks.

B. Related Requirements:
   1. Section 033053 "Miscellaneous Cast-in-Place Concrete" for general building applications of concrete.
   2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
   3. Section 321723 "Pavement Markings."
   4. Section 321726 "Tactile Warning Surfacing" for detectable warning tiles.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Review methods and procedures related to concrete paving, including but not limited to, the following:
      a. Concrete mixture design.
      b. Quality control of concrete materials and concrete paving construction practices.

   2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer of stamped detectable warnings ready-mix concrete manufacturer and testing agency.

B. Material Certificates: For the following, from manufacturer:

   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Fiber reinforcement.
   4. Admixtures.
   5. Curing compounds.
   7. Bonding agent or epoxy adhesive.
   8. Joint fillers.

C. Material Test Reports: For each of the following:

   1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.
B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

C. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

1.8 PRECONSTRUCTION TESTING

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

1.9 FIELD CONDITIONS

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

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.
PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
   1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn galvanized-steel wire into flat sheets.

B. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A767/A767M, Class I coating. Cut bars true to length with ends square and free of burrs.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

D. Zinc Repair Material: ASTM A780/A780M.

2.4 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C150/C150M, white portland cement Type I.
   2. Fly Ash: ASTM C618, Class C.
   3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
B. Normal-Weight Aggregates: ASTM C33/C33M, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260/C260M.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

E. Water: Potable and complying with ASTM C94/C94M.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
D. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

2.7 STAMPED DETECTABLE WARNING MATERIALS

A. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.

1. Size of Stamp: One piece, matching detectable warning area shown on Drawings.

B. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Slag Cement: 50 percent.
3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 5-1/2 percent plus or minus 1-1/2 percent for 1-1/2-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Concrete Mixtures: Normal-weight concrete.

2. Maximum W/C Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

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

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.
3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of a minimum 50 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes.
   a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
   a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.
3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true
planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.8 DETECTABLE WARNING INSTALLATION

A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Section 321726 "Tactile Warning Surfacing."

1. Tolerance for Opening Size: Plus 1/4 inch, no minus.

B. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles specified in Section 321726 "Tactile Warning Surfacing." Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete to comply with Section 321726 "Tactile Warning Surfacing" immediately after screeding concrete surface.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

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

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing moisture-retaining-cover curing curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
3. Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 1000 sq. ft. or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.
a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.12 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313
SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Cold-applied, fuel-resistant joint sealants.
5. Joint-sealant backer materials.
6. Primers.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
1.5 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For Installer.
   B. Product Certificates: For each type of joint sealant and accessory.

1.6 QUALITY ASSURANCE
   A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
   B. Product Testing: Test joint sealants using a qualified testing agency.

1.7 FIELD CONDITIONS
   A. Do not proceed with installation of joint sealants under the following conditions:
      1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
      2. When joint substrates are wet.
      3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
      4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL
   A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS
   A. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D5893/D5893M, Type SL.

2.3 HOT-APPLIED JOINT SEALANTS
   A. Hot-Applied, Single-Component Joint Sealant: ASTM D6690, Type I, II, or III.
2.4 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of joint-sealant backings.
   2. Do not stretch, twist, puncture, or tear joint-sealant backings.
   3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
   1. Place joint sealants so they fully contact joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
   1. Remove excess joint sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.
3.5 PAVING-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within concrete paving.

1. Joint Location:
   a. Expansion and isolation joints in concrete paving.
   b. Contraction joints in concrete paving.
   c. Other joints as indicated.


B. Joint-Sealant Application: Joints within concrete paving and between concrete and asphalt paving.

1. Joint Location:
   a. Joints between concrete and asphalt paving.
   b. Joints between concrete curbs and asphalt paving.
   c. Other joints as indicated.


END OF SECTION 321373
SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Painted markings applied to asphalt paving.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to marking asphalt paving including, but not limited to, the following:

a. Asphalt-paving aging period before application of pavement markings.
b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.4 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.

1. Pavement-marking paint, acrylic.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Virginia Department of Transportation (VDOT) for pavement-marking work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
1.6 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials or 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.

2.2 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint, Acrylic: Acrylic, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952F, Type II, with drying time of less than three minutes.


PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow asphalt paving to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723
SECTION 321726 - TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

2. Surface-applied detectable warning tiles.
3. Detectable warning mats.
5. Surface-applied detectable warning metal tiles.
6. Detectable warning unit pavers.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.
2. Section 321400 "Unit Paving" for unit paving installations incorporating detectable warning unit pavers specified in this Section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of tactile warning surface, in manufacturer's standard sizes unless otherwise indicated, showing edge condition, truncated-dome pattern, texture, color, and cross section; with fasteners and anchors.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1.6 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Mortar and Grout:


2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

   a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set unit pavers within 1 minute of spreading setting-bed mortar.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Deterioration of finishes beyond normal weathering and wear.

   b. Separation or delamination of materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for tactile warning surfaces.

1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

B. Source Limitations: Obtain each type of tactile warning surfacing, joint material, setting material, anchor, and fastener from single source with resources to provide materials and products of consistent quality in appearance and physical properties.
2.2 DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles with replaceable surface configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.

3. Shapes and Sizes:
   a. Rectangular panel, 24 by 48 inches.
5. Mounting:
   a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:

1. Furnish Type 316 stainless-steel fasteners for exterior use.
2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.

B. Adhesive: As recommended by manufacturer for adhering tactile warning surfacing unit to pavement.

C. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.3 INSTALLATION OF DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles:
   1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
   2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
   3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.
   4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
   5. Clean tiles using methods recommended in writing by manufacturer.

3.4 INSTALLATION OF DETECTABLE WARNING MATS

A. Lay out detectable warning mats as indicated and mark concrete pavement at edges of mats.

B. Prepare existing paving surface by grinding and cleaning as recommended by manufacturer.

C. Apply adhesive to back of mat in amounts and pattern recommended by manufacturer, and set mat in place. Firmly seat mat in adhesive bed, eliminating air pockets and establishing full adhesion to pavement. If necessary, temporarily apply weight to mat to ensure full contact with adhesive.

D. Install anchor devices through face of mat and into pavement using anchors located as recommended by manufacturer. Set heads of anchors flush with mat surface.

E. Mask mat perimeter and adjacent concrete, and apply sealant in continuous bead around perimeter of mat.

F. Remove masking, adhesive, excess sealant, and soil from exposed surfaces of detectable warning mat and surrounding concrete pavement using cleaning agents recommended in writing by manufacturer.

G. Protect installed mat from traffic until adhesive has set.
3.5 CLEANING AND PROTECTION

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 321726
SECTION 323113.53 - HIGH-SECURITY CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. High-security chain-link fences.
2. Swing gates.
3. Horizontal-slide, motor-operated gates.

B. Related Requirements:

1. Section 013513.16 "Special Project Procedures for Detention Facilities" for general requirements of detention work, including responsibilities of a single-source detention specialist.
2. Section 033053 "Miscellaneous Cast-in-Place Concrete" for cast-in-place concrete equipment bases/pads for gate operators and controls post footings and concrete weed barrier.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review coordination of soil sterilization with work specified elsewhere.
3. Review sequence of operation for each type of gate operator.
4. Review coordination of interlocked equipment specified in this Section and elsewhere.
5. Review required testing, inspecting, and certifying procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

   a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Accessories: Barbed wire.
d. Gates and hardware.
e. Gate operator, including operating instructions and motor characteristics.

B. Shop Drawings: For each type of fence and gate assembly.
1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.
3. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
4. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For each type of factory-applied finish.

D. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:
1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

1.5 INFORMATIONAL SUBMITTALS
A. Qualification Data: For factory-authorized service representative.
B. Product Certificates: For each type of chain-link fence, operator, and gate.
C. Product Test Reports: For framework strength according to ASTM F1043, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
D. Field quality-control reports.
E. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE
A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of high-security chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure to comply with performance requirements.
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   c. Faulty operation of gate operators and controls.

2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design chain-link fence and gate frameworks.

B. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.2 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in height measured between top and bottom of outer edge of selvage according to "CLFMI Product Manual" and requirements indicated below:

1. Fabric Height: One piece as indicated on Drawings.
   a. Steel Wire for Fabric: Wire diameter of 0.148 inch (9 gage).

1) Mesh Size: 3/4 inch.

2. Polymer-Coated Fabric: ASTM F668, Class 2b over zinc-coated steel wire.
   a. Color: Black, according to ASTM F934.
4. Selvage: Twisted and barbed top and bottom.

2.3 SECURITY FENCE FRAMEWORK

A. Posts and Rails: ASTM F1043 for framework, including rails, braces, and line; terminal; and corner posts.
   1. Fence Height: 96 inches.
   2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.
      a. Line Post: 2.875 inches in diameter.
      b. End, Corner, and Pull Posts: 4.0 inches in diameter.
   3. Rail Members: Intermediate top bottom and brace rails according to ASTM F1043 for Heavy Industrial.
   4. Metallic Coating for Steel Framework:
      a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A123/A123M or 4.0-oz./sq. ft. zinc coating according to ASTM A653/A653M.
   5. Polymer coating over metallic coating.
      a. Color: Black, according to ASTM F934.

2.4 TENSION WIRE

A. Polymer-Coated Steel Wire: 0.177-inch- diameter, tension wire according to ASTM F1664, Class 2b over zinc-coated steel wire.
   1. Color: Black, according to ASTM F934.

2.5 SWING GATES

A. General: ASTM F900 for gate posts and single swing gate types.
   1. Gate Leaf Width: As indicated.
   2. Framework Member Sizes and Strength: Based on gate fabric height as indicated.

B. Pipe and Tubing:
   1. Zinc-Coated Steel: ASTM F1043 and ASTM F1083; protective coating and finish to match fence framework.
   2. Gate Posts: Round tubular steel.
   3. Gate Frames and Bracing: Round tubular steel.
C. Frame Corner Construction: Welded and 3/8-inch- diameter, adjustable truss rods for panels 60 inches or wider.

D. Extended Gate Posts and Frame Members: Fabricate gate posts and frame end members to extend as indicated above top of chain-link fabric at both ends of gate frame as required to attach barbed wire assemblies.

E. Provisions for Electronic Detection System: Isolate gate from fencing to prevent transference of vibration. Gate hinge posts and latch posts may share the same footing but shall not be in contact with fence terminal posts.

1. Separation between Hinge and Latch Posts and Fence Termination Posts: 2 inches minimum, 2-1/2 inches maximum.

F. Hardware:

2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

2.6 HORIZONTAL-SLIDE GATES

A. General: ASTM F1184 for gate posts and single sliding gate types. Provide automated vehicular gates according to ASTM F2200.

1. Classification: Type II Cantilever Slide, Class 2 with internal roller assemblies.

   a. Gate Frame Width and Height: As indicated.

B. Pipe and Tubing:

1. Zinc-Coated Steel: Protective coating and finish to match fence framework.
2. Gate Posts: ASTM F1184 Provide round tubular steel posts.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded and 3/8-inch- diameter, adjustable truss rods for panels 60 inches or wider.

D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame as indicated as required to attach barbed wire assemblies.

E. Overhead Track Assembly: Manufacturer's standard track, with overhead framework supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.

F. Hardware:

2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
3. Lock: Manufacturer's standard internal device.

2.7 FITTINGS

A. Provide fittings according to ASTM F626.

B. Post Caps: Provide for each post.
   1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:
   1. Top-Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
   2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.

E. Tension and Brace Bands, Tension Bars, and Truss Rod Assemblies: According to ASTM F2611.

F. Barbed Wire Arms: Pressed steel or cast iron, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts, for each post unless otherwise indicated, and as follows:
   1. Provide line posts with arms that accommodate top rail or tension wire.
   2. Provide corner arms at fence corner posts unless extended posts are indicated.
   3. Single-Arm Type: Type I, slanted arm.
   4. Use bolts or rivets for connection to posts.

G. Tie Wires, Clips, and Fasteners: According to ASTM F626.
   1. High-Security Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
      a. Metallic-Coated Steel: 0.148-inch diameter wire; zinc coating.
      b. Stainless steel.

H. Power-Driven Fabric Fasteners: As recommended in writing by manufacturer.

I. Finish:
   1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. of zinc.
      a. Polymer coating over metallic coating.
2.8 BARBED WIRE

A. Polymer-Coated, Galvanized-Steel Barbed Wire: ASTM F1665, Type II, two-strand barbed wire; 0.080-inch- diameter line wire with 0.080-inch- diameter, four-point, round galvanized-steel barbs spaced not more than 3 inches o.c.

1. Polymer Coating: Class 2b over zinc-coated steel wire.
   a. Color: Match chain-link fabric according to ASTM F934.

B. Clips: Stainless steel, 0.065 inch thick by 0.375 inch wide; capable of withstanding a minimum 150-lbf pull load to limit extension of coil, resulting in a concertina pattern when deployed.

C. Tie Wires: Stainless steel, 0.065 inch in diameter.

D. Ground-Barrier Stakes: 3/8-inch- diameter galvanized reinforcing bar, 18 inches long with 180-degree end hook 3-1/2 inches long.

2.9 GATE OPERATORS

A. Operators: Factory-assembled, automatic gate-operating system designed for gate size, type, weight, and frequency of use. Control system shall have characteristics suitable for Project conditions, with control stations, safety devices, and weatherproof enclosures.

1. Operator design shall allow for removal of cover or motor without disturbing limit-switch adjustment and without affecting auxiliary emergency operation.
2. Electronic components shall have built-in troubleshooting diagnostic feature.
3. Unit shall be designed and wired for both right-hand/left-hand opening, permitting universal installation.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. The gate operator shall be Hy-Security, Slide Driver 50

D. UL Standard: Manufacture and label gate operators according to UL 325.

E. Motors: Comply with NEMA MG 1.

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
4. Electrical Characteristics:
   a. Horsepower: 2 HP.
   b. Voltage:
c. Voltage: 208 V three phase, 60 hertz.

F. Gate Operators: Pedestal post mounted and as follows:

1. Hydraulic Slide Gate Operators:
   a. Duty: Heavy.
   b. Gate Speed: Minimum 60 feet per minute.
   c. Maximum Gate Weight: 1,500 lb.
   d. Frequency of Use: Continuous duty.
   e. Operating Type: Wheel and rail drive with manual release.
   f. Hydraulic Fluid: Of viscosity required for gate operation at ambient temperature range for Project.
   g. Locking: Hydraulic in both directions.
   h. Heater: Manufacturer's standard track and roller heater with thermostatic control.

G. Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA 250, Type 3R enclosure for Equipment base/pad pedestal mounting and with space for additional optional equipment.

H. Control Devices:

1. Card Reader: Functions only when authorized card is presented. Programmable, magnetic multiple-code system. To be provided and installed by the Authority.

2. Vehicle Loop Detector: System that includes automatic closing timer with adjustable time delay before closing, timer cut-off switch, and loop detector designed to open and close gate, hold gate open until traffic clears, and reverse gate. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, and as recommended in writing by detection system manufacturer for function indicated.
   a. Loop: Field-assembled wire, in size indicated, for pave-over installation.

3. Vehicle Presence Detector: System that includes automatic closing timer with adjustable time delay before closing and presence detector designed to open and close gate.
   a. Provide retroreflective detector with adjustable detection zone pattern and sensitivity, designed to detect presence or transit of a vehicle in gate pathway when an infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator.

I. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
1. Action: Reverse gate in both opening and closing cycles and hold until clear of obstruction.
2. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
3. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using take-up cable reel.
   a. Along entire gate leaf leading edge.
   b. Along entire gate leaf trailing edge.
   c. Across entire gate leaf bottom edge.
   d. Along entire length of gate posts.
   e. Along entire length of gate guide posts.
   f. Where indicated on Drawings.
4. Photoelectric/Infrared Sensor: System designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.

J. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully open and fully closed positions.

K. Emergency Release Mechanism: Quick-disconnect release of operator drive system, permitting manual operation if operator fails. Control circuit power is disconnected during manual operation.
   1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.

L. Operating Features:
   1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability of monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
   2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
   3. Master/Slave Capability: Control stations designed and wired for gate pair operation.
   5. Open Override Circuit: Designed to override closing commands.
   6. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
   7. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
   8. Clock Timer: 24 hour Seven day, programmable for regular events.

M. Accessories:
2. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system.
   a. Fail Safe: Gate opens and remains open until power is restored.
   b. Fail Secure: Gate cycles on battery power, then fail safe when battery is discharged.

3. External electric-powered solenoid lock with delay timer allowing time for lock to release before gate operates.
4. Intercom System.
5. Instructional, Safety, and Warning Labels and Signs: According to UL 325.
6. Equipment Bases/Pads: As dimensioned and reinforced according to gate-operator component manufacturer's written instructions and as indicated on Drawings.

2.10 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

2.11 GROUNDING MATERIALS

A. Comply with requirements in Section 260526 "Grounding and Bonding."

B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.
   1. Connectors for Below-Grade Use: Exothermic welded type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
   1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

   1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
   2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

   a. Exposed Concrete: Extend 2 inches above grade or to same elevation as concrete grade beam; shape and smooth to shed water.
   b. Posts Set into Holes in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.

D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more, at any abrupt change in grade, and at intervals not greater than 500 feet. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.

E. Line Posts: Space line posts uniformly at 10 feet o.c.

F. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

   1. Locate horizontal braces at mid-height of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
G. Barbed Wire Arms: Bolt or rivet to top of post. Angle single arms away from approach side of fence.

H. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

I. Bottom Rails: Secure to posts with fittings.


1. Overlapping Fabric: Overlap ends of fence fabric at or between posts or rails; overlap 6 inches and secure with wire ties or steel strap method.

2. Bottom Clearance: Leave 1-1/2 inches between finish grade or surface and bottom selvage unless otherwise indicated.

K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

L. Tie Wires: Power-fastened or manually fastened ties configured to wrap a full 360 degrees around rail or post and a minimum of one complete diamond of fabric. Twist ends one and one-half machine twists or three full manual twists, and cut off protruding ends to preclude untwisting by hand.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

M. Power-Fastening of Fabric: Fasten 0.192- or 0.148-inch wire fabric with 2- or 1-inch mesh size. Fasten fabric to line posts 12 inches o.c. and to braces 24 inches o.c.

N. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side.

O. Barbed Wire: Install barbed wire uniformly spaced as indicated on Drawings. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.

P. Provisions for Electronic Detection System: Eliminate wind-induced vibrations and rattles of fabric against posts and rails by placing additional tie wires where necessary. Eliminate rattles from bolted end fittings and other component connections by applying additional tightening or diagonal truss rods secured to fabric with tie wires.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.
3.5 GATE-OPERATOR INSTALLATION

A. Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation: Hand-excavate holes for posts, pedestals, and equipment bases/pads, in firm, undisturbed soil to dimensions and depths and at locations according to gate-operator component manufacturer's written instructions and as indicated.

C. Vehicle Loop Detector System: Burywire loop according to manufacturer's written instructions. Connect to equipment operated by detector.

D. Ground electric-powered motors, controls, and other devices according to NFPA 70 and manufacturer's written instructions.

3.6 GROUNDING AND BONDING

A. Comply with requirements in Section 260526 "Grounding and Bonding."

B. Fence and Gate Grounding:

1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
2. Install ground rods and connections at maximum intervals of 100 feet.
3. Ground fence on each side of gates and other fence openings.
   a. Bond metal gates to gate posts.
   b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet on each side of crossing.

D. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.

E. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

   1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
   2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

F. Connections:

   1. Make connections with clean, bare metal at points of contact.
4. Make above-grade ground connections with mechanical fasteners.
5. Make below-grade ground connections with exothermic welds.
6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

H. Comply with requirements in Section 264113 "Lightning Protection for Structures."

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Perform the following tests:

2. Fence Post Rigidity Testing: Test line posts for rigidity according to "Deflection Limits" Paragraph in "Performance Requirements" Article.

C. Prepare test reports.

3.8 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operator: Energize circuits to electrical equipment and devices, start units, and verify proper motor rotation and unit operation.

1. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
2. Test and adjust operator, controls, alarms, and safety devices. Replace damaged and malfunctioning controls and equipment.
3. Lubricate operator and related components.

C. Lubricate hardware and other moving parts.
3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain high-security chain-link fences and gates.

END OF SECTION 323113.53
SECTION 329200 – TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Contract Provisions, Special Provisions, Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Sections subsoil scarification, topsoil placement, application of soil amendments, final grading, fertilizing, turf seeding, mulching, for the areas indicated on Drawings.

B. This Section also includes removing of topsoil from designated stockpiles, areas to be stripped on the site or from approved sources off the site and subsequent transporting of topsoil to area of placement on site.

C. Related Sections:

1. Section 312000 - “Earth Moving.”

D. Sufficient topsoil for indicated turf areas is not available at site. Furnish additional topsoil from approved offsite source as specified under "Products", below.

1.3 SUBMITTALS

A. Submit the following to COTR in accordance with requirements of Division 01 Section, "Submittals."

B. Certification of Grass Seed: Seed vendor's signed statement of turf seed analysis, certifying that each lot of seed has been tested in accordance with requirements of the Commonwealth of Virginia within the previous 6 months by a recognized independent seed testing laboratory. This statement shall include:

1. Name and address of laboratory.
2. Date of analysis.
3. Origin and lot number for each type of seed variety.
4. Results of analysis, including, for each seed variety:
   a. Botanical and common name (species and variety).
   b. Percentage by weight of variety in overall mixture.
   c. Percentage of purity.
   d. Percentage of germination.
   e. Percentage by weight of weed content.
   f. Percentage by weight of inert content.
C. Topsoil Analysis Report: Report of analysis by an Authority approved soil testing laboratory stating percentages of silt, clay, sand and organic matter, soil pH, and the mineral and plant nutrient content of soil. Report shall indicate suitability of topsoil for healthy, vigorous growth of turf grasses. If not suitable, include recommended quantities for nitrogen, phosphorus, potash, limestone, aluminum sulphate, or other soil amendments that shall be added to make topsoil suitable.

D. Sod Analysis: Notify COTR of sod source, including name and telephone number of supplier, and provide certification of seed mix of sod in accordance with sod certification requirements of the Commonwealth of Virginia.

1.4 PROJECT CONDITIONS

A. Planting time: Sow permanent seed in all areas of project in periods between March 15 to May 15, or between August 15 and October 1 unless otherwise approved in writing by the COTR.

B. Maintenance period: Correlate planting with specified maintenance periods to provide required maintenance from date of substantial completion.

1.5 SPECIAL PROJECT WARRANTY

A. Warranty turf areas through specified maintenance period and until final acceptance.

PART 2 - PRODUCTS

2.1 NEW TOPSOIL

A. Fertile, friable, naturally loamy, surface soil; free of subsoil, clay lumps, brush, weeds, and other litter; and free of roots, stumps, stones larger than 2 inches in any dimension, and other extraneous or toxic matter harmful to plant growth.

B. When tested in accordance with the methods of testing as recommended by the Association of Official Agricultural Chemists topsoil shall have a pH range of 5.5 to 7.6. Organic content shall not be less than 3 percent or more than 20 percent as determined by the wet-combustion method (chromic acid reduction). Not less than 20 percent or more than 80 percent of the topsoil material shall pass the 200 - mesh (0.075 mm) sieve, as determined by the wash test in accordance with ASTM C 117.

1. Natural topsoil may be amended by the Contractor with approved materials and methods to meet above requirements.

C. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at site of work. Obtain topsoil from naturally well-drained sites where topsoil occurs at least 4 inches deep. Obtaining topsoil from bogs or marshes is prohibited.

2.2 SOIL AMENDMENTS
A. Lime: Natural limestone, conforming to requirements of ASTM C 602, and containing at least 85 percent of total carbonates ground to such fineness that at least 90 percent passes a 10-mesh sieve and at least 50 percent passes a 100-mesh sieve.

   1. Provide lime in form of dolomitic limestone.

B. Peat Humus: Finely divided or granular texture and with pH of 6.0 to 7.5 composed of moss peat (other than sphagnum), peat humus, or reed-sedge peat.

2.3 FERTILIZER

A. Complete, 10-20-10 commercial fertilizer of neutral character, with some elements derived from organic sources, conforming to requirements of Federal Specification O-F-241d and applicable laws of the Commonwealth of Virginia. Fertilizer to provide nitrogen in a form that will be available during initial period of turf growth.

2.4 GRASS SEED MIXTURE

A. Grass Seed: Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America for lawn grasses. Seeds included in the mix shall be listed in the most current version of the Virginia Turfgrass Variety Recommendations. Seed mixtures shall be a blend of three standard varieties with no dwarf and shall consist of the following (by weight):

   10% Kentucky Bluegrass
   80% Tall Fescue
   10% Perennial Rye

2.5 SOD

A. Machine-cut, strongly rooted, certified turfgrass sod, at least 2 years old and free of weeds and undesirable native grasses. Provide sod capable of vigorous growth and development when planted (viable, not dormant) and complying with the following requirements:

   1. Type: Kentucky Bluegrass (Poa pratensis).

B. Sod Pad Size: Uniform thickness of 5/8 inch, plus or minus 1/4 inch, measured at time of cutting and excluding top growth and thatch. Provide in supplier's standard size of uniform length and width with maximum 5 percent allowable deviation in either length or width. Broken or torn pads or pads with uneven ends are not acceptable.

C. Sod Strength: Provide sod pads capable of supporting their own weight and retaining size and shape when supplier's standard size pad is suspended vertically from a firm grasp on upper 10 percent of the pad.

2.6 MULCH

A. Anti-Erosion Mulch: Clean, salt hay or threshed straw of wheat, rye, oats or barley. Mulch to be air-dry and free of mold and seeds of noxious grasses or weeds.
3.1 SOIL PREPARATION

A. Limit preparation to areas that will be planted within 72 hours.

B. Till subgrade to a minimum depth of 6 inches. Remove stones exceeding 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter including gravel or other inorganic deposits in excess of 4 stones per square foot (average).

1. Immediately after initial tilling, remove existing grass clumps, vegetation, and turf. Dispose of such material outside of Owner's property; do not turn over into soil being prepared for turfs.
2. Maintain grades in a true and even condition where grades to be provided with topsoil have been established by others.
3. Where grades have not yet been established, smooth-grade the areas to the prescribed elevations indicated and leave in a condition that is properly compacted and evenly graded to prevent formation of low areas where water may pond.

C. Spread topsoil mixture to depth required meeting thickness, grades, and elevations shown, after light rolling and natural settlement.

1. Provide minimum depth of 2 inches (50 mm) after compaction, unless otherwise indicated. Do not spread if either topsoil material or sub grade is frozen.
2. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
3. Allow for sod thickness in areas to be sodded.

D. Add soil amendments to top surface of topsoil at rates specified and spread initial fertilizers at rate of 1500 lbs. per acre of topsoil.

1. Mix lime with dry soil before mixing in fertilizer.
2. Mix thoroughly into top 4 inches of topsoil prior to fine-grading.
3. Do not mix fertilizer with topsoil more than 72 hours in advance of seeding or sodding operations.
4. Till soil to a homogenous mixture of fine texture, free of lumps, clods, stones, roots, and other extraneous matter.

E. Fine-grade to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. After compaction rolling, leave surfaces at prescribed grades with uniform slope to drain and free from low areas where water might pond. Limit fine-grading to areas that can be planted within 72 hours. Remove trash, debris, stones larger than 2 inches in diameter, and other objects that may interfere with planting or maintenance operations.
F. Promptly remove topsoil or other materials falling on pavement as result of hauling or spreading of topsoil.

3.2 SEEDING

A. Restore prepared turf areas to specified condition if eroded or otherwise disturbed after fine-grading and before planting.

B. Moisten prepared turf areas before planting if soil is dry. Water thoroughly and allow surface to dry off before seeding operations. Do not create muddy soil.

C. Sow seed with a spreader or a seeding machine. Do not seed when wind velocity exceeds 5 miles per hour. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.
2. Sow no less than the quantity of seed specified.

D. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

3.3 SODDING

A. Lay sod within 24 hours of stripping. Do not lay dormant sod or if ground is frozen.

B. Lay sod to form solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod.

C. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering adjacent grass.

D. Anchor sod on slopes with wood pegs as required to prevent slippage.

E. Water sod with fine spray immediately after planting. During first week, water daily or more frequently as necessary to maintain moist soil to depth of 4 inches.

3.4 MULCHING

A. Protect seeded slopes against erosion with jute mesh erosion netting or other similar coverings acceptable to COTR.

B. Protect seeded areas against hot, dry weather or drying winds by applying specified mulch within 24 hours after completion of seeding operations. Presoak and scatter evenly to a depth of 1/8 inches to 3/16 inches thick and roll to a smooth surface. Do not mound.

3.5 RECONDITIONING EXISTING TURF AREAS

A. Recondition existing turf areas damaged by Contractor's operations including storage of materials or equipment and movement of vehicles.
B. Provide fertilizer, seed or sod, and soil amendments same as specified for new turf areas and as required to provide healthy stand of grass in reconditioned areas. Provide new topsoil as required to fill low spots and meet required finish grades.

C. Remove diseased or unsatisfactory grass clumps; do not bury into soil. Remove topsoil containing foreign materials resulting from Contractor's operations including oil drippings, stone, gravel, and other construction materials; replace with new topsoil.

D. Where substantial turf remains (but is thin), mow, rake, aerate if compacted, fill low spots, remove humps, cultivate soil, apply lime, fertilizer, and sow specified seed at rate indicated. Remove weeds before seeding. If weeds are extensive, apply selective chemical weed killers as required. Apply seedbed mulch, if required, to maintain moist condition.

E. Water newly planted areas and keep moist until new grass is established.

3.6 PROTECTION

A. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout the maintenance period. Maintain barricades until a substantial and healthy stand of grass is established.

B. Take necessary precautions as required to avoid damage to existing plants, turf, and structures.

3.7 MAINTENANCE

A. Obtain the services of a professional lawn and landscape firm to provide the required maintenance services of this Article. Do not use Contractor’s own forces to accomplish this maintenance.

B. Begin maintenance of grass areas immediately after each area is planted and continue for the periods required to establish acceptable stand of turf grass, but no less than the following:

1. Seeded areas, at least 60 days, after date of Substantial Completion.
   a. If seeded in fall after September 1, provide minimum of 30 days maintenance in fall, and provide a minimum of 45 additional days continuing maintenance during following spring until acceptable turf is established.

2. Sodded areas, at least 30 days after date of Substantial Completion.

C. Maintain turf areas by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, re-grading, and replanting as required to establish a smooth, acceptable turf, free of eroded or bare areas.

D. Re-mulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose. Anchor as required preventing displacement.
E. Replant bare areas with same materials specified for new turf.

F. Watering: Provide and maintain temporary piping, hoses and watering equipment to convey water from Authority's water source(s) location indicated and to keep turf areas uniformly moist as required for proper growth. Design temporary watering system to provide a minimum of 3/4 inch of water per day.

1. Lay out temporary watering system and arrange watering schedule to prevent puddling, water erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid necessity of walking over muddy or newly seeded areas.

2. Begin watering immediately. Water on a daily basis for the following 10 days. Apply water uniformly, providing coverage over entire site nominally equivalent to 3/4 inches of rainfall per day. Reduce rate to nominal 1/2 inch of water per day after 5 days.

3. At end of initial 10-day period, remove temporary irrigation system. Continue watering with conventional sprinkler watering system on an as-needed basis.

G. Mow grass as soon as there is 3 - 4 inches of top growth, cut grass with the mower blades set at 1 - 1/2" to 2" height. Repeat mowing as required to maintain specified height.

1. Remove no more than 40 percent of grass leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Time initial and subsequent mowings to maintain following grass heights.

   a. Mow grass from 1-1/2 inches to 2 inches high. Do not mow to less than 1-1/2 inches.

2. Apply second fertilizer application after first mowing and when grass is dry. Use fertilizer that will provide at least 1.0 lb. of actual nitrogen per 1,000 sq. ft. of turf area.

3.8 ACCEPTANCE

A. When work is substantially completed, including maintenance, COTR will, upon request, make an inspection to determine acceptability.

B. Turf work may be inspected for acceptability in parts agreeable to the COTR, provided work offered for inspection is complete, including maintenance.

C. Replant rejected work and continue specified maintenance until re-inspected by COTR and found to be acceptable.

D. Seeded areas will be acceptable provided requirements, including maintenance, have been met and healthy, uniform close stand of specified grass has been established with an average of one healthy grass plant per square inch, free of weeds, with no bare spots in excess of 5 inches in diameter, and free of surface irregularities.

E. Sodded areas will be acceptable provided requirements, including maintenance, have been met and healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open
joints, bare areas, and surface irregularities.

3.9 CLEANUP

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto surface of paved areas.

B. Maintain all areas neat and clean during seeding operations. On a daily basis, remove excess materials and debris to site location designated by COTR. At completion of Work, remove all such materials from site and dispose of in a legal manner.

C. Restore any damage caused by seeding operations to original condition.

D. Remove all staples from sodded areas, upon acceptance.

END OF SECTION 329200
SECTION 334200 - STORMWATER CONVEYANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. HDPE pipe and fittings, Smooth.
   2. Concrete pipe and fittings.
   5. Stormwater inlets.
   6. Stormwater storage systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Manholes: Include plans, elevations, sections, details, frames, and covers.
   2. Catch basins and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of pipe and fitting, from manufacturer.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
B. Protect pipe, pipe fittings, and seals from dirt and damage.
C. Handle manholes in accordance with manufacturer's written rigging instructions.
D. Handle catch basins and stormwater inlets in accordance with manufacturer's written rigging instructions.

1.7 FIELD CONDITIONS
A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by the Authority in compliance with the requirements for existing services/systems interruptions specified in Division I Section "Summary .".

PART 2 - PRODUCTS

2.1 CORRUGATED-PE PIPE AND FITTINGS
A. Source Limitations: Obtain smooth-HDPE pipe and fittings from single manufacturer.
B. Smooth-HDPE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294, Type S, with smooth waterway for coupling joints.
C. Smooth HDPE Soiltight Couplings: AASHTO M 294, matching pipe and fittings.

2.2 CONCRETE PIPE AND FITTINGS
A. Source Limitations: Obtain concrete pipe and fittings from single manufacturer.
B. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C76.
   1. Bell-and-spigot ends and gasketed joints with ASTM C443, rubber gaskets
   2. Class III, Wall A.

2.3 MANHOLES
A. Designed Precast Concrete Manholes:
   1. Description: ASTM C913; designed in accordance with ASTM C890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
   2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
   4. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.
   5. Steps: As indicated on the Construction Drawings.
6. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: As indicated on the Construction Drawings and as follows: Ferrous; 36-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange with cover to fit accordingly.
   a. Include indented top design with lettering cast into cover, using wording "STORM." Letters to be cast into the depression in the top of the cover, 3 inch letter height and raised ¼ inch high to be even with the depression in the top surface of the cover.

2.4 CONCRETE

A. General: Cast-in-place concrete in accordance with ACI 318, ACI 350, and the following:

1. Cement: ASTM C150/C150M, Type II.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
   a. Invert Slope: 1 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
   a. Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.
2.5 CATCH BASINS

A. Designed Precast Concrete Catch Basins: ASTM C913, precast, reinforced concrete; designed in accordance with ASTM C890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.

1. Joint Sealants: ASTM C990, bitumen or butyl rubber.
2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
3. Steps: As indicated on the Construction Drawings.
4. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

B. Frames and Covers: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: 36 inch minimum ID.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

2.6 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening.

1. Frames and Grates: Heavy duty. Size: 36 inch minimum ID.
   a. Include indented top design with lettering cast into cover, using wording "STORM." Letters to be cast into the depression in the top of the cover, 3 inch letter height and raised ¼ inch high to be even with the depression in the top surface of the cover.
   b. Material: ASTM A48/A48M, Class 35 gray iron unless otherwise indicated.

2.7 STORMWATER STORAGE SYSTEMS

A. Pipe: Corrugated PE pipe in accordance with part 2.1 of this specification.

B. Pipe Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."
3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping in accordance with the following:
   1. Install piping pitched down in direction of flow.
   2. Install piping with 36-inch minimum cover.
   3. Install HDPE corrugated sewer piping in accordance with ASTM D2321.
   4. Install reinforced-concrete sewer piping in accordance with ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping in accordance with the following:
   1. Join smooth-HDPE piping in accordance with ASTM D3212 for push-on joints.
   2. Join reinforced-concrete sewer piping in accordance with ACPA's "Concrete Pipe

3.4 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants in accordance with ASTM C891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.
3.5 CATCH BASIN INSTALLATION
   A. Construct catch basins to sizes and shapes indicated.
   B. Set frames and grates to elevations indicated.

3.6 CONCRETE PLACEMENT
   A. Place cast-in-place concrete in accordance with ACI 318.

3.7 STORMWATER STORAGE SYSTEM INSTALLATION
   A. Excavate trenches to indicated gradients, lines, depths, and elevations indicated on the Construction Drawings.
   B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
      1. Clearance: 12 inches each side of pipe or conduit.
   C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
      1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
   D. Place backfill on subgrades free of mud, frost, snow, or ice.
   E. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints and barrels of pipes and for joints, fittings, and bodies of conduits.
   F. Backfill voids with satisfactory soil while removing shoring and bracing.
   G. Initial Backfill:
      1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
         a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
   H. Final Backfill:
      1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
I.  Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.8  CONNECTIONS

A. Make connections to existing piping and underground manholes.
   1. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
      a. Use concrete that will attain a minimum 28-day compressive strength of 4000 psi unless otherwise indicated.
      b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
   2. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.9  CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed.
   1. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Backfill to grade in accordance with Section 312000 "Earth Moving."

3.10  IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
   1. Use detectable warning tape over piping and over edges of underground structures.

3.11  FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
   5. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Exception: Piping with soil-tight joints unless required by authorities having jurisdiction.
      b. Option: Test plastic piping in accordance with ASTM F1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334200