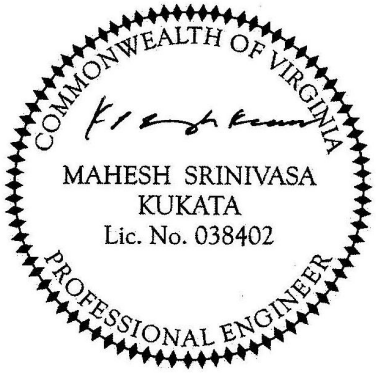
SPECIFICATIONS
FOR
GLYCOL SYSTEM REPAIR
IA1202

WASHINGTON DULLES INTERNATIONAL AIRPORT
METROPOLITAN WASHINGTON AIRPORTS AUTHORITY

Prepared by:

Airport Design Consultants, Inc. (ADCI)
6031 University Boulevard, Suite 330
Ellicott City, MD 21043



October 29, 2013
100% Submittal

THIS PAGE INTENTIONALLY LEFT BLANK

Table of Contents

SECTION 007300 SUPPLEMENTARY CONDITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The articles and paragraphs of this Section represent supplements or additions to the Contract Provisions or the Special Provisions.

1.3 WORK UNDER OTHER CONTRACTS

A. During the period of this Project, the Authority anticipates that other construction contracts may be underway at or near the site of work of this Contract. Coordination with other contractors would be required to minimize any impacts on airport operations.

1.4 MAINTENANCE OF PEDESTRIAN AND VEHICULAR TRAFFIC

Does not apply.

1.5 AIRFIELD AND TERMINAL BUILDING OPERATIONAL REQUIREMENTS

A. The Work, or a portion thereof, will be performed in proximity to the Air Operations Area (AOA), including, active runways, taxiways, and aprons. Normal airport operations will continue adjacent to the Work during all phases of the Project. These activities include:

1. Aircraft movement on runways, taxiways, aprons; aircraft landing and takeoff operations.
2. Aircraft parking, refueling and other aircraft servicing.
3. Baggage handling.
4. Routine aircraft maintenance.
5. Apron maintenance, snow removal and ice control.

B. Phase construction activities as necessary to accommodate all airport operations without disruption. Adhere to all current Airport Orders and Instructions (O & Is), Airport Bulletins, and Airport Advisories. The Authority will provide relevant Orders and Instructions to Offerors in the Solicitation Package. Bulletins and Advisories will be provided to the offeror by the Authority as they are issued.

1.6 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.

1.7 ARCHAEOLOGICAL AND HISTORICAL FINDINGS

A. Notify immediately, through the COTR, the PMC Archaeology/Historic Preservation Coordinator 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.

1.8 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 two copies of this survey to the Contracting Officer within 14 calendar days after Notice-to-Proceed. This survey will assist in resolving any damage claims against the Contractor during and after construction.

1.9 SECURITY DURING CONSTRUCTION

A. Maintain the integrity of the Airport Security fence. Maintain the integrity of doors and walls between public areas and Air Operations Area (AOA) at all times. Comply with Title 49 Code of Federal Regulations, Parts 1500, 1540, 1542 and 1544.

B. Possession of and display of a proper and current Airport Identification Badge, issued by Airport Operations is required for all Contractor personnel passing into the AOA. Refer to "Airport Orders and Instructions" attached as part of the Contract for specific requirements. Security requirements have increased significantly at Washington Dulles International Airport and Contractor can expect possible short delays clearing construction vehicles into the AOA. Offerors shall become intimately familiar with all TSA and Authority security requirements. No increase in contract price will be provided to the Contractor should the contractor not be aware of any security procedure in place at time of submitting their offer that leads to increased time and inconvenience to accomplish the work.

C. Pay all fines levied by the appropriate authorities for penalties resulting from security infractions perpetrated by or caused by Contractor's personnel or work forces of Contractor's subcontractors or suppliers.

D. Establish and maintain the security of Contractor's staging areas, equipment and materials.

E. Provide escort for delivery vehicles transporting materials and supplies to or from the Contractor's staging or work areas into the AOA, in accordance with requirements stated in "Airport Orders and Instructions" attached as part of the Contract.

F. Do not park within 300 feet of a terminal building unless specifically authorized by Airport Operations.

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

H. 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.

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

1.10 MATERIAL HAULING

A. Access to and from the Airport for hauling operations shall be through the entrances indicated. Conduct hauling operations during working hours and as indicated on the drawings.

B. Contractor shall use the haul routes for this project as indicated on the drawings and as designated by the COTR.

C. Submit a detailed Work Plan for Contractor's entire operations to the COTR for approval prior to commencing work. Obtain written approval from the COTR of the Work Plan. Identify clearly on Work Plan each operation requiring coordination with Airport Operations.

1. For taxiway closures of short duration, provide flagmen, with radio contact with the FAA Airport Traffic Control Tower and the Authority Ramp Control Tower, at taxiway crossing intersections. COTR will determine the number of flagmen required.

2. For long-term taxiway closures, clearly mark, light, and barricade the taxiway closures and haul routes in accordance with FAA and Airport Operations requirements.

D. Provide advance notice to the COTR, as required in the drawings, of any scheduled taxiway, or taxi lane closures. Obtain the written approval of the Authority prior to closing or crossing a taxiway or taxi lane.

E. Use load covers on all dump trucks. Load dump trucks so that no spillage occurs during transit on the State, municipal, or Airport roadways, taxiways, and aprons. Clean wheels of trucks leaving the Project construction site of all soil and rocks.

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

damage to aircraft engines due to the ingestion of foreign objects, maintain on the project mechanical sweeper/vacuum (wet/dry) equipment with nylon brushes complete with operators. Maintain a water truck on site at all times in order to effectively control dust rising from construction activities.

G. Provide sweeper/vacuum equipment with a usable hopper capacity of 6 cubic yards and with a regenerative air capacity of 15,000 CFM. Provide equipment with gutter brooms of poly brush material so as not to damage airfield pavement markings; a dust control system that includes an external spray system with front mounted spray bar, nozzles located at each gutter broom; and an internal spray system with nozzles in the internal air stream. Maintain the equipment in good working order throughout the project and replace the brooms and or spray systems, as necessary, to ensure proper sweeping and vacuuming of paved surfaces.

1.11 PORTABLE LIGHTING

A. Contractor shall be responsible for portable lighting for all night-work or early morning work. Portable lighting shall be in accordance with the Authority design manual and must be approved by the COTR.

B. 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.

1.12 RADIO COMMUNICATIONS

A. If Contractor’s personnel use two-way radio communication on the job site, submit proposed frequencies to COTR for approval in writing by the COTR. Frequencies shall not conflict with or overlay any of the Airports radio frequencies.

B. Provide, at a minimum, the following with radio equipment: The Project Superintendent, Foreman of all work groups physically separated from the general vicinity of the Project Superintendent, gate guards, and others who may be working in a separate and remote area.

C. Provide two-way radios capable of operating on both the "Ground" and "Ramp" frequencies for work adjacent to or affecting taxiways, Mobile Lounge roads, or Mobile Lounge docking areas. Such radios shall be either a handheld programmable type capable of operating off of vehicle power and antenna or a vehicle-mounted type, which operates solely off of the vehicle’s power, and antenna. Provide radios that provide a minimum of 3 watts transmitting power. Provide radios of sufficient power to communicate with the appropriate controller.

1.13 Not used.

1.14 SAFETY

A. Comply with all requirements set forth in the most current edition of the Authority ***Construction Safety Manual”***. Offerors are provided with the most recent addition when

obtaining contract documents prior to proposal. Requirements included in this Section are in addition to the Authority's ***Construction Safety Manual***. Comply with all local, State and Federal requirements. Where conflicts or discrepancies exist between requirements, the more stringent requirement shall govern. For additional information see Division 01 Section "Quality Requirements".

B. Contractor Safety Organization:

1. Safety Engineer.

a. Duties: Outlined in The Authority Construction Safety Manual.
b. Qualifications: Outlined in The Authority ***Construction Safety Manual.***

C. Submit the résumés of individuals proposed to serve in the role of Contractor's Safety Engineer to the COTR for approval in writing. If qualified, Contractor's Superintendent or Foreman will be allowed to serve the role of Safety Engineer. In addition to indicating the qualifications in the Authority ***Construction Safety Manual*** résumés shall include but not be 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 and personal references of contacts for verification shall also be required.

D. Provide safe and healthful working conditions on each operation at all times during execution the work of this Contract. 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 well as amendments to these laws. Comply 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. 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. Stop work whenever a work procedure or a condition at a work site is deemed unsafe by the either of the following individuals: COTR, Program Safety Manager (PSM), the Contractor's Project Manager, the Contractor's Foreman or the Contractor's Safety Engineer(s).

E. Provide the services of responsible safety personnel per construction work shift for the duration of this Contract. The Safety personnel shall be responsible for all safety and health requirements as included herein and as required by the Authority's Construction Safety Manual.

F. Comply with all requirements set forth in the Authority's "Construction Safety Manual." Provide during the Work the services of Safety Engineer(s) as outlined in the Authority's "Construction Safety Manual" and in Division 01 Section "Quality Requirements". The Safety Engineer shall undertake the duties and responsibilities as stated in the Authority's "Construction Safety Manual".

G. Prior to start of construction activities in the Air Operations Area (AOA), the Contractor's Safety Engineer shall tour the AOA with the Authority Safety Program Manager.

H. Flagmen Training: The Authority will sponsor Flagman training sessions. Contractor's personnel who will be assigned flagmen duties on the Airport for this project shall attend training sessions.

I. Fire Safety: Conform to the following requirements:

1. Obtain a permit to perform any welding, cutting, or hot work from the Office of the Authority Fire Marshal.
2. Ensure adequate access to all construction areas for emergency response.
3. Obtain a permit from the Office of the Authority Fire Marshal to store, handle, or use any hazardous material, including but not limited to fuels for equipment. Complete an application prior to issuance.
4. Remove combustible debris from the site daily.
5. Provide at least seven (7) days notice for any request for inspections, tests, permits, etc., required of personnel from the Office of the Authority Fire Marshal.
6. Obtain a permit from the Office of the Authority Fire Marshal for the use, storage or handling of any explosives.
7. Provide to the Office of the Authority Fire Marshal a list of emergency contact numbers for the COTR and the Contractor prior to the commencement of Work.

J. Submit Site-Specific Safety and Health Plans to COTR within 15 calendar days of Notice to Proceed and prior to the start of any construction activities. Prepare this plan using the Authority's Guidelines as defined in the Authority's "***Construction Safety Manual***" and as supplemented by these specifications for each and every work zone as shown on the drawings or as anticipated by the Contractor. COTR must approve the Site-Specific Safety Plan prior to the start of any work.

K. Be responsible for the safe operation of all job site motor vehicles. Provide a "spotter" or flagman for all backing operations of construction vehicles with restricted rear vision.

L. All motorized equipment and vehicles working on or entering MWAA construction project work areas shall be equipped with functional audible backup alarms.

M. Crane Operators. Crane use must be approved by the COTR and Airport Operations.

N. For all airside projects attach a Safety Plan to the Safety Program. Include in the Safety Plan, to the extent applicable, provisions for the following:

1. Scope of work performed by Contractor, including proposed duration of work.
2. Job Hazard Analysis Program.
3. Work control measures.
4. Limitations on equipment height.
5. Location of airport operational areas.
6. Location of and access to stockpiled construction materials and equipment.
7. Inspection requirements.
8. Trenches and excavations, and cover requirements.
9. Vehicle operation and pedestrian access in airport movement areas.
10. Construction site access and haul roads, includes maintenance of and keeping open ARFF access routes.
11. Limitations on construction.
12. Radio communications.

13. Foreign object debris (FOD) control provisions.
14. Hazardous materials (HAZMAT) management.
15. Wildlife abatement.
16. NOTAM issuance.
17. Vehicle identification.
18. Vehicle parking.
19. Use of temporary visual aids.
20. Obstacle-free zones (OFZ).
21. Approach clearance to runways.
22. Runway and taxiway safety areas.
23. Required compliance of contractor personnel.
24. Emergency notification for fire, medical, and police response.

1.15 HEIGHT LIMITATION

A. For all construction within the Airport, limit the height of Contractor's equipment to a maximum of 15 feet. For any work that requires equipment higher than 15 feet, Contractor must request in writing COTR's approval.

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.

1.16 NOISE CONTROL

Not applicable.

1.17 EXAMINATION OF PLANS, SPECIFICATIONS AND SITE OF WORK

A. 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.

1.18 AIRPORT SECURITY/VEHICLE INSPECTION PROCEDURE

A. Contractor access to the project site shall be as shown on the drawings.

B. The following procedures will be utilized for all escorted vehicles and AOA approved vehicles with non-badged passengers seeking entry to the AOA:

1. All vehicles are searched.
2. Coordinate all vehicle deliveries with the COTR in advance. Provide the vehicle license plate number and expected delivery time for all vehicle deliveries. Contractor may compile the expected daily delivery schedule on one sheet for submission to the COTR.

3. The vehicle operator shall have in his or her possession a commercial manifest, which identifies the contents of the vehicle and/or trailer.
4. An escort from the company for whom the shipment is intended shall respond to the vehicle access gate and remain with the vehicle until the vehicle exits the secured area.
5. A vehicle search will be conducted and once cleared; vehicles will be permitted escorted access to their delivery point.
6. Contractors should expect minor delays up at AOA gate as a result of these security provisions.
7. Priority consideration may be offered to concrete trucks with resulting delays estimated to be 20 minutes. To receive priority consideration, schedule concrete deliveries with Airport Operations and COTR at time of batching.

C. Prior approval from the Manager of Airport Operations or his/her designated representative is required for any exceptions to the above procedures.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 007300

SECTION 011000 SUMMARY

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 Section includes the following:

1. Work covered by the Contract Documents.
2. Type of the Contract.
3. Work phases.
4. Work under other contracts.
5. Use of premises.
6. Work restrictions.
7. Specification formats and conventions.

B. Related Sections include the following:

1. None.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: IA1202 – Project consists of the removal of Portland cement concrete (PCC) apron pavement, unclassified excavation, installation of new Pre-Cast Concrete Manhole Structures, backfill, new PCC apron pavement and cured-in-place pipe liner installation for three glycol collection lines located under the pavement of the Northwest Apron/ Runway 30 Run-up block at Washington Dulles International Airport.

B. Architect/Engineer Identification: The 100% Submission Documents, dated October 29, 2013 were prepared for the Project by ADCI, 6031 University Boulevard, Suite 330, Ellicott City, MD 21043.

1.4 TYPE OF CONTRACT

A. Project will be constructed under a general construction contract.

1.5 WORK PHASES

A. Conduct the Work in accordance with the phases and restrictions shown on the plans.

B. Schedule the execution of the Work according to the phasing sequence indicated and to avoid interference with normal functions of the Airport.

C. Before commencing Work of each phase, submit a schedule to COTR showing the sequence, the commencement and completion dates, and the move-out and move-in dates of personnel for the various phases of the Work.

1.6 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.7 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. Limits: Confine constructions operations to the project site shown on the plans.
2. Authority Occupancy: Allow for Authority occupancy of site and day-to-day use by tenants, and air carriers.
3. 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 Authority's right to perform work or to retain other contractors on portions of Project.
4. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to the Authority, the Authority's employees, tenants, air carriers, 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."

1.8 CONTRACTOR HOURS OF OPERATION

A. Contractor Working Hours: Work shall be performed during daytime hours with a 2pm shutdown requirement unless otherwise directed by the COTR.

1.9 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 ‘04" 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.

1.10 MARKING UTILITY SERVICES

A. Employ underground utilities location subcontractor to locate and mark the horizontal location of all utility lines, that might be impacted by construction activities, including but not limited to the following:

1. Electric power lines.
2. Storm Sewers.
3. FAA communications, signal, and security lines.
4. Runway lighting lines

B. 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 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. 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.

C. 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.

D. Check and verify the horizontal and vertical location (coordinates and elevation) of all drainage lines that are within the limits of proposed work, regardless of whether such utilities are indicated or not.

1.11 UTILITY OUTAGES

None anticipated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012200 UNIT PRICES

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 Section includes administrative and procedural requirements for unit prices.

B. Related Sections include the following:
   1. Division 01 Section "Measurement and Payment" for procedures for measurement and payment for unit-price items.

1.3 DEFINITIONS

A. A unit price is an amount proposed by offerors and stated on the Schedule as a price per unit of measurement for materials or services. An estimate of the quantities of work to be done and materials to be furnished under these specifications is given in Section III, "Schedule." It is given only as a basis for comparison of proposals and the award of the Contract. The Authority does not expressly or by implication agree that the actual quantities involved will correspond exactly therewith; nor shall Contractor plead misunderstanding or deception because of such estimates of quantities, or of the character, location, or other conditions pertaining to the work. Payment to Contractor will be made only for the actual quantities of work performed or materials furnished according to the plans and specifications.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit. The sum of all extended unit prices in the Section III, "Schedule," shall be deemed to include all work described in the Contract Documents including Drawings and Specifications. Unit prices will apply only to unclassified excavation and embankment (P-152-4.1) and select embankment (borrow) (P-152-4.2). All other work will be lump sum.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of` unit prices. Methods of measurement and payment for unit prices are specified in those Sections and in Division 01 Section "Measurement and Payment."

C. The Authority reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at the Authority's expense, by an independent surveyor acceptable to Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012200

SECTION 012210 MEASUREMENT AND PAYMENT

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 Section includes administrative and procedural requirements governing methods of measurement and computations to be used in determination of quantities of material furnished and unit amount of Work performed under the Contract in order for Contractor to receive payment according to pre-established unit prices.

B. At the discretion of the COTR, payment may be reduced for any Work which is not in full compliance with the Contract Documents or which has been damaged or repaired by Contractor. Such action may be used when the end product may have a reduced service life or less than desirable aesthetic characteristics.

1.3 MEASUREMENT OF QUANITITES

Measurement of quantities on this contract is as specified in the Technical Specifications. Measurement of quantities will apply only to unclassified excavation and embankment (P-152-4.1) and select embankment (borrow) (P-152-4.2). All other work will be lump sum.

1.4 SCALES

Not used.

1.5 PAYMENT FOR MATERIALS ON HAND

Not used.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012210

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 012900 – APPLICATION FOR PAYMENT

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

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

B. Related Sections include the following:

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

1.3 DEFINITIONS

Not used.

1.4 SCHEDULE OF VALUES

Not used.

1.5 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 Authority.

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

B. Payment Application Times: Application for Payment shall coincide with the schedule monthly update, or as otherwise indicated in the Agreement between the 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.

C. Payment Application Forms: Use forms provided by the Contracting Officer, but supplied by COTR, for Application for Payment.

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

1. Include amounts of Contract Modifications issued before last day of construction period covered by application.

E. Transmittal: Submit one original and four copies of Application for Payment to the address provided by the Contracting Officer, each one signed and notarized. 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.

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

1. The 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 Authority.

G. 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. Contractor's Construction Schedule (preliminary if not final).
3. Products list.
4. Submittals Schedule (preliminary if not final).
5. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
6. Performance and payment bonds.
7. Subcontractor Payment Form

H. 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. Updated Inspection Control Log. Highlight changes from previous month.
4. Update of Contract Record Documents.

I. 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.

J. 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, liquidated damages settlement statement.
6. Return of all Airport identification badges and keys.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 013100 PROJECT MANAGEMENT AND COORDINATION

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 Section includes administrative provisions for coordinating construction operations on the Project including, but not limited to the following:

1. General project coordination procedures.
2. Administrative and supervisory personnel.
3. Project meetings.

    a. Pre-construction conference.
    b. Progress meetings.

B. Related Sections include the following:

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

1.3 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 execution of work.

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. 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. Delivery and processing of submittals.
3. Progress meetings.

4. Project closeout activities.

1.4 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, 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.

1.5 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. RFIs submitted by entities other than Contractor will be returned with no response.
2. 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 Resident Engineer
6. Name of Task Manager
7. RFI number, numbered sequentially.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. 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.
12. Contractor's signature.
13. Attachments: Include drawings, descriptions, measurements, color photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
    a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

2. RFI must be signed and scanned for electronic transmission.
3. Hard-Copy RFI shall follow Software-Generated RFI for the record.

D. COTR's Action: COTR will review each RFI, determine action required, and return it. Allow seven (7) working 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 three (3) days of receipt of the RFI response.

E. On receipt of COTR's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify COTR within three (3) days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly prior to progress meeting for inclusion in progress meeting minutes. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name of COTR.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date COTR's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.6 SUPERVISORY PERSONNEL

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

1.7 PROJECT MEETINGS

A. 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.

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

2. Attendees: Contracting Officer, COTR, Engineer; Contractor and its superintendent; major subcontractors; 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.

B. Weekly Progress Meetings

1. General: COTR will conduct progress meetings weekly at regularly scheduled times convenient for all parties involved. Additionally, discussions will address administrative

and technical issues of concern, determining resolutions, and development of deadlines for resolution within allowable time frames.

a. Minutes: COTR will record and distribute meeting minutes.

2. Attendees: As may be required by COTR, in addition to representatives of the Authority and Contractor, each subcontractor, 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.

3. 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) Time.
3) Sequence of operations.
4) Status of submittals.
5) Deliveries.
6) Storage Areas
7) Access.
8) Requests for information.
9) Submittals.
10) Noncompliance notices.
11) Temporary facilities and controls.
12) Work hours.
13) Hazards and risks.
14) Progress cleaning.
15) Quality and work standards.
16) Contract Modifications.
17) Documentation of information for payment requests.
18) Preparation of Record Documents.

4. 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.

5. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 CONSTRUCTION PROGRESS DOCUMENTATION

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 Section specifies administrative and procedural requirements for 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 this Contract.

C. Schedules required include the following:

1. Contract Construction Progress Schedule
2. Submittals Schedule.
3. Schedule of Tests and Inspections.
4. Record, As-Built Schedule.

D. Reports required include the following:

1. Daily Construction Reports.
2. Material Location Reports.
3. Field Correction Reports.
4. Special Reports.
5. Monthly Progress Reports.
6. Contractor Quality Control Reports.

E. Related Sections include the following:

1. Division 01 Section "Project Management and Coordination" for Project meeting minutes.
2. Division 01 Section "Quality Requirements" for test and inspection reports.
3. 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 and a detailed estimate of resources required to construct the

task. Each activity is assigned a unique description, activity number, activity codes, and dollar value.

B. 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.

C. Critical Path: The critical path is the longest connected chain of interdependent activities that impacts the completion of the Project.

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

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

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

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.

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 provide all schedule submittals on computer disk media.

B. Daily Progress Report: Submit duplicate copies to COTR by noon on the day following the date of actual progress.

C. 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.

D. Record As-Built Schedule: A Record 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 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).
9. Stoppages, delays, shortages, losses.
10. Emergency procedures.
11. Orders and requests of governing authorities.
12. Change Notices/Directives and Contract Modifications received, implemented.
13. Services connected, disconnected.
14. Equipment or system tests and startups.
15. Partial Completions, occupancies.
16. Substantial Completions authorized.
17. Material deliveries.

3.2 MATERIAL LOCATION REPORTS

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

3.3 FIELD CORRECTION REPORT

A. 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.

3.4 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, 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.

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

3.5 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. Contractor acknowledges and agrees that delays in activities, irrespective of the party causing 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.

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

3.6 RECORD SCHEDULE

A. After all Contract work items are complete, and as a condition of final payment, Contractor shall submit three copies of a Record, As-Built Schedule showing actual start and finish dates for all work activities and milestones, based on the accepted monthly updates.

END OF SECTION 013200

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 013300 SUBMITTALS

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 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 "Project Closeout" for submitting warranties.
2. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
3. Technical Specifications for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

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

1.4 SUBMITTAL PROCEDURES

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

B. Contractor's Responsibilities: Contractor is responsible for the scheduling and submission of all submittals. Submit to COTR all required Submittals. The COTR will forward submittals to the appropriate parties for review.

C. Processing Time: Allow enough time for submittal review, including time for re-submittals, as follows. Time for review shall commence on COTR’s receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.

1. Initial Review: Allow 7 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. COTR will advise Contractor when a submittal processed must be delayed for coordination.
2. Re-submittal Review: Allow 5 calendar days for review of each re-submittal.
3. No extension of the Contract Time will be authorized because of failure to transmit submittals to COTR enough in advance of the Work to permit processing. Processing of

incomplete or unacceptable submissions by COTR shall not reduce the number of calendar days specified above for COTR's review.

4. Notations on submittals that increase the Contract cost or time of completion shall be brought to COTR's attention before proceeding with the Work.

D. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by COTR and Architect.
3. Include the following information on label for processing and recording action taken:

    a. Contract name and number.
    b. Date.
    c. Name and address of Architect/Engineer.
    d. Name and address of Contractor.
    e. Name and address of subcontractor, if applicable.
    f. Name and address of supplier, if applicable.
    g. Name of manufacturer, if applicable.
    h. Submittal number or other unique identifier, including revision identifier.
    i. Alphanumeric project Identifier. Identifier is shown on the Project Drawings cover sheet.
    j. Number and title of appropriate Specification Section.
    k. Drawing number and detail references, as appropriate.
    l. Location(s) where product is to be installed, as appropriate.
    m. Transmittal number.

E. Resubmissions: Re-submittal procedure shall follow the same procedures and same number as the initial submittal with the following exceptions:

1. 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 and the date shall be the revised date for that submission.
2. No new material shall be included on the same transmittal for a resubmission.
3. COTR rejection shall not warrant a claim by Contractor for additional time or cost.

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

G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal from Contractor to COTR using the approved transmittal form provided by COTR. COTR will return submittals, without review**,** received from sources other than Contractor.

1. Transmittal Form: Use transmittal forms and follow other submittal procedures according to information provided to Contractor at the preconstruction meeting.

H. Distribution: Provide 5 copies of each submittal.

I. Use for Construction: Use only final submittals with mark indicating “approved” 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 Contractor's **construction** schedule specified in Division 01 Section "Construction Progress Documentation." Organize the submittal log by Section number. Assign each submittal a sequential number for identification and tracking purposes.

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

a. Title of submittal/description.
b. Submittal number (sequential).
c. Scheduled date for the first submittal.
d. Drawing number, if applicable.
e. Applicable Section number.
f. Name of subcontractor/vendor.
g. Scheduled date of COTR's final release or approval.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

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

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. Mill reports.
e. Compliance with recognized trade association standards.
f. Compliance with recognized testing agency standards.

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

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

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

F. 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.

G. 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.

H. Special Warranty Letters: Provide dates of warranty coverage and provide point of contact information for warranty service for special warranties required in the Technical Specifications.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to COTR.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents, which shall include dimensions, clearances, compatibility, and coordination with Shop Drawings and Product Data submitted for other work.

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

3.2 COTR’S ACTION

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

B. COTR Responsibilities: The review of Shop Drawings and other submittals by 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 Documents. COTR review shall not relieve Contractor of its responsibility for accuracy of Shop Drawings nor for the furnishing and installation of materials or equipment according to the Contract requirements.

1. 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."

C. Action Submittals: COTR will review each submittal, make marks to indicate corrections or modifications required, and return it. COTR will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows. Do not permit submittals marked "Revise and Resubmit" or "Rejected" to be used at Project site, or elsewhere where Work is in progress.

1. Approved: Means fabrication/installation may be undertaken. Approval does not authorize changes to the Contract Price or the Contract Time.
2. Approved as Corrected: Same as "Approved," providing Contractor complies with corrections noted on submittal. Resubmission required only if Contractor is unable to comply with noted corrections.
3. Revise and Resubmit: Fabrication and/or installation may 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 may not be undertaken. Prepare a new submittal according to requirements and submit without delay.

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

E. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION 013300

THIS PAGE INTENTIONALLY LEFT BLANK

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 01 Section “Submittals” for process required to submit the Contractor’s Quality Control Plan.
2. Division 01 Section “Construction Progress Documentation” for developing a schedule of required tests and inspections.
3. Division 01 Section “Project Closeout”
4. Technical Specifications for specific test and inspection requirements.

1.2 SUMMARY

A. This Section includes the following:

1. Administrative and procedural requirements for Contractor to provide and maintain an effective Quality-Control Program that complies with this Section.

2. Establish a QC Program that consists of the following:

   a. QC Organization
   b. QC Plan
   c. Submittal review and approval
   d. Testing, completion inspections, and QC certifications and documentation necessary to provide materials, equipment, workmanship, construction and operations that comply with the requirements of this Contract.

3. Specific quality-control requirements for individual construction activities are specified in the Sections that require those activities. Requirements in those Sections may also cover production of standard products.

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

5. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.

6. The provisions of this Section shall not limit requirements for Contractor to provide quality-control services required by the 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. METROPOLITAN WASHINGTON AIRPORT AUTHORITY

a. *Construction Safety Manual*, most current edition

1.4 DEFINITIONS

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

B. Control: To guide and have influence over.

C. Contractor Quality Control (CQC): The construction contractor's system to manage, control, and document their own, their supplier's, and their subcontractor's activities to comply with the contract requirements.

D. 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.

E. Quality-Assurance Services: Activities, actions, and procedures performed by the Authority before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirement. Additionally, the Authority fulfills its responsibility to be certain that the CQC is functioning and the specified end product is achieved.

1.5 CONFLICTING REQUIREMENTS

A. General: If compliance with two 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 case of a difference between drawings and the specifications, the specifications shall govern.

1.6 SUBMITTALS

A. Submit the following in accordance with Division 01 Section, "Submittals."

1. Action Submittals.

a. Quality Control (QC) Plan.

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

C. QC Plan shall be submitted along with the Schedule submittal.

D. Any approval by the COTR of the QC Plan shall be treated as “accepted, predicated upon successful implementation.” Stop work if the QC Plan becomes disapproved. The exception is the work authorized in the paragraph entitled "Preliminary Work Authorized Prior to Approval," shall stop.

1.7 INFORMATION FOR THE CONTRACTING OFFICER

A. Provide a sample copy set of report forms to the Contracting Officer during the Pre-Construction Conference. The report forms shall consist of the Quality Control Daily Report.

B. Deliver the following listed items to the COTR at the times specified:

1. Quality Control Daily Report: Original and 6 copies, by 12:00 noon the next working day after each day that work is performed.
2. Superintendent’s Daily Report: Original and 6, by 12:00 noon the next working day after each day that work is performed, attached to the Quality Control Daily Report.

1.8 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 receipt of such notice. Such notice, when delivered to the Contractor at the work site, 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 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 or the contract provisions. Or 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 Contractor shall maintain a detailed record of every non-compliance and corrective action taken.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014000

SECTION 017113 MOBILIZATION/DEMOBILIZATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This work shall consist of the performance of construction preparatory operations, including the movement of personnel, equipment, and materials to the project site, and for establishment and maintenance of the contractor's facilities necessary to begin and sustain work on the Contract. In addition, mobilization and demobilization shall include but not limited to the following items:

1. Obtaining personnel identification and other items as necessary to facilitate work.
2. Obtaining AOA decals for construction vehicles/equipment.
3. Deliver necessary equipment as needed to complete the project.
4. Prepare various plans and other items as necessary to facilitate work as outlined in the contract documents.
5. Recurring costs for record documentation for the duration of the project.
6. Other work items necessary to begin construction, as shown in the plans.
7. Utility sweeps and markouts.
8. Survey/stakeout.
9. Demobilization efforts (including cleanup and restoration of the contractor staging and parking areas) at completion of the Project.
10. Project closeout.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

PART 4 – METHOD OF MEASUREMENT AND BASIS OF PAYMENT (NOT USED)

END OF SECTION 017113

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 017114 MAINTENANCE AND PROTECTION OF TRAFFIC DURING CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. The Contractor shall be required to carry out his operations in a manner that will cause a minimum of interference with air traffic as indicated in the phasing plans, and shall be required to cooperate with the FAA, the Authority, the airlines, and Contractors involved in work on other projects. All work shall be completed in accordance with FAA Advisory Circular 150/5370-2E.

B. The Contractor shall be required to furnish for each area of operations his own two-way radio equipment ground control and designate a foreman trained in the use of the equipment to be available at all times to receive instructions from FAA Control Tower personnel. Vehicles with two-way radios shall have amber non-flashing lights.

PART 2 - PRODUCTS

2.1 CONTROL AND WARNING DEVICES

A. During construction operations within distance indicated on the drawings to the centerline of aircraft aprons, taxilanes, or taxiways, the Contractor shall furnish and maintain barricades along the edges of the construction area to warn the air and ground traffic to stay clear of the construction work. These barricades shall be placed as detailed in the plans or as designated by the COTR. The Contractor shall maintain warning flags around all equipment, stockpiles or other areas as directed by the COTR.

B. Red warning flags to mark equipment stockpiles, or staging areas shall be 20” by 20” square, tacked along a staff having a length of five (5) feet and having a minimum thickness of one (1) inch. The staff shall be securely driven into the ground or attached to the pavement so that the top of the flag shall be four (4) feet above ground. Contractor shall install concrete barriers with warning lights (Red) around the project area where new manholes will be installed.

PART 3 - EXECUTION

3.1 CONTROL REQUIREMENTS: The Contractor's responsibility for work areas and marking equipment is as follows:

A. Nothing shall be placed upon runways, taxiways, taxilanes, or aprons without approval of the COTR.

B. No vehicle shall enter a paved surface except at predetermined locations.

C. Warning flags and barrier fence shall be provided and erected by the Contractor as shown on the plans or as directed by the COTR.

D. No private vehicles shall be allowed on the runways or taxiways at any time.

E. Through the duration of the job any practice or situation that the COTR determines to be unsafe or a hindrance to regular Airport traffic shall be immediately rectified.

F. The Contractor shall be held responsible for the controlling of his employees, subcontractors and their employees with regard to traffic movement.

G. The Contractor shall rebuild, repair, restore and make good at his own expense all injuries or damages to any portion of the work occasioned by his use of these facilities before completion and acceptance of his work.

H. The Contractor shall submit to the COTR in writing a plan for controlling construction equipment and vehicular movements in the air operations area. This plan shall be submitted before notice to proceed is given. The Plan shall include material haul roads.

I. If required, the Contractor shall provide qualified flagmen whose duty it shall be to direct all traffic on or near active runways, taxiways, haul roads and highways. Paved surfaces shall be kept clear at all times and specifically must be kept free from all small stones which might damage aircraft.

L. The Control Tower shall at all times have control of operations on or near active runways, taxiways and approach zones. Before entering upon or crossing any runway or taxiway, the Contractor shall receive proper clearance from the Control Tower. Arrivals and departures of airplanes are under the control of the FAA Control Tower. Emergencies and operating conditions may necessitate sudden changes, both in Airport operations and in the operations of the Contractor. Aircraft operations shall always have priority over any and all of the Contractor's operations. Should runways or taxiways be required for the use of aircraft and should the Control Tower or the COTR deem the Contractor to be too close to Airport areas used by aircraft for safety, the Control Tower or the COTR may, at their discretion, order the Contractor to suspend his operations, remove his personnel, plant, equipment and

materials to a safe distance and stand by until the runways and taxiways are no longer required for use by aircraft.

M. Where any work is to be done adjacent to any operational taxiway, the Contractor shall notify the COTR one week in advance so that provisions can be made to perform the work.

N. The Contractor shall contact the COTR each day before he begins work to coordinate the status and nature of work to be done that day. The Contractor shall also report to the COTR at the end of each day to schedule the work he plans to do on the following day.

O. The Contractor shall remove all equipment and all materials that would constitute a hazard to air traffic to the designated storage area whenever work is not in progress.

P. Violations of these regulations shall be considered a violation of the Contract itself and shall be sufficient cause for halting the work without extending the time limit of the job.

PART 4 – METHOD OF MEASUREMENT AND BASIS OF PAYMENT (NOT USED)

END OF SECTION 017114

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 017700 PROJECT CLOSEOUT

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 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 "Project Record Documents" for submitting Record Drawings, Record Specifications, Record Product Data, and other Record Documents.
3. Technical Specifications for specific closeout and special cleaning requirements for products of those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Definition*:* "Substantial Completion" is the stage in the progress of the work when COTR determines that all the Work, or a designated portion thereof, is sufficiently complete and functional according to the Contract Documents so that the Authority can occupy or utilize the Work for its intended use. The only remaining physical work shall be the completion of punch list work prior to Final Acceptance.

B. Preliminary Procedures: Before requesting 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 value of items on the list, reasons why the Work is not complete, and a schedule for completing punch list work.
2. Ensure previously outstanding technical submittals and Shop Drawings have been submitted and approved.
3. Advise COTR of pending insurance changeover requirements.

4. Submit warranties required by Contract Documents, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

    a. Submit Contractor Warranty Letter, for review and approval, before requesting inspection for determining date of Substantial Completion. After date of Substantial Completion has been determined revise the Contractor's Warranty Letter to include that date as start of Warranty period.
5. Prepare and submit Project Record Documents except Record Contract Schedule; damage or settlement surveys, and similar final record information.
6. Prepare and submit proof that specified testing has been completed and accepted.
7. Terminate and remove temporary facilities from Project site.

C. Inspection: Submit a written request 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 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 by the COTR. Failure to complete the punch list work within the duration specified may result in the Contracting Officer ordering the work to be completed by others at the cost to Contractor.
3. Results of completed inspection will form the basis of requirements for Final Acceptance.

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 administrative obligations. 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 COTR's 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.
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 Schedule.
9. Submit warranty documentation.

C. Inspection: Submit a written request 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 construction 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.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit four copies of list.

PART 2 - PRODUCTS

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.

B. Cleaning:

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.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Authority's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

1. Where extra materials of value remaining after completion of associated Work have become the Authority's property, arrange for disposition of these materials as directed by COTR.

END OF SECTION 017700

SECTION 017839 PROJECT RECORD DOCUMENTS

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 Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
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.

1.3 SUBMITTALS

A. Record Drawings. Comply with the following:

1. Submit copies of Record Drawings as follows:

a. Initial Submittal: Submit one set of complete, full-sized, marked-up Record Drawings. Contractor shall retain the originals for correction and final reproduction. The 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 mark-ups are acceptable. The COTR will return review comments indicating any corrections

that need to be made to the drawings. The corrected 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 on the drawings, submit three complete, full-sized, printed sets and four CD ROMs of marked-up Record Drawings. The CD ROM's shall include all of the files necessary to duplicate the printed material. Include each sheet, whether or not changes and additional information were recorded. In addition, submit the original set of marked-up record drawings onto which the mark-ups were made.

B. Record Specifications: Submit two copies of Project Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one copy of each Product Data submittal at the direction of 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 three copies of Record Schedule.

F. Miscellaneous Record Submittals: Submit miscellaneous Record Submittals as specified.

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 Contract Drawings, applicable shop drawings and coordination drawings for record purposes.

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. 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 drawings). Show cross-references to the new sheets on the Drawings. Update drawing index as needed to reflect new sheets.
4. 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.
5. Mark important additional information that was either shown schematically or not indicated on the original Drawings.
6. 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. 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)

4. 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 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.
7. Include contract required coordination drawings in the record drawing set.

2.2 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.

2.3 RECORD SCHEDULE

A. Record Schedule Submittal: Immediately prior to date of inspection for Final Acceptance, submit a copy of the As-built Contract Schedule 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.

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.

END OF SECTION 017839

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION D-751 MANHOLES

PART 1 – GENERAL

1.1 DESCRIPTION

A. This item shall consist of construction of manholes, catch basins, inlets, and inspection holes, in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the Engineer.

PART 2 – MATERIALS

2.1 MORTAR.

A. Mortar shall consist of one part Portland cement and two parts sand. The Portland cement shall conform to the requirements of ASTM C 150, Type I. The sand shall conform to the requirements of ASTM C 144.

2.2 CONCRETE.

A. Plain and reinforced concrete used in structures, connections of pipes with structures, and the support of structures or frames shall conform to the requirements of Items P-610 and P-611.

2.3 PRECAST CONCRETE PIPE MANHOLE RINGS.

A. Precast concrete pipe manhole rings shall conform to the requirements of ASTM C 478. Unless otherwise specified, the risers and offset cone sections shall have an inside diameter of not less than 36 in (90 cm).

2.4 FRAMES, COVERS, AND GRATES.

A. The castings shall conform to ASTM A 536 for Ductile Iron Castings.

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings, aircraft gear configuration and/or direct loading, specified.

Each frame and cover or grate unit shall be provided with fastening members to prevent it from being dislodged by traffic but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned.

2.5 STEPS

A. The steps or ladder bars shall be either aluminum, reinforcing bars encased in a corrosion resistant rubber sheath, galvanized steel (ASTM A-123) or as approved by the COTR. The steps shall be the size, length, and shape shown on the plans.

PART 3 - CONSTRUCTION METHODS

3.1 UNCLASSIFIED EXCAVATION

A. The Contractor shall do all excavation for structures and structure footings to the lines and grades or elevations, shown on the plans. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximately only; and the Engineer may order, in writing, changes in dimensions or elevations of footings necessary to secure a satisfactory foundation.

B. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the Engineer. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation, and excavation to final grade shall not be made until just before the concrete or reinforcing is to be placed.

C. The Contractor shall do all bracing, sheathing, and/or shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, and/or shoring shall be included in the unit price bid for the structure. Contractor shall be required to submit an excavation plan to the COTR for approval, detailing its intended excavation methods. Contractor's excavation plan must be produced by an Engineer professionally licensed to practice in the Commonwealth of Virginia.

D. Unless otherwise provided, bracing, sheathing, or shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall be effected in a manner that will not disturb or mar finished masonry. The cost of removal shall be included in the unit price bid for the structure.

E. After each excavation is completed, the Contractor shall notify the Engineer to that effect; and concrete or reinforcing steel shall be placed after the Engineer has approved the depth of the excavation and the character of the foundation material.

F. Contractor shall refer to the Geotechnical Engineering Study located in Appendix A of these specifications for further specific requirements and recommendations related to the excavation required for the installation of the glycol manholes. Contractor shall coordinate all excavation operations to comport with geotechnical engineering recommendations found in the study.

3.2 CONCRETE STRUCTURES.

A. Concrete structures shall be built on prepared foundations, conforming to the dimensions and form indicated on the plans. The construction shall conform to the requirements specified in Items P-610 and P-611. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the Engineer before the concrete is poured.

All invert channels shall be constructed and shaped accurately so as to be smooth, uniform, and cause minimum resistance to flowing water. The interior bottom shall be sloped downward toward the outlet.

3.3 PRECAST CONCRETE PIPE STRUCTURES.

A. Precast concrete pipe structures shall be constructed on prepared or previously placed slab foundations and shall conform to the dimensions and locations shown on the plans. All precast concrete pipe sections necessary to build a completed structure shall be furnished. The different sections shall fit together readily, and all jointing and connections shall be cemented with mortar. The top of the upper precast concrete pipe member shall be suitably formed and dimensioned to receive the metal frame and cover or grate, or other cap, as required. Provision shall be made for any connections for lateral pipe, including drops and leads that may be installed in the structure. The flow lines shall be smooth, uniform, and cause minimum resistance to flow. The metal steps that are embedded or built into the side walls shall be aligned and placed at vertical intervals of 12 in (300 mm). When a metal ladder replaces the steps, it shall be securely fastened into position.

3.4 INLET AND OUTLET PIPES.

A. Inlet and outlet pipes shall extend through the walls of the structures for a sufficient distance beyond the outside surface to allow for connections but shall be cut off flush with the wall on the inside surface, unless otherwise directed. Mortar shall be placed around these pipes so as to form a tight, neat connection.

3.5 PLACEMENT AND TREATMENT OF CASTINGS, FRAMES, AND FITTINGS.

A. All castings, frames, and fittings shall be placed in the positions indicated on the plans or as directed by the Engineer, and shall be set true to line and to correct elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

When frames or fittings are to be placed upon previously constructed masonry, the bearing surface or masonry shall be brought true to line and grade and shall present an even bearing surface in order that the entire face or back of the unit will come in contact with the masonry. The unit shall be set in mortar beds and anchored to the masonry as indicated on the plans or as directed and approved by the Engineer. All units shall set firm and secure.

After the frames or fittings have been set in final position and the concrete or mortar has been allowed to harden for 7 days, then the grates or covers shall be placed and fastened down.

3.6 INSTALLATION OF STEPS

A. The steps shall be installed as indicated on the plans or as directed by the Engineer. When the steps are to be set in concrete, they shall be placed and secured in position before the concrete is poured. When the steps are installed in brick masonry, they shall be placed as the masonry is being built. The steps shall not be disturbed or used until the concrete or mortar has hardened for at least 7 days. After this period has elapsed, the steps shall be cleaned and painted, unless they have been galvanized.

For precast concrete pipe structures, steps shall be cast into the sides of the pipe at the time the pipe sections are manufactured or set in place after the structure is erected by drilling holes in the concrete and cementing the steps in place.

When steps are required with corrugated metal structures, they shall be welded into aligned position at a vertical spacing of 12 in (300 mm).

In lieu of steps, prefabricated ladders may be installed. Ladder shall be held in place by grouting the supports in drilled holes.

3.7 BACKFILLING

A. After a structure has been completed, the area around it shall be filled with approved material, in horizontal layers not to exceed 8 in (200 mm) in loose depth, and compacted to the density required in Item P-152. Each layer shall be deposited all around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the Engineer.

B. Backfilling shall not be placed against any structure until permission is given by the Engineer. In the case of concrete, such permission shall not be given until the concrete has been in place 7 days, or until tests made by the laboratory under supervision of the Engineer establish that the concrete has attained sufficient strength to provide a factor of safety against damage or strain in withstanding any pressure created by the backfill or the methods used in placing it.

C. Select backfill material shall be measured for direct payment under item P-152-4.2.

D. Contractor shall refer to the Geotechnical Engineering Study located in Appendix A of these specifications for further specific requirements and recommendations related to the backfilling associated with the installation of the glycol manholes. Contractor shall coordinate all backfilling operations to comport with geotechnical engineering recommendations found in the study.

3.8 CLEANING AND RESTORATION OF SITE.

A. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as ordered by the Engineer. The Contractor shall restore all disturbed areas to their original condition.

After all work is completed, the Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

PART 4 – METHOD OF MEASUREMENT AND BASIS OF PAYMENT (NOT USED)

MATERIAL
REQUIREMENT

ASTM A 47	Ferritic Malleable Iron Castings
ASTM A 48	Gray Iron Castings
ASTM A 123	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 536	Ductile Iron Castings
ASTM C 150	Portland Cement
ASTM C 478	Precast Reinforced Concrete Manhole Sections

END OF SECTION D-751

THIS PAGE INTENTIONALLY LEFT BLANK

ITEM P-152 EXCAVATION AND EMBANKMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required for drainage or other purposes in accordance with these specifications and in conformity to the dimensions and cross sections shown on the plans.

1.2 CLASSIFICATION

A. All material excavated shall be classified as defined below:

1. Unclassified Excavation. Unclassified excavation shall consist of the excavation/embankment and disposal of all unsuitable material off airport property.

PART 2 - MATERIALS (NOT USED)

PART 3 - CONSTRUCTION METHODS

3.1 GENERAL

A. The suitability of material shall be subject to approval by the COTR. All excess unclassified excavation and material not suited for backfill shall be disposed of off-site. The Geotechnical Engineering Study for the project is available by request.

B. When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued. At the direction of the COTR, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

EXCAVATION

C. No excavation shall be started until the work has been staked out by the Contractor and the COTR has approved. All suitable excavated material shall be used for backfill as shown on the plans. All unsuitable material shall be disposed of off site.

D. The contractor shall be responsible for dewatering of the excavation area.

1. Undercutting: Muck, peat, matted roots, or other yielding material, unsatisfactory for structural subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be

disposed of at location off airport property. The excavated area shall be refilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary refilling will constitute a part of the embankment. If required, suitable embankment material can be obtained from MWAA soil bank within airport property.

2. Overbreak: Overbreak, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the COTR. The COTR shall determine if the displacement of such material was unavoidable and his/her decision shall be final. All overbreak shall be graded or removed by the Contractor and disposed of as directed; however, payment will not be made for the removal and disposal of overbreak which the COTR determines as avoidable. Unavoidable overbreak will be classified as "Unclassified Excavation."

3. Compaction Requirements: All areas shall be compacted to a density of not less than 95 % of the maximum density as determined by ASTM D 1557. The material to be compacted shall be within +/-2 percent of optimum moisture content before rolled to obtain the prescribed compaction (except for expansive soils).

E. The in-place field density shall be determined in accordance with ASTM D 2992 and D3017 (Nuclear Density Method) to verify the density, degree of compaction, and moisture content. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in the backfill. Contractor will not be responsible for testing. Authority will provide necessary testing services.

F. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line of finished grade of slope. All cut-and-fill slopes shall be uniformly dressed to the slope, cross section, and alignment shown on the plans or as directed by the COTR.

G. Blasting will not be permitted.

3.2 HAUL

A. All hauling will be considered a necessary and incidental part of the work. Its cost shall be considered by the Contractor and included in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.1 Unclassified excavation/embankment will be measured on a per cubic yard basis and shall be paid for under the contract unit price. Select embankment/borrow will be measured on a cubic yard basis and shall be paid for under the contract unit price. Payment shall be made under:

A. P-152-4.1 Unclassified Excavation and embankment – per cubic yard

B. P-152-4.2 Select Embankment (Borrow) – per cubic yard

TESTING REQUIREMENTS

ASTM D 1557	Test for Laboratory Compaction Characteristics of Soil Using Modified Effort
ASTM D 2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	Test Methods for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

END OF ITEM P-152

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION P-304 CEMENT-TREATED BASE COURSE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This item shall consist of a base course composed of mineral aggregate and cement uniformly blended and mixed with water. The mixed material shall be spread, shaped, and compacted in accordance with these specifications and in conformity to the lines, grades, dimensions, and typical cross sections shown on the plans. Runway and taxiway pavements shall be built in a series of parallel lanes using a plan of processing that reduces longitudinal and transverse joints to a minimum.

PART 2 - MATERIALS

2.1 PORTLAND CEMENT

A. Portland cement shall conform to the requirements of ASTM C 150, Type I.

2.2 WATER.

A. Water used in mixing or curing shall be as clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product as possible. Water will be tested in accordance with the requirements of AASHTO T 26. Water known to be of potable quality may be used without testing.

2.3 AGGREGATE

A. Aggregates shall consist of clean, sound, durable particles of crushed stone, or crushed gravel and shall be free from coatings of clay, silt, vegetable matter, and other objectionable materials and shall contain no clay balls. Fine aggregate passing the No. 4 sieve shall consist of fines from the operation of crushing the coarse aggregate. If necessary, fine aggregate may be added to produce the correct gradation. The fine aggregate shall be produced by crushing stone, gravel that meet the requirements for wear and soundness specified for coarse aggregate.

The crushed aggregate portion, which is retained on the No. 4 sieve shall contain not more than 15 percent, by weight, of flat or elongated pieces as defined in ASTM D 693 and shall have at least 90 percent by weight of particles with at least two fractured faces and 100 percent with at least one fractured face. The area of each face shall be equal to at least 75 percent of the smallest midsectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 to count as two fractured faces.

The percentage of wear shall not be greater than 45 percent when tested in accordance with ASTM C 131. The sodium sulfate soundness loss shall not exceed 12 percent, after 5 cycles, when tested in accordance with ASTM C 88.

The fraction passing the No. 40 sieve shall have a liquid limit no greater than 25 and a plasticity index of not more than 4 when tested in accordance with ASTM D 4318. The fine aggregate

shall have a minimum sand equivalent value of 35 when tested in accordance with ASTM D 2419.

B. Sampling and Testing.

Aggregates for preliminary testing shall be furnished by the Contractor prior to the start of production. All tests for initial aggregate submittals necessary to determine compliance with the specification requirements will be made by the Resident Engineer.
Samples of aggregates shall be furnished by the Contractor at the start of production and at intervals during production. The sampling points and intervals will be designated by the Resident Engineer. The samples will be the basis of approval of specific lots of aggregates from the standpoint of the quality requirements of this section.

In lieu of testing, the Resident Engineer may accept certified state test results indicating that the aggregate meets specification requirements.

Aggregates suspected of containing injurious quantities of sulfates shall be examined petrographically in accordance with ASTM C 295.

The aggregate shall conform to the gradation shown in Table 1 when tested in accordance with ASTM C 136.

TABLE 1. AGGREGATE CEMENT-TREATED BASE COURSE

Sieve Size	Percentage by Weight Passing Sieves
1 in.	100
No. 4	45-100
No. 10	37-80
No. 40	15-50
No. 80	0-25

The gradations in the table represent the limits that shall determine suitability of aggregate for use from the sources of supply. The final gradations decided on, within the limits designated in the table, shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on adjacent sieves, or vice versa. The portion of the base aggregate, including any blended material, passing the No. 40 sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than 6 when tested in accordance with ASTM D 4318.

All aggregate samples required for testing shall be furnished by the Contractor at the expense of the Contractor. Sampling shall be in accordance with ASTM D 75 and will be observed by the Resident Engineer. No aggregate shall be used in production of mixtures without prior approval.

Samples of aggregates to check gradation shall be supplied to the Resident Engineer by the Contractor at the expense of the Contractor at least once daily. Sampling shall be in accordance with ASTM D 75, and testing shall be in accordance with ASTM C 136 and C 117.

2.4 COVER MATERIAL FOR CURING.

A. Curing materials shall conform to one of the following specifications:

1. Liquid membrane-forming compounds for curing cement-treated base course shall conform to the requirements of ASTM C 309, Type 2, Class A or B.

2. Asphalt emulsion for curing cement treated base shall conform to the requirements of ASTM D 977, Type SS-1h.

PART 3 - CEMENT CONTENT

3.1 Prior to start of work, laboratory tests of materials submitted by the Contractor shall be made to determine the quantity of cement required in the mix. The cement content for construction shall be that at which the mix develops a 7-day compressive strength of at least 500 psi and a 28 day compressive strength of 750 psi with a maximum of 1,200 psi. The testing procedure shall be as follows: mold and cure specimens in accordance with ASTM D 560; soak specimens in water for 4 hours; cap and break specimens in compression in accordance with ASTM D 1633. The freeze-thaw weight loss shall not exceed 14 percent when tested in accordance with ASTM D 560. The Contractor shall perform the laboratory tests to determine the cement content and submit the test results to the Resident Engineer. The testing shall be at the Contractor's expense.

PART 4 - CONSTRUCTION METHODS

4.1 WEATHER LIMITATIONS.

A. The cement-treated base shall not be mixed or placed while the atmospheric temperature is below 40° F, when conditions indicate that the temperature may fall below 35°F within 24 hours, or when the weather is rainy. Cement-treated base shall not be placed on frozen subgrade or mixed when aggregate is frozen. Cement-treated base shall not be placed during rain fall events.

4.2 PREPARING UNDERLYING COURSE.

A. The underlying crushed aggregate base course shall be checked and accepted by the Resident Engineer before placing and spreading operations are started. Any ruts or soft yielding places caused by improper drainage conditions, hauling, or any other cause shall be corrected before the base course is placed thereon.

4.3 MIXING.

A. The aggregate shall be proportioned and mixed with cement and water in a central mixing plant. The plant shall be equipped with feeding and metering devices which will introduce the cement, aggregate, and water into the mixer in the quantities specified. Mixing shall continue until a thorough and uniform mixture has been obtained.

4.4 PLACING.

A. The mixture shall be transported to the job site in suitable vehicles and shall be deposited on the moistened crushed aggregate base course in uniform layers by means of approved mechanical spreaders. Not more than 60 minutes shall elapse between the start of moist mixing and the start of compaction of the cement-treated mixture on the prepared base.

4.5 HANDLING, MEASURING, AND BATCHING MATERIAL.

A. The batch plant site, layout, equipment, and provisions for transporting material shall assure a continuous supply of material to the work. Stockpiles shall be built up in layers of not more than 3 feet in thickness. Each layer shall be completely in place before beginning the next layer and shall not be allowed to "cone" down over the next lower layer. Aggregates from different sources and of different grading shall not be stockpiled together. Improperly placed stockpiles will not be accepted by the Resident Engineer.

Aggregates shall be handled from stockpiles or other sources to the batching plant in such manner to secure the specified grading of the material. Aggregates that have become segregated or mixed with earth or foreign material shall not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least 12 hours before being batched. Rail shipments requiring more than 12 hours will be accepted as adequate binning only if the car bodies permit free drainage. The fine aggregate and coarse aggregate shall be separately weighed into hoppers in the respective amounts set by the Resident Engineer in the job mix except where a unit aggregate such as crusher run or pit run are used, in which case a single stockpile will be satisfactory. Cement shall be measured by weight. Separate scales and hopper, with a device to positively indicate the complete discharge of the batch of cement into the batch box or container shall be used for weighing the cement.

When required by the contract or when permitted, batching plants shall be equipped to proportion aggregates and bulk cement, by weight, automatically using interlocked proportioning devices of an approved type. The Contractor shall use a suitable method of handling the cement from weighing hopper to transporting container or into the batch itself for transportation to the mixer, such as a chute, boot, or other approved device, to prevent loss of cement. The device shall be arranged to provide positive assurance of the actual presence in each batch of the entire cement content specified.

When cement is placed in contact with the aggregates, batches may be rejected unless mixed within 1-1/2 hours of such contact. Batching shall be conducted so that the results in the weights of each material required will be within a tolerance of 1 percent for cement and 2 percent for aggregates.

Water may be measured either by volume or by weight. The accuracy of measuring the water shall be within plus or minus 1 percent of required amounts. Unless the water is to be weighed, the water-measuring equipment shall include an auxiliary tank from which the measuring tank shall be filled.

Methods and equipment for adding air-entraining agent or other admixtures to the batch, when required, shall be approved by the Resident Engineer. All admixtures shall be measured into the mixer with an accuracy of plus or minus 3 percent.

4.6 ACCEPTANCE SAMPLING AND TESTING OF CEMENT-TREATED BASE COURSE (COMPACTION).

A. Immediately upon completion of the spreading operations, the mixture shall be thoroughly compacted. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density.

The cement-treated base course shall be accepted for density on a lot basis. A lot will consist of one days production where it is not expected to exceed 1,200 square yards and will be divided into four equal sublots. A lot will consist of one-half day's production where a day's production is expected to consist of between 1,200 and 2,400 square yards. One test shall be made for each sublot. Sampling locations will be determined by the Resident Engineer on a random basis in accordance with statistical procedures contained in ASTM D 3665.

Each lot of compacted material will be accepted, with respect to density, when the average field density is equal to or greater than 98 percent of the maximum density of laboratory specimens prepared from samples of cement-treated base course taken from the material in place.

The laboratory specimens shall be compacted and tested in accordance with ASTM D 558. The in-place field density shall be determined in accordance with ASTM D 1556 or ASTM D 2167 or ASTM D 2922.

The lot will be accepted without adjustment in payment if the average density, based on four acceptance tests of the lot, is greater than or equal to 98 percent. If the average density does not meet this requirement, the Contractor may elect to leave the lot in place at a reduced unit price as determined in accordance with Table 2.

TABLE 2. SLIDING SCALE PAY FACTORS

Average Percent Density	Recommended Percent Payment
98.0 and greater	100
97.0-97.9	95
96.0-96.9	90
95.0-95.9	75
Less than 95.0	reject

Any mixture that has not been compacted shall not be left undistributed for more than 30 minutes. The water content of the mixture at the start of compaction shall not be below nor more than 2 percentage points above the optimum water content. The optimum water content shall be determined in accordance with ASTM D 558 and shall be less than that amount which will cause the mixture to become unstable during compaction and finishing.

If the average percent density is lower than 95, the cement-treated base course will be rejected, removed and replaced at no expense to the owner.

4.7 LAYER THICKNESS.

A. The maximum depth of a compacted layer shall be 6 inches, except where that total depth of the compacted base course is required to be greater than 6 inches, no layer shall be in excess of 8 inches or less than 4 inches when compacted. In multilayer construction, the surface of the compacted material shall be kept moist until covered with the next layer. Successive layers shall be placed and compacted so that the required total depth of the base course is completed the same day.

B. Thickness Testing. The CTB shall be tested for thickness using the same lot and sublot designations established for density testing. After 3 days of curing, one (1) 4 in (102 mm) diameter core per sublot shall be obtained from a random location, as identified using the procedures contained in ASTM D 3665. The thickness of each sampled core shall be determined using the caliper measurement procedures provided in ASTM C 174. The average thickness for the lot shall be determined using the individual sublot core thicknesses. Acceptance criteria for CTB thickness are provided in paragraphs 4.6 and 4.7. At all locations where cores have been drilled, the resulting core holes shall be filled by the Contractor with CTB, HMA, or non-shrink grout.

4.8 FINISHING.

A. Finishing operations shall be completed during daylight hours or under adequate artificial lighting approved by the Resident Engineer, and the completed base course shall conform to the required lines, grades, and cross section. If necessary, the surface shall be lightly scarified to eliminate any imprints made by the compacting or shaping equipment. The surface shall then be recompacted to the required density. The compaction and finishing operations shall be completed within 2 hours of the time water is added to the mixture and shall produce a smooth, dense surface that is free of surface checking, ridges, or loose material. Material not completed within the 2 hour time limit shall be removed and replaced at no expense to the Owner.

4.9 SURFACE TOLERANCE.

A. The finished surface shall not vary more than 3/8 inch when tested with a 16-foot straightedge applied parallel with, or at right angles to, the centerline of the stabilized area. Any deviation in excess of this amount shall be corrected by the Contractor at the Contractor's expense.

4.10 CONSTRUCTION JOINTS.

A. At the end of each day's construction, a transverse construction joint shall be formed by a header or by cutting back into the compacted material to form a true vertical face free of loose material.

Longitudinal joints shall be formed by cutting back into the compacted material to form a true vertical edge.

4.11 PROTECTION AND CURING.

A. The completed cement-treated base shall be cured with a curing material applied as soon as possible, and in no case later than 24 hours after completion of the finishing operations. The surface of the base course shall be kept moist until the curing material is applied.

The following are alternate approved methods for curing cement-treated base courses.

1. Impervious Membrane Method. The entire surface of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the base has taken place. The curing compound shall not be applied during rainfall. Curing compound shall be applied by mechanical sprayers under pressure at the rate of 1 gallon to not more than 200 square feet. The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed condition with pigment uniformly dispersed throughout the vehicle. During application, the compound shall be stirred continuously by effective mechanical means. Hand spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. Curing compound shall not be applied to the inside faces of joints to be sealed, but approved means shall be used to ensure proper curing for 72 hours. The curing compound shall be of such character that the film will harden within 30 minutes after application. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional compound. Upon removal of side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface.

2. Asphalt Emulsion. The entire surface of the pavement shall be uniformly sprayed with asphalt emulsion before the set of the base has taken place. The asphalt emulsion shall be applied by distributing equipment at the rate of approximately 0.2 gallons per square yard. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional asphalt emulsion.

3. Curing in Cold Weather. When the average daily temperature is below 40 degrees F, curing shall consist of covering the newly laid pavement with insulation blankets, which shall be retained in place for 10 days. The insulation blankets shall be secured to avoid cold air penetration or being blown away.

   When cement-treated base is being placed and the air temperature may be expected to drop below 35 degrees F, a sufficient supply of suitable insulation blanketing material such as burlap or polyethylene shall be provided along the work. Any time the temperature may be expected to reach the freezing point during the day or night, the material so provided shall be spread over the pavement to a sufficient depth to prevent freezing of the cement-treated base.

   The period of time such protection shall be maintained shall not be less than 10 days. The Contractor shall be responsible for the quality and strength of the cement-treated base placed during cold weather, and any base material injured by frost action shall be removed and replaced at the Contractor's expense.

   The cement-treated base course shall cure for a minimum of 10 days prior to exposing it to construction traffic. If the cement-treated base course is damaged in any manner by

construction equipment or construction operation the Contractor shall replace the damaged section at no expense to the Owner.

Prior to placement of concrete pavement, apply a bond breaker in accordance with Item P-501.

PART 5 – METHOD OF MEASUREMENT AND BASIS OF PAYMENT (NOT USED)

TESTING REQUIREMENTS

ASTM C 136	Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 295	Guide for Petrographic Examination of Aggregates for Concrete
ASTM D 75	Practice for Sampling Aggregates
ASTM D 558	Test Methods for Moisture-Density Relations of Soil-Cement Mixtures
ASTM D 560	Test Methods for Freezing and Thawing Compacted Soil-Cement Mixtures
ASTM D 1556	Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1633	Test Method for Compressive Strength of Molded Soil-Cement Cylinders
ASTM D 2167	Test Method for Density and Unit Weight of Soil in Place by the Rubber-Balloon Method
ASTM D 2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3665	Practice for Random Sampling of Construction Materials
ASTM D 4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
AASHTO T 26	Quality of Water to be Used in Concrete

MATERIAL REQUIREMENTS

ASTM C 150	Specification for Portland Cement
ASTM C 309	Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM D 977	Specification for Emulsified Asphalt

ASTM D 2028	Specification for Cutback Asphalt (Rapid Curing Type)
ASTM D 2397	Specification for Cationic Emulsified Asphalt

END OF SECTION P-304

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION P-501 PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. This work shall consist of pavement composed of Portland Cement Concrete, with and without reinforcement constructed on a prepared underlying surface in accordance with these specifications and shall conform to the lines, grades, thickness, and typical cross sections shown on the plans.

PART 2 - MATERIALS

2.1 AGGREGATES

A. Reactivity. Aggregates shall be tested for deleterious reactivity with alkalis in the cement, which may cause excessive expansion of the concrete. Tests of coarse and fine aggregate shall be made in accordance with ASTM C 1260. If the expansion of the coarse or fine aggregate test specimens, tested in accordance with ASTM C 1260, does not exceed 0.10 % at 28 days from casting, the coarse or fine aggregates shall be accepted.

If the expansion of any aggregate, coarse or fine, at 28 days is greater than 0.10%, tests of combined materials shall be made in accordance with ASTM C 1567 using the aggregates, cementitious materials, and/or specific reactivity reducing chemicals in the proportions proposed for the mixture design. If the expansion of the proposed combined materials test specimens, tested in accordance with ASTM C 1567, does not exceed 0.10 % at 28 days from casting, the proposed combined materials will be accepted. If the expansion of the proposed combined materials test specimens is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10 % at 28 days, or new aggregates shall be evaluated and tested.

B. Fine Aggregate**.** Fine aggregate shall conform to the requirements of ASTM C 33. Gradation shall meet the requirements of Table 1 when tested in accordance with ASTM C 136, except as may otherwise be qualified under Section 6 of ASTM C 33.

TABLE 1. GRADATION FOR FINE AGGREGATE (ASTM C 33)

Sieve Designation (Square Openings)	Percentage by Weight Passing Sieves
3/8 in.	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

C. Coarse Aggregate. Coarse aggregate shall conform to the requirements of ASTM C 33. Gradation, within the separated size groups, shall meet the requirements of Table 2 when tested in accordance with ASTM C 136. When the nominal maximum size of the aggregate is greater than 1 inch, the aggregates shall be furnished in two size groups.

Aggregates delivered to the mixer shall consist of crushed stone, crushed or uncrushed gravel, air-cooled blast furnace slag, crushed recycled concrete pavement, or a combination thereof. The aggregate shall be composed of clean, hard, uncoated particles and shall meet the requirements for deleterious substances contained in ASTM C 33, Class 45. Dust and other coating shall be removed from the aggregates by washing. The aggregate in any size group shall not contain more than 8 percent by weight of flat or elongated pieces when tested in accordance with ASTM D 4791. A flat or elongated particle is one having a ratio between the maximum and the minimum dimensions of a circumscribing rectangular prism exceeding 5 to 1.

Prior to approval of mixture design, the Contractor shall submit written certification that the aggregate does not have a history of D-Cracking and that the aggregate is approved by Maryland State Highway Administration (SHA) specifically addressing susceptibility to D-Cracking. If the aggregate is not approved by the SHA, the aggregates may be approved provided the aggregate is tested in accordance with ASTM C 666 and receives a durability factor of 95 percent or greater.

The percentage of wear shall be no more than 40 when tested in accordance with ASTM C 131 or ASTM C 535.

TABLE 2. GRADATION FOR COARSE AGGREGATE
ASTM C 33

	Percentage by Weight Passing Sieves
Square Designations (square openings) in.	**No. 57 Stone, per VDOT 1-Inch - No. 4**
1-1/2	**100**
1	**95-100**
3/4	**--**
1/2	**25-60**
3/8	**--**
No. 4	**0-10**
No. 8	**0-5**

Aggregate susceptibility to Disintegration (D) Cracking. Aggregates that have a history of D-cracking shall not be used. Prior to approval of mixture design and production of Portland cement concrete the Contractor shall submit written certification that the aggregate does not have a history of D-Cracking and that the aggregate meets the specified requirements of the Maryland State Highway Administration (SHA).

1) Other sources of crushed stone aggregate may be approved if the durability factor as determined by ASTM C 666 is greater than or equal to 95 and all other quality test

requirements within these specifications are fulfilled. The FAA will consider and reserves final approval of other State classification procedures.

2) Crushed gravel and sand-gravel aggregates shall not be required to meet freeze-thaw durability ratings. These aggregates shall be approved for use in concrete by the state highway agency in the state from which the aggregate originates and the state in which they are to be used and shall meet all other criteria within these specifications.

2.2 CEMENT. Cement shall conform to the requirements of ASTM C150 Type I or II, or ASTM C595, Type IS.

If for any reason, cement becomes partially set or contains lumps of caked cement, it shall be rejected. Cement salvaged from discarded or used bags shall not be used.

Only cements containing less than 0.6% equivalent alkali or cements that can demonstrate a positive reduction in the expansion created by alkali-silica reactions shall be used.

2.3 CEMENTITIOUS MATERIALS.

A. Fly Ash. Fly ash shall meet the requirements of ASTM C 618, Class F with the exception of loss of ignition, where the maximum shall be less than 6 percent for Class F. The supplementary optional chemical and physical properties of Table 3 contained in ASTM C 618 shall apply. Fly ash such as is produced in furnace operations utilizing liming materials or soda ash (sodium carbonate) as an additive shall not be acceptable. The Contractor shall furnish vendor's certified test reports for each shipment of Fly Ash used in the project. The vendor's certified test report can be used for acceptance or the material may be tested independently by the Engineer.

B. Blast Furnace Slag (Slag Cement). Ground Granulated Blast Furnace (GGBF) slag shall conform to ASTM C 989, Grade 100 or 120. GGBF shall be used only at a rate between 25 and 55 percent of the total cementitious material by mass.

2.4 PREMOLDED JOINT FILLER**.** Premolded joint filler for expansion joints shall conform to the requirements of ASTM D 1751 and shall be punched to admit the dowels where called for on the plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint, unless otherwise specified by the Engineer. When the use of more than one piece is required for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to the Engineer.

2.5 JOINT SEALER. The joint sealer for the joints in the concrete pavement shall be of the type(s) specified in the plans.

2.6 STEEL REINFORCEMENT. Reinforcing shall consist of welded wire fabric conforming to the requirements of ASTM A-185. Welded wire fabric shall be furnished in flat sheets only.

2.7 DOWEL AND TIE BARS. Tie bars shall be deformed steel bars and conform to the requirements of ASTM A 615 or ASTM A 996, except that rail steel bars, Grade 50 or 60, shall not be used for tie bars that are to be bent or restraightened during construction. Tie bars designated as Grade 40 in ASTM A 615 can be used for construction requiring bent bars.

Dowel bars shall be plain steel bars conforming to ASTM A 615 or ASTM A 966 and shall be free from burring or other deformation restricting slippage in the concrete. High strength dowel bars shall conform to ASTM A 714, Class 2, Type S, Grade I, II or III, Bare Finish. Before delivery to the construction site each dowel bar shall be painted with one coat of paint conforming to MIL-DTL-24441/20A.SSPC Paint 5 or SSPC Paint 25. Metal or plastic collars shall be full circular device supporting the dowel until the epoxy hardens.

The sleeves for dowel bars used in expansion joints shall be metal or other type of an approved design to cover 2 to 3 inches of the dowel, with a closed end and with a suitable stop to hold the end of the bar at least 1 inch from the closed end of the sleeve. Sleeves shall be of such design that they will not collapse during construction.

2.8 WATER. Water used in mixing or curing shall be clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product. Water will be tested in accordance with the requirements of AASHTO T 26. Water known to be of potable quality may be used without testing.

2.9 COVER MATERIAL FOR CURING.

A. Curing materials shall conform to the following specifications:

1. Liquid membrane-forming compounds for curing concrete shall conform to the requirements of ASTM C 309, Type 2, Class B, or Class A if wax base only.

2.10 ADMIXTURES. The use of any material added to the concrete mix shall be approved by the Engineer. The Contractor shall submit certificates indicating that the material to be furnished meets all of the requirements indicated below. In addition, the Engineer may require the Contractor to submit complete test data from an approved laboratory showing that the material to be furnished meets all of the requirements of the cited specifications. Subsequent tests may be made of samples taken by the Engineer from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved. A certification from the supplier shall be submitted with the mix design which indicates that the admixture products utilized are compatible with all other materials utilized in the proposed mixture.

A. Air-Entraining Admixtures. Air-entraining admixtures shall meet the requirements of ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entrainment agent and any water reducer admixture shall be compatible.

B. Chemical Admixtures. Water-reducing, set retarding, and set-accelerating admixtures shall meet the requirements of ASTM C 494, including the flexural strength test.

2.11 EPOXY-RESIN. Epoxy-resin used to anchor dowels and tie bars in pavements shall conform to the requirements of ASTM C 881, Type I, Grade 3, Class C. Class A or B shall be used when the surface temperature of the hardened concrete is below 60 degrees F.

2.12 MATERIAL ACCEPTANCE. Prior to use of materials, the Contractor shall submit certified test reports to the Engineer for those materials proposed for use during construction. The certification shall show the appropriate ASTM test(s) for each material, the test results, and a statement that the material passed or failed. Test results should be less than 90 days old. Current VDOT certifications will be acceptable.

The Engineer may request samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

PART 3 - MIX DESIGN

3.1 PROPORTIONS. Concrete shall be designed to achieve a 28-day flexural strength that meets or exceeds the acceptance criteria contained in paragraph 501-5.2 for a flexural strength of 700 psi. The mix shall be designed using the procedures contained in Chapter 9 of the Portland Cement Association's manual, "Design and Control of Concrete Mixtures".

The Contractor shall note that to ensure that the concrete actually produced will meet or exceed the acceptance criteria for the specified strength, the mix design average strength must be higher than the specified strength. The amount of overdesign necessary to meet specification requirements depends on the producer's standard deviation of flexural test results and the accuracy that that value can be estimated from historic data for the same or similar materials.

The minimum cementitious material (cement plus fly ash, or GGBFS) shall be 611 pounds per cubic yard. The ratio of water to cementitious material, including free surface moisture on the aggregates but not including moisture absorbed by the aggregates shall not be more than 0.45 by weight.

Prior to the start of paving operations and after approval of all material to be used in the concrete, the Contractor shall submit a mix design showing the proportions and flexural strength obtained from the concrete at 7 and 28 days. The mix design shall include copies of test reports, including test dates, and a complete list of materials including type, brand, source, and amount of cement, fly ash, ground slag, coarse aggregate, fine aggregate, water, and admixtures. The fineness modulus of the fine aggregate and the air content shall also be shown. The mix design shall be submitted to the Engineer at least 21 days prior to the start of operations. The submitted mix design shall not be more than 90 days old. Production shall not begin until the mix design is approved in writing by the Engineer.

Should a change in sources be made, or admixtures added or deleted from the mix, a new mix design must be submitted to the Engineer for approval.

Flexural strength test specimens shall be prepared in accordance with ASTM C 192 and tested in accordance with ASTM C 78. The mix determined shall be workable concrete having a slump for side-form concrete between 1 and 2 inches as determined by ASTM C 143. For vibrated slip-form concrete, the slump shall be between 1/2 inch and 1 1/2 inches.

3.2 CEMENTITIOUS MATERIALS.

A. Fly Ash. Fly ash may be used in the mix design. When fly ash is used as a partial replacement for cement, the minimum cement content may be met by considering Portland cement plus fly ash as the total cementitious material. The replacement rate shall be determined from laboratory trial mixes, but shall not be less than 20 percent and shall not exceed 25 percent by weight of the total cementitious material. If fly ash is used in conjunction with ground granular blast furnace slag the maximum replacement rate shall not exceed 10 percent by weight of total cementitious material.

B. Ground Slag. Ground blast-furnace slag may be used in a mix design containing Type I or Type II cement. The slag, or slag plus fly ash if both are used, may constitute between 25 to 55 percent of the total cementitious material by weight. If the concrete is to be used for slipforming operations and the air temperature is expected to be lower than 55 degrees F the percent slag shall not exceed 30 percent by weight.

3.3 ADMIXTURES.

A. Air-Entraining. Air-entraining admixture shall be added in such a manner that will insure uniform distribution of the agent throughout the batch. The air content of freshly mix air-entrained concrete shall be based upon trial mixes with the materials to be used in the work adjusted to produce concrete of the required plasticity and workability. The percentage of air in the mix shall be 6% ± 1.2%. Air content shall be determined by testing in accordance with ASTM C 231 for gravel and stone coarse aggregate and ASTM C 173 for slag and other highly porous coarse aggregate.

B. Chemical. Water-reducing, set-controlling, and other approved admixtures shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted on trial mixes, with the materials to be used in the work, in accordance with ASTM C 494.

3.4 TESTING LABORATORY. The laboratory used to develop the mix design shall meet the requirements of ASTM C 1077. The laboratory accreditation will include ASTM C 78. A certification that it meets these requirements shall be submitted to the Engineer prior to the start of mix design. The certification shall include evidence that the laboratory is inspected/accredited for the test methods required herein by a nationally recognized laboratory inspection accreditation organization.

PART 4 - CONSTRUCTION METHODS

4.1 EQUIPMENT. Equipment necessary for handling materials and performing all parts of the work shall be approved by the engineer as to design, capacity, and mechanical

conditions. The equipment shall be at the jobsite sufficiently ahead of the start of paving operations to be examined thoroughly and approved.

A. Batch Plant and Equipment. The batch plant and equipment shall conform to the requirements of ASTM C 94.

B. Mixers and Transportation Equipment.

1) General. Concrete may be mixed at a central plant, or wholly or in part in truck mixers. Each mixer shall have attached in a prominent place a manufacturer's nameplate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

2) Central plant mixer. Central plant mixers shall conform to the requirements of ASTM C 94.

The mixer shall be examined daily for changes in condition due to accumulation of hard concrete or mortar or wear of blades. The pickup and throwover blades shall be replaced when they have worn down 3/4 inch (19 mm) or more. The Contractor shall have a copy of the manufacturer's design on hand showing dimensions and arrangement of blades in reference to original height and depth.

3) Truck mixers and truck agitators. Truck mixers used for mixing and hauling concrete and truck agitators used for hauling central-mixed concrete shall conform to the requirements of ASTM C 94.

4) Nonagitator trucks. Nonagitating hauling equipment shall conform to the requirements of ASTM C 94.

C. Finishing Equipment. The finishing equipment shall be of sufficient weight and power for proper finishing of the concrete. The finishing machine shall be designed and operated to strike off, screed, and consolidate the concrete such that laitance on the surface is less than 1/8-inch think.

D. Vibrators. Vibrator shall be the internal type. Operating frequency for internal vibrators shall be between 8,000 and 12,000 vibrations per minute. Average amplitude for internal vibrators shall be 0.025-0.05 inches.

The number, spacing, and frequency shall be as necessary to provide a dense and homogeneous pavement and meet the recommendations of ACI 309, Guide for Consolidation of Concrete. Adequate power to operate all vibrators shall be available on the paver. The vibrators shall be automatically controlled so that they shall be stopped as forward motion ceases. The contractor shall provide an electronic or mechanical means to monitor vibrator status. The checks on vibrator status shall occur a minimum of two times per day or when requested by the Engineer.

Hand held vibrators may be used in irregular areas only, but shall meet the recommendations of ACI 309, Guide for Consolidation of Concrete. A sufficient number of hand held vibrators shall be available at all times.

E. Concrete Saws. The Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions. The Contractor shall provide at least one standby saw in good working order and a supply of saw blades at the site of the work at all times during sawing operations.

F. Side Forms. Straight side forms shall be made of steel and shall be furnished in sections not less than 10 feet in length. Forms shall have a depth equal to the pavement thickness at the edge, and a base width equal to or greater than the depth. Flexible or curved forms of proper radius shall be used for curves of 100-foot radius or less. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms with battered top surfaces and bent, twisted or broken forms shall not be used. Built-up forms shall not be used, except as approved by the Engineer. The top face of the form shall not vary from a true plane more than 1/8 inch in 10 feet, and the upstanding leg shall not vary more than 1/4 inch. The forms shall contain provisions for locking the ends of abutting sections together tightly for secure setting. Wood forms may be used under special conditions, when approved by the Engineer.

G. Pavers. The paver shall be fully energized, self-propelled, and designed for the specific purpose of placing, consolidating, and finishing the concrete pavement, true to grade, tolerances, and cross section. It shall be of sufficient weight and power to construct the maximum specified concrete paving lane width as shown in the plans, at adequate forward speed, without transverse, longitudinal or vertical instability or without displacement. The paver shall be equipped with electronic or hydraulic horizontal and vertical control devices.

4.2 FORM SETTING. Forms shall be set sufficiently in advance of the concrete placement to insure continuous paving operation. After the forms have been set to correct grade, the underlying surface shall be thoroughly tamped, either mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms shall be staked into place sufficiently to maintain the form in position for the method of placement.

Form sections shall be tightly locked and shall be free from play or movement in any direction. The forms shall not deviate from true line by more than 1/8 inch at any joint. Forms shall be so set that they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms shall be cleaned and oiled prior to the placing of concrete.

The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete.

For concrete that is to be placed against existing pavement, pavement shall be sawcut in accordance with Specification Item X-85, Sawcutting. The sawcutting will maintain a vertical surface for the depth of the pavement to be placed. Sub-grade or sub-base conditions shall conform to the requirements of section 501-4.4, Conditioning of Underlying Surface, Side-Form, and Fill-In Lane Construction.

4.3 CONDITIONING OF UNDERLYING SURFACE. The compacted underlying surface on which the pavement will be placed shall be widened approximately 3 feet to extend beyond the paving machine track to support the paver without any noticeable displacement. After the underlying surface has been placed and compacted to the required density, the areas that will support the paving machine and the area to be paved shall be trimmed or graded to the plan grade elevation and profile by means of a properly designed machine. The grade of the underlying surface shall be controlled by a positive grade control system using lasers, stringlines, or guide wires. If the density of the underlying surface is disturbed by the trimming operations, it shall be corrected by additional compaction and retested at the option of the Engineer before the concrete is placed except when stabilized subbases are being constructed. If damage occurs on a stabilized subbase, it shall be corrected full depth by the Contractor. If traffic is allowed to use the prepared grade, the grade shall be checked and corrected immediately before the placement of concrete. The prepared grade shall be moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from concrete. The underlying surface shall be protected so that it will be entirely free of frost when concrete is placed.

4.4 CONDITIONING OF UNDERLYING SURFACE, SIDE-FORM AND FILL-IN LANE CONSTRUCTION. The prepared underlying surface shall be moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from the concrete. Damage caused by hauling or usage of other equipment shall be corrected and retested at the option of the Engineers. If damage occurs to a stabilized subbase, it shall be corrected full depth by the Contractor. A template shall be provided and operated on the forms immediately in advance of the placing of all concrete. The template shall be propelled only by hand and not attached to a tractor or other power unit. Templates shall be adjustable so that they may be set and maintained at the correct contour of the underlying surface. The adjustment and operation of the templates shall be such as will provide an accurate retest of the grade before placing the concrete thereon. All excess material shall be removed and wasted. Low areas shall be filled and compacted to a condition similar to that of the surrounding grade. The underlying surface shall be protected so that it will be entirely free from frost when the concrete is placed. The use of chemicals to eliminate frost in the underlying surface shall not be permitted.

The template shall be maintained in accurate adjustment, at all times by the Contractor, and shall be checked daily.

4.5 HANDLING, MEASURING, AND BATCHING MATERIAL. The batch plant site, layout, equipment, and provisions for transporting material shall assure a continuous supply of material to the work. Stockpiles shall be constructed in such a manner that prevents segregation and intermixing of deleterious materials.

Aggregates that have become segregated or mixed with earth or foreign material shall not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least 12 hours before being batched. Rail shipments requiring more than 12 hours will be accepted as adequate binning only if the car bodies permit free drainage.

Batching plants shall be equipped to proportion aggregates and bulk cement, by weight, automatically using interlocked proportioning devices of an approved type. When bulk cement is used, the Contractor shall use a suitable method of handling the cement from weighing hopper to transporting container or into the batch itself for transportation to the mixer, such as a chute, boot, or other approved device, to prevent loss of cement. The device shall be arranged to provide positive assurance that the cement content specified is present in each batch.

4.6 MIXING CONCRETE. The concrete may be mixed at the work site, in a central mix plant or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials, except water, are emptied into the drum. All concrete shall be mixed and delivered to the site in accordance with the requirements of ASTM C 94.

Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators, or nonagitating trucks. The elapsed time from the addition of cementitious material to the mix until the concrete is deposited in place at the work site shall not exceed 30 minutes when the concrete is hauled in nonagitating trucks, nor 90 minutes when the concrete is hauled in truck mixers or truck agitators. Retempering concrete by adding water or by other means will not be permitted. With transit mixers additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements provided the addition of water is performed within 45 minutes after the initial mixing operations and provided the water/cementitious ratio specified in the approved mix design is not exceeded, and approved by the Engineer.

4.7 LIMITATIONS ON MIXING AND PLACING. No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

A. Cold Weather. Unless authorized in writing by the Engineer, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches 40 degrees F and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35 degrees F.

The aggregate shall be free of ice, snow, and frozen lumps before entering the mixer. The temperature of the mixed concrete shall not be less than 50 degrees F at the time of placement. Concrete shall not be placed on frozen material nor shall frozen aggregates be used in the concrete.

When concreting is authorized during cold weather, water and/or the aggregates may be heated to not more than 150 degrees F. The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might be detrimental to the materials.

B. Hot Weather. During periods of hot weather when the maximum daily air temperature exceeds 85 degrees F, the following precautions shall be taken.

The forms and/or the underlying surface shall be sprinkled with water immediately before placing the concrete. The concrete shall be placed at the coolest temperature practicable, and in no case shall the temperature of the concrete when placed exceed 90 degrees F. The aggregates and/or mixing water shall be cooled as necessary to maintain the concrete temperature at or not more than the specified maximum.

The finished surfaces of the newly laid pavement shall be kept damp by applying a water-fog or mist with approved spraying equipment until the pavement is covered by the curing medium. If necessary, wind screens shall be provided to protect the concrete from an evaporation rate in excess of 0.2 psf per hour as determined in accordance with Figure 2.1.5 in ACI 305R, Hot Weather Concreting, which takes into consideration relative humidity, wind velocity, and air temperature.

When conditions are such that problems with plastic cracking can be expected, and particularly if any plastic cracking begins to occur, the Contractor shall immediately take such additional measures as necessary to protect the concrete surface. Such measures shall consist of wind screens, more effective fog sprays, and similar measures commencing immediately behind the paver. If these measures are not effective in preventing plastic cracking, paving operations shall be immediately stopped.

B. Temperature Management Program. Prior to the start of paving operation for each day of paving, the contractor shall provide the engineer with a Temperature Management Program for the concrete to be placed to assure that uncontrolled cracking is avoided. As a minimum the program shall address the following items:

1) Anticipated tensile strains in the fresh concrete as related to heating and cooling of the concrete material.

2) Anticipated weather conditions such as ambient temperatures, wind velocity, and relative humidity.

3) Anticipated timing of initial sawing of joint.

4.8 PLACING CONCRETE. The Contractor has the option of placing the concrete with either side (fixed) forms or slip-forms. At any point in concrete conveyance, the free vertical drop of the concrete from one point to another or to the underlying surface shall not exceed 3 feet. Backhoes and Grading equipment shall not be used to distribute the concrete in front of the paver. Front end loaders will not be used unless the contractor demonstrates that they can be used without contaminating the concrete and base course and it is approved by the Engineer.

Hauling equipment or other mechanical equipment can be permitted on adjoining previously constructed pavement when the concrete strength reaches a flexural strength of 550 psi , based on the average of four field cured specimens per 2,000 cubic yards of concrete placed. Also, subgrade and subbase planers, concrete pavers, and concrete finishing equipment may be permitted to ride upon the edges of previously constructed pavement when the concrete has attained a minimum flexural strength of 550 psi.

A. Slip-Form Construction. The concrete shall be distributed uniformly into final position by a self propelled slip-form paver without delay. The alignment and elevation of the paver shall be regulated from outside reference lines established for this purpose. The paver shall vibrate the concrete for the full width and depth of the strip of pavement being placed and the vibration shall be adequate to provide a consistency of concrete that will stand normal to the surface with sharp well defined edges. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms.

The plastic concrete shall be effectively consolidated by internal vibration with transverse vibrating units for the full width of the pavement and/or a series of equally placed longitudinal vibrating units. The space from the outer edge of the pavement to longitudinal unit shall not exceed 9 inches. The spacing of internal units shall be uniform and shall not exceed 18 inches.

The term internal vibration means vibrating units located within the specified thickness of pavement section.

The rate of vibration of each vibrating unit shall be within 8000 to 12000 cycles per minute and the amplitude of vibration shall be sufficient to be perceptible on the surface of the concrete along the entire length of the vibrating unit an for a distance of at least one foot. The frequency of vibration or amplitude shall vary proportionately with the rate of travel to result in a uniform density and air content. The paving machine shall be equipped with a tachometer or other suitable device for measuring and indicating the actual frequency of vibrations.

The concrete shall be held at a uniform consistency. The slip-form paver shall be operated with as nearly a continuous forward movement as possible. And all operations of mixing, delivering, and spreading concrete shall be coordinated to provide uniform progress with stopping and starting of the paver held to a minimum. If for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement shall be equipped with protective pads on crawler tracks or rubber-tired wheels on which the bearing surface is offset to run a sufficient distance from the edge of the pavement to avoid breaking the pavement edge.

B. Side-Form Construction. Side form sections shall be straight, free from warps, bends, indentations, or other defects. Defective forms shall be removed from the work. Metal side forms shall be used except at end closures and transverse construction joints where straight forms of other suitable material may be used.

Side forms may be built up by rigidly attaching a section to either top or bottom of forms. If such build-up is attached to the top of metal forms, the build-up shall also be metal.

Width of the base of all forms shall be equal to at least 80 percent of the specified pavement thickness.

Side forms shall be of sufficient rigidity, both in the form and in the interlocking connection with adjoining forms, that springing will not occur under the weight of subgrading and paving equipment or from the pressure of the concrete. The Contractor shall provide sufficient forms so that there will be no delay in placing concrete due to lack of forms.

Before placing side forms, the underlying material shall be at the proper grade. Side forms shall have full bearing upon the foundation throughout their length and width of base and shall be placed to the required grade and alignment of the finished pavement. They shall be firmly supported during the entire operation of placing, compacting, and finishing the pavement.

Forms shall be drilled in advance of being placed to line and grade to accommodate tie bars where these are specified.

Immediately in advance of placing concrete and after all subbase operations are completed, side forms shall be trued and maintained to the required line and grade for a distance sufficient to prevent delay in placing.

Side forms shall remain in place at least 12 hours after the concrete has been placed, and in all cases until the edge of the pavement no longer requires the protection of the forms. Curing compound shall be applied to the concrete immediately after the forms have been removed.

Side forms shall be thoroughly cleaned and oiled each time they are used and before concrete is placed against them.

Concrete shall be spread, screeded, shaped and consolidated by one or more self-propelled machines. These machines shall uniformly distribute and consolidate concrete without segregation so that the completed pavement will conform to the required cross section with a minimum of handwork.

The number and capacity of machines furnished shall be adequate to perform the work required at a rate equal to that of concrete delivery.

Concrete for the full paving width shall be effectively consolidated by internal vibrators without causing segregation. Internal type vibrators' rate of vibration shall be not less than 7,000 cycles per minute. Amplitude of vibration shall be sufficient to be perceptible on the surface of the concrete more than one foot from the vibrating element. The Contractor shall furnish a tachometer or other suitable device for measuring and indicating frequency of vibration.

Power to vibrators shall be connected so that vibration ceases when forward or backward motion of the machine is stopped.

The provisions relating to the frequency and amplitude of internal vibration shall be considered the minimum requirements and are intended to ensure adequate density in the hardened concrete.

C. Consolidation Testing. The provisions relating to the frequency and amplitude of internal vibration shall be considered the minimum requirements and are intended to ensure adequate density in the hardened concrete. If a lack of consolidation of the concrete is suspected by the Engineer, additional referee testing may be required. Referee testing of hardened concrete will be performed by cutting cores from the finished pavement after a minimum of 24 hours curing. Density determinations will be made based on the water content of the core as taken. ASTM C 642 shall be used for the determination of core density in the saturated-surface dry condition. Referee cores will be taken at the minimum rate of one for each 500 cubic yards of pavement, or fraction thereof.

The average density of the cores shall be at least 97 percent of the original mix design density, with no cores having a density of less than 96 percent of the original mix design density.

Failure to meet the above requirements will be considered as evidence that the minimum requirements for vibration are inadequate for the job conditions, and additional vibrating units or other means of increasing the effect of vibration shall be employed so that the density of the hardened concrete as indicated by further referee testing shall conform to the above listed requirements.

4.9 STRIKE-OFF OF CONCRETE AND PLACEMENT OF REINFORCEMENT. Following the placing of the concrete, it shall be struck off to conform to the cross section shown on the plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement shall be at the elevation shown on the plans. When reinforced concrete pavement is placed in two layers, the bottom layer shall be struck off to such length and depth that the sheet of reinforcing steel fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck off, and screeded. If any portion of the bottom layer of concrete has been placed more than 30 minutes without being covered with the top layer or if initial set has taken place, it shall be removed and replaced with freshly mixed concrete at the Contractor's expense. When reinforced concrete is placed in one layer, the reinforcement may be positioned in advance of concrete placement or it may be placed in plastic concrete by mechanical or vibratory means after spreading.

Reinforcing steel, at the time concrete is placed, shall be free of mud, oil, or other organic matter that may adversely affect or reduce bond. Reinforcing steel with rust, mill scale or a combination of both will be considered satisfactory, provided the minimum dimensions, weight, and tensile properties of a hand wire-brushed test specimen are not less than the applicable ASTM specification requirements.

4.10 JOINTS. Joints shall be constructed as shown on the plans and in accordance with these requirements. All joints shall be constructed with their faces perpendicular to the surface of the pavement and finished or edged as shown on the plans. Joints shall not vary more than 1/2 inch from their designated position and shall be true to line with not more than 1/4-inch variation in 10 feet. The surface across the joints shall be tested with a 10-foot straightedge as the joints are finished and any irregularities in excess of 1/4 inch shall be

corrected before the concrete has hardened. All joints shall be so prepared, finished, or cut to provide a groove of uniform width and depth as shown on the plans.

A. Construction. Longitudinal construction joints shall be slip-formed or formed against side forms with or without keyways, as shown in the plans.

Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for more than 30 minutes or it appears that the concrete will obtain its initial set before fresh concrete arrives. The installation of the joint shall be located at a planned contraction or expansion joint. If placing of the concrete is stopped, the Contractor shall remove the excess concrete back to the previous planned joint.

B. Contraction. Contraction joints shall be installed at the locations and spacing as shown on the plans. Contraction joints shall be installed to the dimensions required by sawing a groove into the concrete surface after the concrete has hardened. When the groove is formed in plastic concrete the sides of the grooves shall be finished even and smooth with an edging tool. If an insert material is used, the installation and edge finish shall be according to the manufacturer's instructions. The groove shall be finished or cut clean so that spalling will be avoided at intersections with other joints. Grooving or sawing shall produce a slot at least 1/8 inch wide and to the depth shown on the plans.

C. Expansion. Expansion joints shall be installed as shown on the plans. The premolded filler of the thickness as shown on the plans, shall extend for the full depth and width of the slab at the joint, except for space for sealant at the top of the slab. The filler shall be securely staked or fastened into position perpendicular to the proposed finished surface. A cap shall be provided to protect the top edge of the filler and to permit the concrete to be placed and finished. After the concrete has been placed and struck off, the cap shall be carefully withdrawn leaving the space over the premolded filler. The edges of the joint shall be finished and tooled while the concrete is still plastic. Any concrete bridging the joint space shall be removed for the full width and depth of the joint.

D. Tie bars. Tie bars shall consist of deformed bars installed in joints as shown on the plans. Tie bars shall be placed at right angles to the centerline of the concrete slab and shall be spaced at intervals shown on the plans. They shall be held in position parallel to the pavement surface and in the middle of the slab depth. When tie bars extend into an unpaved lane, they may be bent against the form at longitudinal construction joints, unless threaded bolt or other assembled tie bars are specified. These bars shall not be painted, greased, or enclosed in sleeves.

E. Dowel bars. Dowel bars or other load-transfer units of an approved type shall be placed across joints in the manner as shown on the plans. They shall be of the dimensions and spacings as shown and held rigidly in the middle of the slab depth in the proper horizontal and vertical alignment by an approved assembly device to be left permanently in place. The dowel or load-transfer and joint devices shall be rigid enough to permit complete assembly as a unit ready to be lifted and placed into position. A metal, or other type, dowel expansion cap or sleeve shall be furnished for each dowel bar used with expansion joints. These caps shall be substantial enough to prevent collapse and shall be placed on the ends of the dowels as shown on the plans. The caps or sleeves shall fit the

dowel bar tightly and the closed end shall be watertight. The portion of each dowel painted with rust preventative paint, as required under paragraph 501-2.7 and shown on the plans to receive a debonding lubricant, shall be thoroughly coated with an approved lubricant, to prevent the concrete from bonding to that portion of the dowel. If free-sliding plastic-coated or epoxy-coated steel dowels are used, a lubrication bond breaker shall be used except when approved pullout tests indicate it is not necessary. Where butt-type joints with dowels are designated, the exposed end of the dowel shall be oiled.

Dowel bars at contraction joints may be placed in the full thickness of pavement by a mechanical device approved by the Engineer. The device shall be capable of installing dowel bars within the maximum permissible alignment tolerances. Dowels bars at longitudinal construction joints shall be bonded in drilled holes.

F. Installation. All devices used for the installation of expansion joints shall be approved by the Engineer.

The top of an assembled joint device shall be set at the proper distance below the pavement surface and the elevation shall be checked. Such devices shall be set to the required position and line and shall be securely held in place by stakes or other means to the maximum permissible tolerances during the pouring and finishing of the concrete. The premolded joint material shall be placed and held in a vertical position; if constructed in sections, there shall be no offsets between adjacent units.

Dowel bars and assemblies shall be checked for position and alignment. The maximum permissible tolerances on dowel bar alignment shall be in accordance with paragraph 501-5.2e(6). During the concrete placement operation, it is advisable to place plastic concrete directly on dowel assemblies immediately prior to passage of the paver to help maintain dowel position and alignment within maximum permissible tolerances.

When concrete is placed using slip-form pavers, dowels and tie bars shall be placed in longitudinal construction joints by bonding the dowels or tie bars into holes drilled into the hardened concrete. Holes approximately 1/8-inch to 1/4-inch greater in diameter than the dowel or tie bar shall be drilled with rotary-type core drills that must be held securely in place to drill perpendicularly into the vertical face of the pavement slab. Rotary-type percussion drills may be used provided that spalling of concrete does not occur. Any damage of the concrete shall be repaired by the Contractor in a method approved by the Engineer. Dowels or tie bars shall be bonded in the drilled holes using an epoxy resin material. Installation procedures shall be adequate to insure that the area around dowels is completely filled with epoxy grout. Epoxy shall be injected into the back of the hole and displaced by the insertion of the dowel bar. Bars shall be completely inserted into the hole and shall not be withdrawn and reinserted creating air pockets in the epoxy around the bar. The Contractor shall furnish a template for checking the position and alignment of the dowels. Dowel bars shall not be less than 10 inches from a transverse joint and shall not interfere with dowels in the transverse direction.

G. Sawing of Joints. Joints shall be cut as shown on the plans. Equipment shall be as described in paragraph 501-4.1. The circular cutter shall be capable of cutting a groove

in a straight line and shall produce a slot at least 1/8 inch wide and to the depth shown on the plans. The top portion of the slot shall be widened by sawing to provide adequate space for joint sealers as shown on the plans. Sawing shall commence as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing and before uncontrolled shrinkage cracking of the pavement occurs. Sawing shall be carried on both during the day and night as required. The joints shall be sawed at the required spacing, consecutively in sequence of the concrete placement. Curing compound, if being used as the cure type, shall be reapplied in the initial sawcut and maintained for the remaining cure period. Curing compound shall not be applied, and used as the cure method, to any final concrete face that is to receive a sealant. All slurry and debris produced in the sawing of joints shall be removed by vacuuming and washing.

4.11 FINAL STRIKE-OFF, CONSOLIDATION, AND FINISHING.

A. Sequence. The sequence of operations shall be the strike-off, floating and removal of laitance, straightedging, and final surface finish. The addition of superficial water to the surface of the concrete to assist in finishing operations will not be permitted.

B. Finishing at Joints. The concrete adjacent to joints shall be compacted or firmly placed without voids or segregation against the joint material; it shall be firmly placed without voids or segregation under and around all load-transfer devices, joint assembly units, and other features designed to extend into the pavement. Concrete adjacent to joints shall be mechanically vibrated as required in paragraph 501-4.8.a. After the concrete has been placed and vibrated adjacent to the joints, the finishing machine shall be operated in a manner to avoid damage or misalignment of joints. If uninterrupted operations of the finishing machine, to, over, and beyond the joints, cause segregation of concrete, damage to, or misalignment of the joints, the finishing machine shall be stopped when the screed is approximately 8 inches from the joint. Segregated concrete shall be removed from the front of and off the joint; and the forward motion of the finishing machine shall be resumed. Thereafter, the finishing machine may be run over the joint without lifting the screed, provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.

C. Machine Finishing. The concrete shall be spread as soon as it is placed, and it shall be struck off and screeded by a finishing machine. The machine shall go over each area as many times and at such intervals as necessary to give to proper consolidation and to leave a surface of uniform texture. Excessive operation over a given area shall be avoided. When side forms are used, the tops of the forms shall be kept clean by an effective device attached to the machine, and the travel of the machine on the forms shall be maintained true without lift, wobbling, or other variation tending to affect the precision finish. During the first pass of the finishing machine, a uniform ridge of concrete shall be maintained ahead of the front screed for its entire length. When in operation, the screed shall be moved forward with a combined longitudinal and transverse shearing motion, always moving in the direction in which the work is progressing, and so manipulated that neither end is raised from the side forms during the striking-off process. If necessary, this shall be repeated until the surface is of uniform texture, true to grade and cross section, and free from porous areas.

D. Hand Finishing. Hand finishing methods will not be permitted, except under the following conditions: in the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade; in areas of narrow widths or of irregular dimensions where operation of the mechanical equipment is impractical. Concrete, as soon as placed, shall be struck off and screeded. An approved portable screed shall be used. A second screed shall be provided for striking off the bottom layer of concrete when reinforcement is used.

The screed for the surface shall be a least 2 feet longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and shall be constructed either of metal or of other suitable material covered with metal. Consolidation shall be attained by the use of suitable vibrators.

E. Floating. After the concrete has been struck off and consolidated, it shall be further smoothed and trued by means of a longitudinal float using one of the following methods:

1) Hand Method. Long-handled floats shall not be less than 12 feet in length and 6 inches in width, stiffened to prevent flexibility and warping. The float shall be operated from foot bridges spanning but not touching the concrete or from the edge of the pavement. Floating shall pass gradually from one side of the pavement to the other. Forward movement along the centerline of the pavement shall be in successive advances of not more than one-half the length of the float. Any excess water or laitance in excess of 1/8-inch thick shall be removed and wasted.

2) Mechanical method. The Contractor may use a machine composed of a cutting and smoothing float(s), suspended from and guided by a rigid frame and constantly in contact with, the side forms or underlying surface. If necessary, long-handled floats having blades not less than 5 feet in length and 6 inches in width may be used to smooth and fill in open-textured areas in the pavement. When the crown of the pavement will not permit the use of the mechanical float, the surface shall be floated transversely by means of a long-handled float. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and laitance in excess of 1/8-inch thick shall be removed and wasted. Successive drags shall be lapped one-half the length of the blade.

F. Straight-edge Testing and Surface Correction. After the pavement has been struck off and while the concrete is still plastic, it shall be tested for trueness with a Contractor furnished 16-foot straightedge swung from handles 3 feet longer than one-half the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary. Advancing shall be in successive stages of not more than one-half the length of the straightedge. Any excess water and laitance in excess of 1/8-inch thick shall be removed from the surface of the pavement and wasted. Any depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the smoothness requirements of paragraph 501-5.2e(3). Straightedge testing and surface corrections

shall continue until the entire surface is found to be free from observable departures from the straightedge and until the slab conforms to the required grade and cross section. The use of long-handled wood floats shall be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment.

4.12 SURFACE TEXTURE. The surface of the pavement shall be finished with either a brush or broom, burlap drag, or artificial turf finish for all newly constructed concrete pavements. It is important that the texturing equipment not tear or unduly roughen the pavement surface during the operation. Any imperfections resulting from the texturing operation shall be corrected to the satisfaction of the Engineer.

A. Brush or Broom Finish. If the pavement surface texture is to be a type of brush or broom finish, it shall be applied when the water sheen has practically disappeared. The equipment shall operate transversely across the pavement surface, providing corrugations that are uniform in appearance and approximately 1/16 of an inch in depth.

B. Burlap Drag Finish. If a burlap drag is used to texture the pavement surface, it shall be at least 15 ounces per square yard. To obtain a textured surface, the transverse threads of the burlap shall be removed approximately 1 foot from the trailing edge. A heavy buildup of grout on the burlap threads produces the desired wide sweeping longitudinal striations on the pavement surface. The corrugations shall be uniform in appearance and approximately 1/16 of an inch in depth.

C. Artificial Turf Finish. If artificial turf is used to texture the surface, it shall be applied by dragging the surface of the pavement in the direction of concrete placement with an approved full-width drag made with artificial turf. The leading transverse edge of the artificial turf drag will be securely fastened to a lightweight pole on a traveling bridge. At least 2 feet of the artificial turf shall be in contact with the concrete surface during dragging operations. A variety of different types of artificial turf are available and approval of any one type will be done only after it has been demonstrated by the Contractor to provide a satisfactory texture. One type that has provided satisfactory texture consists of 7,200 approximately 0.85-inches-long polyethylene turf blades per square foot. The corrugations shall be uniform in appearance and approximately 1/16 of an inch in depth.

D. Filler Lane Edges. After placing of concrete in filler lanes, Contractor will scrape the edges of the outlying concrete lanes edges to remove excess concrete. Contractor shall use a wire brush or other physical abrasive device to remove cement grout from pavement. Concrete or grout removal should not mar the surface texture by the methods of 501-4.12 of the existing pavement.

4.13 CURING. Immediately after finishing operations are completed and marring of the concrete will not occur, the entire surface of the newly placed concrete shall be cured for a 7-day cure period in accordance with one of the methods below. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than 1/2 hour during the curing period.

When a two-sawcut method is used to construct the contraction joint, the curing compound shall be applied to the sawcut immediately after the initial cut has been made. The sealant reservoir shall not be sawed until after the curing period has been completed. When the one cut method is used to construct the contraction joint, the joint shall be cured with wet rope, wet rags, or wet blankets. The rags, ropes, or blankets shall be kept moist for the duration of the curing period.

A. Impervious Membrane Method. The entire surface of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. The curing compound shall not be applied during rainfall. Curing compound shall be applied by mechanical sprayers under pressure at the rate of 1 gallon to not more than 150 square feet. The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application the compound shall be stirred continuously by mechanical means. Hand spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. When hand spraying is approved by the Engineer, a double application rate shall be used to insure coverage. The curing compound shall be of such character that the film will harden within 30 minutes after application. Should the film become damaged from any cause, including sawing operations, within the required curing period, the damaged portions shall be repaired immediately with additional compound or other approved means. Upon removal of side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface.

1) Curing in Cold Weather. The concrete shall be maintained at a temperature of at least 50 degrees F for a period of 72 hours after placing and at a temperature above freezing for the remainder of the curing time. The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather, and any concrete injured by frost action shall be removed and replaced at the Contractor's expense.

4.14 REMOVING FORMS. Unless otherwise specified, forms shall not be removed from freshly placed concrete until it has hardened sufficiently to permit removal without chipping, spalling, or tearing. After the forms have been removed, the sides of the slab shall be cured as outlined in one of the methods indicated in paragraph 501-4.14. Major honeycombed areas shall be considered as defective work and shall be removed and replaced in accordance with paragraph 501-5.2(f).

4.15 SEALING JOINTS. The joints in the pavement shall be sealed in accordance with Item P-605.

4.16 PROTECTION OF PAVEMENT. The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents. This shall include watchmen to direct traffic and the erection and maintenance of warning signs, lights, pavement bridges, crossovers, and protection of unsealed joints from intrusion of foreign material, etc. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement replaced at the Contractor's expense. The Contractor shall have available at all times, materials for the

protection of the edges and surface of the unhardened concrete. Such protective materials shall consist of rolled polyethylene sheeting at least 4 mils thick of sufficient length and width to cover the plastic concrete slab and any edges. The sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the plastic concrete surface. When rain appears imminent, all paving operations shall stop and all available personnel shall begin covering the surface of the unhardened concrete with the protective covering.

4.17 OPENING TO TRAFFIC. The pavement shall not be opened to traffic until test specimens molded and cured in accordance with ASTM C 31 have attained a flexural strength of 550 pounds per square inch when tested in accordance with ASTM C 78. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed. Prior to opening the pavement to construction traffic, all joints shall either be sealed or protected from damage to the joint edge and intrusion of foreign materials into the joint. As a minimum, backer rod or tape may be used to protect the joints from foreign matter intrusion. The pavement shall be cleaned before opening for normal operations.

4.18 REPAIR, REMOVAL, REPLACEMENT OF SLABS.

A. General. New pavement slabs that are broken or contain cracks shall be removed and replaced or repaired, as specified hereinafter at no cost to the owner. Spalls along joints shall be repaired as specified. Removal of partial slabs is not permitted. Removal and replacement shall be full depth, shall be full width of the slab, and the limit of removal shall be normal to the paving lane and to each original transverse joint. The engineer will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores shall be 4-inch diameter, shall be drilled by the Contractor and shall be filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin, using approved procedures. Drilling of cores and refilling holes shall be at no expense to the owner. All epoxy resin used in this work shall conform to ASTM C 881, Type V.

B. Shrinkage Cracks. Shrinkage cracks, which do not exceed 4 inches in depth, shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1, using procedures as approved. Care shall be taken to assure that the crack is not widened during epoxy resin injection. All epoxy resin injection shall take place in the presence of the Engineer. Shrinkage cracks, which exceed 4 inches in depth, shall be treated as full depth cracks in accordance with paragraphs 4.19b and 4.19c.

C. Slabs With Cracks through Interior Areas. Interior area is defined as that area more than 6 inches from either adjacent original transverse joint. The full slab shall be removed and replaced at no cost to the owner, when there are any full depth cracks, or cracks greater than 4” in depth, that extend into the interior area.

D. Cracks Close To and Parallel To Joints. All cracks essentially parallel to original joints, extending full depth of the slab, and lying wholly within 6 inches either side of the joint shall be treated as specified hereinafter. Any crack extending more than 6 inches from the joint shall be treated as specified above in subparagraph "Slabs With Cracks Through Interior Area."

1) Full Depth Cracks Present, Original Joint Not Opened. When the original uncracked joint has not opened, the crack shall be sawed and sealed, and the original joint filled with epoxy resin as specified below. The crack shall be sawed with equipment specially designed to follow random cracks. The reservoir for joint sealant in the crack shall be formed by sawing to a depth of 3/4 inch, plus or minus 1/16 inch, and to a width of 5/8 inch, plus or minus 1/8 inch. Any equipment or procedure which causes raveling or spalling along the crack shall be modified or replaced to prevent such raveling or spalling. The joint sealant shall be a liquid sealant as specified. Installation of joint seal shall be as specified for sealing joints or as directed. If the joint sealant reservoir has been sawed out, the reservoir and as much of the lower saw cut as possible shall be filled with epoxy resin, Type IV, Grade 2, thoroughly tooled into the void using approved procedures. If only the original narrow saw cut has been made, it shall be cleaned and pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. If filler type material has been used to form a weakened plane in the transverse joint, it shall be completely sawed out and the saw cut pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. Where a parallel crack goes part way across paving lane and then intersects and follows the original joint which is cracked only for the remained of the width, it shall be treated as specified above for a parallel crack, and the cracked original joint shall be prepared and sealed as originally designed.

2) Full Depth Cracks Present, Original Joint Also Cracked. At a joint, if there is any place in the lane width where a parallel crack and a cracked portion of the original joint overlap, the entire slab containing the crack shall be removed and replaced for the full lane width and length.

E. Removal and Replacement of Full Slabs. Where it is necessary to remove full slabs, unless there are keys or dowels present, all edges of the slab shall be cut full depth with a concrete saw. All saw cuts shall be perpendicular to the slab surface. If keys, dowels, or tie bars are present along any edges, these edges shall be sawed full depth 24 inches from the edge if only keys are present, or just beyond the end of the dowels or tie bars if they are present. These joints shall then be carefully sawed on the joint line to within 1 inch of the depth of the dowel or key.

The main slab shall be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. Suitable equipment shall be used to provide a truly vertical lift, and approved safe lifting devices used for attachment to the slabs. The narrow strips along keyed or doweled edges shall be carefully broken up and removed using light, hand-held jackhammers, 30 LB or less, or other approved similar equipment.

Care shall be taken to prevent damage to the dowels, tie bars, or keys or to concrete to remain in place. The joint face below keys or dowels shall be suitably trimmed so that there is not abrupt offset in any direction greater than 1/2 inch and no gradual offset greater than 1 inch when tested in a horizontal direction with a 12-foot straightedge.

No mechanical impact breakers, other than the above hand-held equipment shall be used for any removal of slabs. If underbreak between 1-1/2 and 4 inches deep occurs at any

point along any edge, the area shall be repaired as directed before replacing the removed slab. Procedures directed will be similar to those specified for surface spalls, modified as necessary.

If underbreak over 4 inches deep occurs, the entire slab containing the underbreak shall be removed and replaced. Where there are no dowels, tie bars, or keys on an edge, or where they have been damaged, dowels of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete using procedures as specified. Original damaged dowels or tie bars shall be cut off flush with the joint face. Protruding portions of dowels shall be painted and lightly oiled. All 4 edges of the new slab shall thus contain dowels or original keys or original tie bars.

Placement of concrete shall be as specified for original construction. Prior to placement of new concrete, the underlying material (unless it is stabilized) shall be re-compacted and shaped as specified in the appropriate section of these specifications. The surfaces of all four joint faces shall be cleaned of all loose material and contaminants and coated with a double application of membrane forming curing compound as bond breaker. Care shall be taken to prevent any curing compound from contacting dowels or tie bars. The resulting joints around the new slab shall be prepared and sealed as specified for original construction.

F. Repairing Spalls Along Joints. Where directed, spalls along joints of new slabs, and along parallel cracks used as replacement joints, shall be repaired by first making a vertical saw cut at least 1 inch outside the spalled area and to a depth of at least 4 inches and overcuts shall be sealed. Saw cuts shall be straight lines forming rectangular areas. The concrete between the saw cut and the joint, or crack, shall be chipped out to remove all unsound concrete and at least 1/2 inch of visually sound concrete. The cavity thus formed shall be thoroughly cleaned with high-pressure water jets supplemented with compressed air to remove all loose material. Immediately before filling the cavity, a prime coat of epoxy resin, Type III, Grade I, shall be applied to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Pooling of epoxy resin shall be avoided. The cavity shall be filled with low slump Portland cement concrete or mortar or with epoxy resin concrete or mortar. Concrete shall be used for larger spalls, generally those more than 1/2 cu. ft. in size, and mortar shall be used for the smaller ones. Any spall less than 0.1 cu. ft. shall be repaired only with epoxy resin mortar or a Grade III epoxy resin. Portland cement concrete and mortar mixtures shall be proportioned as directed and shall be mixed, placed, consolidated, and cured as directed. Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, using proportions and mixing and placing procedures as recommended by the manufacturer and approved by the Engineer. The epoxy resin materials shall be placed in the cavity in layers not over 2 inches thick. The time interval between placement of additional layers shall be such that the temperature of the epoxy resin material does not exceed 140oF at any time during hardening. Mechanical vibrators and hand tampers shall be used to consolidate the concrete or mortar. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens. Where the spalled area abuts a joint, an insert or other bond-breaking medium shall be used to prevent bond at the joint face. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints,

or as required to be routed for cracks. The reservoir shall be thoroughly cleaned and sealed with the sealer specified for the joints. If any spall penetrates half the depth of the slab or more, the entire slab shall be removed and replaced as previously specified.

4.19 EXISTING CONCRETE PAVEMENT REMOVAL AND REPAIR. All operations shall be carefully controlled to prevent damage to the concrete pavement and to the underlying material to remain in place. All saw cuts shall be made perpendicular to the slab surface.

A. Removal of Existing Pavement Slab. When it is necessary to remove existing concrete pavement and leave adjacent concrete in place, the joint between the removal area and adjoining pavement to stay in place, shall first be cut full depth with a standard diamond-type concrete saw. Next, a full depth saw cut shall be made parallel to the joint at least 24 inches from the joint and at least 12 inches from the end of any dowels. All pavement between this last saw cut and the joint line shall be carefully broken up and removed using hand-held jackhammers, 30 lb. or less, or the approved light-duty equipment which will not cause stress to propagate across the joint saw cut and cause distress in the pavement which is to remain in place. Where dowels are present, care shall be taken to produce an even, vertical joint face below the dowels. If the Contractor is unable to produce such a joint face, or if underbreak or other distress occurs, the Contractor shall saw the dowels flush with the joint. The Contractor shall then install new dowels, of the size and spacing used for other similar joints, by epoxy resin bonding them in holes drilled in the joint face as specified in paragraph "Placing dowels and Tie-bars. All this shall be at no additional cost to the Owner. Dowels of the size and spacing indicated shall be installed as shown on the drawings by epoxy resin bonding them in holes drilled in the joint face as specified in paragraph "Placing Dowels and Tie Bars". The joint face shall be sawed or otherwise trimmed so that there is no abrupt offset in any direction greater than 1/2-inch and no gradual offset greater than 1 inch when tested in a horizontal direction with a 12 ft. straightedge.

B. Edge Repair. The edge of existing concrete pavement against which new pavement abuts shall be protected from damage at all times. Areas that are damaged during construction shall be repaired at not cost to the Owner.

1) Spall Repair. Spalls shall be repaired where indicated and where directed. Repair materials and procedures shall be as previously specified in subparagraph "Repairing Spalls Along Joints."

2) Underbreak Repair. All underbreak shall be repaired. First, all delaminated and loose material shall be carefully removed. Next, the underlying material shall be recompacted, without addition of any new material. Finally, the void shall be completely filled with paving concrete, thoroughly consolidated. Care shall be taken to produce an even joint face from top to bottom. Prior to placing concrete, the underlying material shall be thoroughly moistened. After placement, the exposed surface shall be heavily coated with curing compound.

3) Underlying Material. The underlying material adjacent to the edge of an under the existing pavement which is to remain in place shall be protected from damage or disturbance during removal operations and until placement of new concrete,

and shall be shaped as shown on the drawings or as directed. Sufficient material shall be kept in place outside the joint line to prevent disturbance (or sloughing) of material under the pavement that is to remain in place. Any material under the portion of the concrete pavement to remain in place, which is disturbed or loses its compaction shall be carefully removed and replaced with concrete as specified in paragraph "Underbreak Repair." The underlying material outside the joint line shall be thoroughly compacted and moist when new concrete is placed.

PART 5 - MATERIAL ACCEPTANCE

5.1 ACCEPTANCE SAMPLING AND TESTING. All acceptance sampling and testing, with the exception of coring for thickness determination, necessary to determine conformance with the requirements specified in this section will be performed by the Engineer. Concrete shall be accepted for strength and thickness on a lot basis.

A lot shall consist of:

A day's production.

Testing organizations performing these tests shall meet the requirements of ASTM C 1077, including accreditation. The accreditation will include ASTM C 78. The Contractor shall bear the cost of providing curing facilities for the strength specimens, per paragraph 501-5.1a(3), and coring and filling operations, per paragraph 501-5.1b(1).

A. Flexural Strength.

1) Sampling. One sample shall be taken for each lot from the plastic concrete delivered to the job site. Sampling locations shall be determined by the Engineer in accordance with random sampling procedures contained in ASTM D 3665. The concrete shall be sampled in accordance with ASTM C 172.

2) Testing. Two (2) specimens shall be made from each sample. Specimens shall be made in accordance with ASTM C 31 and the flexural strength of each specimen shall be determined in accordance with ASTM C 78. The flexural strength for each sublot shall be computed by averaging the results of the two test specimens representing that sublot.

Immediately prior to testing for flexural strength, the beam shall be weighed and measured for determination of a sample unit weight. Measurements shall be made for each dimension; height, depth, and length, at the mid-point of the specimen and reported to the nearest tenth of an inch. The weight of the specimen shall be reported to the nearest 0.1 pound. The sample unit weight shall be calculated by dividing the sample weight by the calculated volume of the sample. This information shall be reported as companion information to the measured flexural strength for each specimen.

The samples will be transported while in the molds. The curing, except for the initial cure period, will be accomplished using the immersion in saturated lime water method.

Slump, air content, and temperature tests will also be conducted by the quality assurance laboratory for each set of strength test samples, per ASTM C 31.

3) Curing. The Contractor shall provide adequate facilities for the initial curing of beams. During the 24 hours after molding, the temperature immediately adjacent to the specimens must be maintained in the range of 60 to 80 degrees F, and loss of moisture from the specimens must be prevented. The specimens may be stored in tightly constructed wooden boxes, damp sand pits, temporary buildings at construction sites, under wet burlap in favorable weather, or in heavyweight closed plastic bags, or using other suitable methods, provided the temperature and moisture loss requirements are met.

4) Acceptance. Acceptance of pavement for flexural strength will be determined by the Engineer in accordance with paragraph 501-5.2b.

5.2 ACCEPTANCE CRITERIA.

A. General. Acceptance will be based on the following characteristics of the completed pavement; any deficiencies shall be corrected as directed by the COTR and the Engineer.

1) Flexural strength
2) Thickness
3) Smoothness
4) Edge slump
5) Dowel bar alignment

Acceptance for flexural strength will be based on the criteria contained in accordance with paragraph 501-5.2B(1). Acceptance for thickness will be based on the criteria contained in paragraph 501-5.2B(2). Acceptance for smoothness will be based on the criteria contained in paragraph 501-5.2B(3).

The Engineer may at any time, not withstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of concrete mixture which is rendered unfit for use due to contamination, segregation, or improper slump. Such rejection may be based on only visual inspection. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the Engineer, and if it can be demonstrated in the laboratory, in the presence of the Engineer, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

B. Acceptance Criteria.

1) Flexural Strength. The 28-day flexural strength shall be 700 psi.

2) Thickness. Visual inspection to check against the design thickness.

3) Smoothness. As soon as the concrete has hardened sufficiently, the pavement surface shall be tested with a 16-foot straightedge or other specified device. Surface smoothness deviations shall not exceed 1/4 inch from a 16-foot straightedge placed in any direction, including placement along and spanning any pavement joint edge.

Areas in a slab showing high spots of more than 1/4 inch but not exceeding 1/2 inch in 16 feet shall be marked and immediately ground down with an approved grinding machine to an elevation that will fall within the tolerance of 1/4 inch or less. Where the departure from correct cross section exceeds 1/2 inch, the pavement shall be removed and replaced at the expense of the Contractor when so directed by the Engineer.

4) Edge Slump. When slip-form paving is used, not more than 15 percent of the total free edge of each 500 foot segment of pavement, or fraction thereof, shall have an edge slump exceeding 1/4-inch, and none of the free edge of the pavement shall have an edge slump exceeding 3/8-inch. (The total free edge of 500 feet of pavement will be considered the cumulative total linear measurement of pavement edge originally constructed as nonadjacent to any existing pavement; i.e., 500 feet of paving lane originally constructed as a separate lane will have 1,000 feet of free edge, 500 feet of fill-in lane will have no free edge, etc.). The area affected by the downward movement of the concrete along the pavement edge shall be limited to not more than 18 inches from the edge. When excessive edge slump cannot be corrected before the concrete has hardened, the area with excessive edge slump shall be removed and replaced at the expense of the Contractor when so directed by the Engineer.

5) Dowel Bar Alignment. Dowel bars and assemblies shall be checked for position and alignment. The maximum permissible tolerance on dowel bar alignment in each plane, horizontal and vertical, shall not exceed 2 percent or 1/4 inch per foot of a dowel bar. Vertical alignment of dowels shall be measured parallel to the designed top surface of the pavement, except for those across the crown or other grade change joints. Dowels across crowns and other joints at grade changes, shall be measured to a level surface. Horizontal alignment shall be checked perpendicular to the joint edge.

F. Removal and Replacement of Concrete. Any area or section of concrete that is removed and replaced shall be removed and replaced back to planned joints. The Contractor shall replace damaged dowels and the requirements for doweled longitudinal construction joints in paragraph 501-4.10 shall apply to all contraction joints exposed by concrete removal. Removal and replacement shall be in accordance with paragraph 501-4.19 of this specification.

PART 6 - CONTRACTOR QUALITY CONTROL

6.1 QUALITY CONTROL PROGRAM. The Contractor shall develop a Quality Control Program to address all elements that effect the quality of the pavement including but not limited to:

a. Mix Design	e. Proportioning	i. Dowel Placement and Alignment
b. Aggregate Gradation	f. Mixing and Transportation	j. Flexural or Compressive Strength
c. Quality of Materials	g. Placing and Consolidation	k. Finishing and Curing
d. Stockpile Management	h. Joints	l. Surface Smoothness

6.2 QUALITY CONTROL TESTING. The Contractor shall perform all quality control tests necessary to control the production and construction processes applicable to this specification and as set forth in the Quality Control Program. The testing program shall include, but not necessarily be limited to, tests for aggregate gradation, aggregate moisture content, slump, and air content.

A Quality Control Testing Plan shall be developed as part of the Quality Control Program.

A. Fine Aggregate.

1) Gradation. A sieve analysis shall be made at least twice daily in accordance with ASTM C 136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

2) Moisture Content. If an electric moisture meter is used, at least two direct measurements of moisture content shall be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter, two tests shall be made per day. Tests shall be made in accordance with ASTM C 70 or ASTM C 566.

B. Coarse Aggregate.

1) Gradation. A sieve analysis shall be made at least twice daily for each size of aggregate. Tests shall be made in accordance with ASTM C 136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

2) Moisture Content. If an electric moisture meter is used, at least two direct measurements of moisture content shall be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter,

two tests shall be made per day. Tests shall be made in accordance with ASTM C 566.

C. Slump. Four slump tests shall be performed for each lot of material produced in accordance with the lot size defined in Section 501-5.1. One test shall be made for each sublot. Slump tests shall be performed in accordance with ASTM C 143 from material randomly sampled from material discharged from trucks at the paving site. Material samples shall be taken in accordance with ASTM C 172.

D. Air Content. Four air content tests, shall be performed for each lot of material produced in accordance with the lot size defined in Section 501-5.1. One test shall be made for each sublot. Air content tests shall be performed in accordance with ASTM C 231 for gravel and stone coarse aggregate and ASTM C 173 for slag or other porous coarse aggregate, from material randomly sampled from trucks at the paving site. Material samples shall be taken in accordance with ASTM C 172.

E. Four unit weight and yield tests shall be made in accordance with ASTM C 138. The samples shall be taken in accordance with ASTM C 172 and at the same time as the air content tests.

6.3 CONTROL CHARTS. The Contractor shall maintain linear control charts for fine and coarse aggregate gradation, slump, and air content.

Control charts shall be posted in a location satisfactory to the Engineer and shall be kept up to date at all times. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and suspension Limits, or Specification limits, applicable to each test parameter, and the Contractor's test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a potential problem and the Contractor is not taking satisfactory corrective action, the Engineer may halt production or acceptance of the material.

A. Fine and Coarse Aggregate Gradation. The Contractor shall record the running average of the last five gradation tests for each control sieve on linear control charts. Specification limits contained in Tables 1 and 2 shall be superimposed on the Control Chart for job control.

B. Slump and Air Content. The Contractor shall maintain linear control charts both for individual measurements and range (i.e. difference between highest and lowest measurements) for slump and air content in accordance with the following Action and Suspension Limits.

CONTROL CHART LIMITS			
Control Parameter	Individual Measurements		Range Suspension Limit
	Action Limit	Suspension Limit	
Slip Form:			
Slump	+0 to -1 inch (0-25mm)	+0.5 to -1.5 inch (13-38mm)	+/- 1.5 inch (38 mm)
Air Content	+/- 1.2%	+/- 1.8%	+/- 2.5%
Fixed Form			
Slump	+ 0.5 to -1 inch (13-25mm)	+1 to -1.5 inch (25-38mm)	+/- 1.5 inch (38mm)
Air Content	+/- 1.2%	+/- 1.8%	+/- 2.5%

The individual measurement control charts shall use the mix design target values as indicators of central tendency.

6.4 CORRECTIVE ACTION. The Contractor Quality Control Program shall indicate that appropriate action shall be taken when the process is believed to be out of control. The Contractor Quality Control Program shall detail what action will be taken to bring the process into control and shall contain sets of rules to gauge when a process is out of control. As a minimum, a process shall be deemed out of control and corrective action taken if any one of the following conditions exists.

A. Fine and Coarse Aggregate Gradation. When two consecutive averages of five tests are outside of the Tables 1 or 2 specification limits, immediate steps, including a halt to production, shall be taken to correct the grading.

B. Fine and Coarse Aggregate Moisture Content. Whenever the moisture content of the fine or coarse aggregate changes by more than 0.5 percent, the scale settings for the aggregate batcher(s) and water batcher shall be adjusted.

C. Slump. The Contractor shall halt production and make appropriate adjustments whenever:

1) one point falls outside the Suspension Limit line for individual measurements or range; or

2) two points in a row fall outside the Action Limit line for individual measurements.

D. Air Content. The Contractor shall halt production and adjust the amount of air-entraining admixture whenever:

1) one point falls outside the Suspension Limit line for individual measurements or range; or

2) two points in a row fall outside the Action Limit line for individual measurements.

Whenever a point falls outside the Action Limits line, the air-entraining admixture dispenser shall be calibrated to ensure that it is operating correctly and with good reproducibility.

PART 7 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT (NOT USED)

TESTING REQUIREMENTS

ASTM C 31	Making and Curing Concrete Test Specimens in the Field
ASTM C 39	Compressive Strength of Cylindrical Concrete Specimens
ASTM C 70	Surface Moisture in Fine Aggregate
ASTM C 78	Test for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C 88	Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 131	Test for Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM C 138	Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 143	Test for Slump of Hydraulic Cement Concrete
ASTM C 172	Sampling Freshly Mixed Concrete
ASTM C 173	Test for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 174	Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
ASTM C 227	Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
ASTM C 231	Test for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 289	Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
ASTM C 295	Petrographic Examination of Aggregates for Concrete
ASTM C 114	Chemical Analysis of Hydraulic Cement

ASTM C 535	Test for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 566	Total Evaporable Moisture Content of Aggregates by Drying
ASTM C 642	Test for Density, Absorption, and Voids in Hardened Concrete
ASTM C 666	Resistance of Concrete to Rapid Freezing and Thawing
ASTM C 1077	Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction And Criteria for Laboratory Evaluation
ASTM C 1260	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM D 3665	Random Sampling of Paving Materials
ASTM D 4791	Test Method for Flat or Elongated Particles in Coarse Aggregate
ASTM E 178	Dealing With Outlying Observations
ASTM E 1274	Test for Measuring Pavement Roughness Using a Profilograph
AASHTO T 26	Quality of Water to be Used in Concrete

MATERIAL REQUIREMENTS

ASTM A 184	Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 497	Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 704	Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement
ASTM A 714	Specification for High-Strength Low-Alloy Welded and Seamless Steel Pipe
ASTM A 996	Specification for Rail-Steel and Axle Steel Deformed Bars for Concrete Reinforcement
ASTM C 33	Specification for Concrete Aggregates
ASTM C 94	Specification for Ready-Mixed Concrete
ASTM C 150	Specification for Portland Cement

ASTM C 171	Specification for Sheet Materials for Curing Concrete
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete
ASTM C 309	Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	Specification for Chemical Admixtures for Concrete
ASTM C 595	Specification for Blended Hydraulic Cements
ASTM C 618	Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 881	Specification for Epoxy-Resin Base Bonding System for Concrete
ASTM C 989	Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM D 1751	Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving And Structural Construction
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 309	Guide for Consolidation of Concrete

MIL-DTL-24441/20a (1999)_Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type III Department of Defense

END OF SECTION P-501

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION P-610 STRUCTURAL PORTLAND CEMENT CONCRETE

PART 1 – GENERAL

1.1 DESCRIPTION

A. This item shall consist of reinforced structural cast-in place portland cement concrete, prepared and constructed in accordance with these specifications, at the locations and of the form and dimensions shown on the plans.

PART 2 - MATERIALS

2.1 GENERAL

A. Only approved materials, conforming to the requirements of these specifications, shall be used in the work. They may be subjected to inspection and tests at any time during the progress of their preparation or use. The source of supply of each of the materials shall be approved by the Engineer before delivery or use is started. Representative preliminary samples of the materials shall be submitted by the Contractor, when required, for examination and test. Materials shall be scored and handled to insure the preservation of their quality and fitness for use and shall be located to facilitate prompt inspection. All equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed therein.

In no case shall the use of pit-run or naturally mixed aggregates be permitted. Naturally mixed aggregate shall be screened and washed, and all fine and coarse aggregates shall be stored separately and kept clean. The mixing of different kinds of aggregates from different sources in one storage pile or alternating batches of different aggregates will not be permitted.

Aggregates shall be tested for deleterious reactivity with alkalies in the cement that may cause excessive expansion of the concrete. Acceptance of aggregates shall be based upon satisfactory evidence furnished by the Contractor that the aggregates, combined with other mixture constituents, do not produce excessive expansion in the concrete. This evidence shall include service records of concrete of comparable properties under similar conditions or exposure and certified records of tests by a testing laboratory that meets the requirements of ASTM C 1077. Tests shall be made in accordance with ASTM C 1260. Test specimens shall be produced using all components (e.g. coarse aggregate, fine aggregate, cement and fly ash…) to be included in the produced concrete. If the mean expansion of the test specimens, tested in accordance with ASTM C 1260, does not exceed 0.10 % at 16 days from casting the aggregates shall be accepted. If the mean expansion at 16 days is greater than 0.10% but less than 0.15%, the aggregate may be accepted based upon satisfactory service records and acceptance of the aggregate by a State Highway Department specifically addressing Alkali-Silica Reactivity. If the expansion is greater than 0.15%, the aggregate shall not be accepted for use.

2.2 COARSE AGGREGATE

A. The coarse aggregate for concrete shall meet the requirements of ASTM C 33. Crushed stone aggregate shall have a durability factor, as determined by ASTM C 666, greater than or equal to 95. The Engineer may consider and reserve final approval of other State classification procedures addressing aggregate durability.

Coarse aggregate shall be well graded from coarse to fine and shall meet one of the gradations shown in Table 1, using ASTM C 136.

2.3 FINE AGGREGATE.

A. The fine aggregate for concrete shall meet the requirements of ASTM C 33. The fine aggregate shall be well graded from fine to coarse and shall meet the requirements of Table 2 when tested in accordance with ASTM C 136:

TABLE 1. GRADATION FOR COARSE AGGREGATE

Sieve Designation (square openings)	Percentage by Weight Passing Sieves						
	2”	1-1/2”	1”	3/4"	1/2"	3/8"	No.4
No. 4 to 3/4 in. (4.75-19.0 mm)			100	90-100		20-55	0-10
No. 4 to 1 in. (4.75-25.0 mm)		100	90-100		25-60		0-10
No. 4 to 1-1/2 in. (4.75-38.1 mm)	100	95-100		35-70		10-30	0-5

TABLE 2. GRADATION FOR FINE AGGREGATE

Sieve Designation (square openings)	Percentage by Weight Passing Sieves
3/8 inch (9.5 mm)	100
No. 4 (4.75 mm)	95-100
No. 16 (1.18 mm)	45-80
No. 30 (0.60 mm)	25-55
No. 50 (0.30 mm)	10-30
No. 100 (0.15 mm)	2-10

Blending will be permitted, if necessary, in order to meet the gradation requirements for fine aggregate. Fine aggregate deficient in the percentage of material passing the No. 50 mesh sieve may be accepted, provided that such deficiency does not exceed 5% and is remedied by the addition of pozzolanic or cementitious materials other than portland cement, as specified in 610-2.6 on admixtures, in sufficient quantity to produce the required workability as approved by the Engineer.

2.4 CEMENT

A. Cement shall conform to the requirements of ASTM C 150 Type II, or IIA. The Contractor shall furnish vendors' certified test reports for each carload, or equivalent, of cement shipped to the project. The report shall be delivered to the Engineer before permission to use the cement is granted. All such test reports shall be subject to verification by testing sample materials received for use on the project.

2.5 WATER

A. The water used in concrete shall be free from sewage, oil, acid, strong alkalies, vegetable matter, and clay and loam. If the water is of questionable quality, it shall be tested in accordance with AASHTO T 26.

2.6 ADMIXTURES

A. The use of any material added to the concrete mix shall be approved by the Engineer. Before approval of any material, the Contractor shall be required to submit the results of complete physical and chemical analyses made by an acceptable testing laboratory. Subsequent tests shall be made of samples taken by the Engineer from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.

Pozzolanic admixtures shall be fly ash or raw or calcined natural pozzolons meeting the requirements of ASTM C 618, Class F or N with the exception of loss of ignition, where the maximum shall be less than 6 percent. Class F or N flyash for use in mitigating alkali-silica reactivity shall have a Calcium Oxide (CaO) content of less than 13 percent and a total equivalent alkali content less than 3 percent.

Air-entraining admixtures shall meet the requirements of ASTM C 260. Air-entraining admixtures shall be added at the mixer in the amount necessary to produce the specified air content.

Water-reducing, set-controlling admixtures shall meet the requirements of ASTM C 494, Type A, water-reducing or Type D, water-reducing and retarding. Water-reducing admixtures shall be added at the mixer separately from air-entraining admixtures in accordance with the manufacturer's printed instructions.

2.7 PREMOLDED JOINT MATERIAL

A. Premolded joint material for expansion joints shall meet the requirements of ASTM D 1751.

2.8 JOINT FILLER

A. The filler for joints shall meet the requirements of Item P-605, unless otherwise specified in the proposal.

2.9 STEEL REINFORCEMENT

A. Reinforcing shall be as shown in the plans conforming to the following requirements:

Deformed and Plain Billett-Steel Bars	ASTM A 615, Grade 60
Welded Wire Reinforcing	ASTM A185

2.10 COVER MATERIALS FOR CURING

A. Curing materials shall conform to one of the following specifications:

Waterproof paper for curing concrete	ASTM C 171
Polyethylene Sheeting for Curing Concrete	ASTM C 171
Liquid Membrane-Forming Compounds for Curing Concrete	ASTM C 309, Type 2

2.11 DAMPPROOFING.

A Asphalt dampproofing shall conform to AASHTO M 115 and the primer shall conform to AASHTO M 116.

2.12 BENTONITE WATERSTOP.

A. Flexible strip of bentonite/butyl rubber based compound in coil form, designed specifically for vertical and horizontal joints in concrete construction, nominal 1”x3/4” extruded rectangular shape.

PART 3 - CONSTRUCTION METHODS

3.1 GENERAL

A. The Contractor shall furnish all labor, materials, and services necessary for, and incidental to, the completion of all work as shown on the drawings and specified herein. All machinery and equipment owned or controlled by the Contractor, which he proposes to use on the work, shall be of sufficient size to meet the requirements of the work, and shall be such as to produce satisfactory work; all work shall be subject to the inspection and approval of the Engineer.

3.2 CONCRETE COMPOSITION

A. The concrete shall develop a compressive strength of 4000 psi in 28 days as determined by test cylinders made in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The concrete shall contain not less than 470 pounds of cement per cubic yard (280 kg per cubic meter). The concrete shall contain 5 percent of entrained air, plus or minus 1 percent, as determined by ASTM C 231 and shall have a slump of not more than 4 inches (10 cm) as determined by ASTM C 143.

3.3 ACCEPTANCE SAMPLING AND TESTING

A. Concrete for each structure will be accepted on the basis of the compressive strength specified in paragraph 3.2. The concrete shall be sampled in accordance with ASTM C 172. Compressive strength specimens shall be made in accordance with ASTM C 31 and tested in accordance with ASTM C 39.

Concrete cylindrical test specimens shall be made in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The Contractor shall cure and store the test specimens under such conditions as directed. The Contractor will make the actual tests on the specimens at no expense to the Authority.

3.4 PROPORTIONING AND MEASURING DEVICES

A. When package cement is used, the quantity for each batch shall be equal to one or more whole sacks of cement. The aggregates shall be measured separately by weight. If aggregates are delivered to the mixer in batch trucks, the exact amount for each mixer charge shall be contained in each batch compartment. Weighing boxes or hoppers shall be approved by the Engineer and shall provide means of regulating the flow of aggregates into the batch box so that the required and exact weight of aggregates can be readily obtained.

3.5 CONSISTENCY

A. The consistency of the concrete shall be checked by the slump test specified in ASTM C 143.

3.6 MIXING

A. Concrete may be mixed at the construction site, at a central point, or wholly or in part in truck mixers. The concrete shall be mixed and delivered in accordance with the requirements of ASTM C 94.

3.7 MIXING CONDITIONS

A. The concrete shall be mixed only in quantities required for immediate use. Concrete shall not be mixed while the air temperature is below 40°F (4°C) without permission of the Engineer. If permission is granted for mixing under such conditions, aggregates or water, or both, shall be heated and the concrete shall be placed at a temperature not less than 50°F (10°C) nor more than 100°F (38°C). The Contractor shall be held responsible for any defective work, resulting from freezing or injury in any manner during placing and curing, and shall replace such work at his/her expense.

Retempering of concrete by adding water or any other material shall not be permitted.

The delivery of concrete to the job shall be in such a manner that batches of concrete will be deposited at uninterrupted intervals.

3.8 FORMS.

A. Concrete shall not be placed until all the forms and reinforcements have been inspected and approved by the Engineer. Forms shall be of suitable material and shall be of the type, size, shape, quality, and strength to build the structure as designed on the plans. The forms shall be true to line and grade and shall be mortar-tight and sufficiently rigid to prevent displacement and sagging between supports. The Contractor shall bear responsibility for their adequacy. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes.

The internal ties shall be arranged so that, when the forms are removed, no metal will show in the concrete surface or discolor the surface when exposed to weathering. All forms shall be wetted with water or with a non-staining mineral oil, which shall be applied shortly before the concrete is placed. Forms shall be constructed so that they can be removed without injuring the concrete or concrete surface. The forms shall not be removed before the expiration of at least 30 hours from vertical faces, walls, slender columns, and similar structures; forms supported by falsework under slabs, beams, girders, arches, and similar construction shall not be removed until tests indicate that at least 60% of the design strength of the concrete has developed.

3.9 PLACING REINFORCEMENT.

A. All reinforcement shall be accurately placed, as shown on the plans, and shall be firmly held in position during concreting. Bars shall be fastened together at intersections. The reinforcement shall be supported by approved metal chairs. Shop drawings, lists, and bending details shall be supplied by the Contractor when required.

3.10 EMBEDDED ITEMS

A. Before placing concrete, any items that are to be embedded shall be firmly and securely fastened in place as indicated. All such items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The embedding of wood shall be avoided. The concrete shall be spaded and consolidated around and against embedded items.

3.11 PLACING CONCRETE

A. All concrete shall be placed during daylight, unless otherwise approved. The concrete shall not be placed until the depth and character of foundation, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved. Concrete shall be placed as soon as practical after mixing and in no case later than 1 hour after water has been added to the mix. The method and manner of placing shall be such to avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes shall be used as an aid in placing concrete when necessary. Dropping the concrete a distance of more than 5 feet (1.5 m), or depositing a large quantity at one point, will not be permitted. Concrete shall be placed upon clean, damp surfaces, free from running water, or upon properly consolidated soil.

The concrete shall be compacted with suitable mechanical vibrators operating within the concrete. When necessary, vibrating shall be supplemented by hand spading with suitable tools to assure proper and adequate compaction. Vibrators shall be manipulated so as to work the concrete thoroughly around the reinforcement and embedded fixtures and into corners and angles of the forms. The vibration at any joint shall be of sufficient duration to accomplish compaction but shall not be prolonged to the point where segregation occurs. Concrete deposited under water shall be carefully placed in a compact mass in its final position by means of a tremie, a closed bottom dump bucket, or other approved method and shall not be disturbed after being deposited.

3.12 CONSTRUCTION JOINTS

A. When the placing of concrete is suspended, necessary provisions shall be made for joining future work before the placed concrete takes its initial set. For the proper bonding of old and new concrete, such provisions shall be made for grooves, steps, keys, dovetails, reinforcing bars or other devices as may be prescribed. The work shall be arranged so that a section begun on any

day shall be finished during daylight of the same day. Before depositing new concrete on or against concrete that has hardened, the surface of the hardened concrete shall be cleaned by a heavy steel broom, roughened slightly, wetted, and covered with a neat coating of cement paste or grout.

3.13 EXPANSION JOINTS

A. Expansion joints shall be constructed at such points and of such dimensions as may be indicated on the drawings. The premolded filler shall be cut to the same shape as that of the surfaces being joined. The filler shall be fixed firmly against the surface of the concrete already in place in such manner that it will not be displaced when concrete is deposited against it.

3.14 DEFECTIVE WORK

A. Any defective work discovered after the forms have been removed shall be immediately removed and replaced. If any dimensions are deficient, or if the surface of the concrete is bulged, uneven, or shows honeycomb, which in the opinion of the Engineer cannot be repaired satisfactorily, the entire section shall be removed and replaced at the expense of the Contractor.

3.15 SURFACE FINISH

A. All exposed concrete surfaces shall be true, smooth, and free from open or rough spaces, depressions, or projections. The concrete in horizontal plane surfaces shall be brought flush with the finished top surface at the proper elevation and shall be struck-off with a straightedge and floated. Mortar finishing shall not be permitted, nor shall dry cement or sand-cement mortar be spread over the concrete during the finishing of horizontal plane surfaces.

When directed, the surface finish of exposed concrete shall be a rubbed finish. If forms can be removed while the concrete is still green, the surface shall be pointed and wetted and then rubbed with a wooden float until all irregularities are removed. If the concrete has hardened before being rubbed, a carborundum stone shall be used to finish the surface. When approved, the finishing can be done with a rubbing machine.

3.16 CURING AND PROTECTION

A. All concrete shall be properly cured and protected by the Contractor. The work shall be protected from the elements, flowing water, and from defacement of any nature during the building operations. The concrete shall be cured as soon as it has sufficiently hardened by covering with an approved material. Water-absorptive coverings shall be thoroughly saturated when placed and kept saturated for a period of at least 3 days. All curing mats or blankets shall be sufficiently weighted or tied down to keep the concrete surface covered and to prevent the surface from being exposed to currents of air. Where wooden forms are used, they shall be kept wet at all times until removed to prevent the opening of joints and drying out of the concrete. Traffic shall not be allowed on concrete surfaces for 7 days after the concrete has been placed.

3.17 DRAINS OR DUCTS

A. Drainage pipes, conduits, and ducts that are to be encased in concrete shall be installed by the Contractor before the concrete is placed. The pipe shall be held rigidly so that it will not be displaced or moved during the placing of the concrete.

3.18 COLD WEATHER PROTECTION

A. When concrete is placed at temperatures below 40°F (4°C), the Contractor shall provide satisfactory methods and means to protect the mix from injury by freezing. The aggregates, or water, or both, shall be heated in order to place the concrete at temperatures between 50°F and 100°F (10°C and 38°C).

Calcium chloride may be incorporated in the mixing water when directed by the Engineer. Not more than 2 pounds (908 grams) of Type 1 nor more than 1.6 pounds (726 grams) of Type 2 shall be added per bag of cement. After the concrete has been placed, the Contractor shall provide sufficient protection such as cover, canvas, framework, heating apparatus, etc., to enclose and protect the structure and maintain the temperature of the mix at not less than 50°F (10°C) until at least 60% of the designed strength has been attained.

3.19 HOT WEATHER PROTECTION.

A. When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 degrees F. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperatures will not exceed the ambient air temperature immediately before embedding in concrete.

Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to the Engineer.

3.20 FILLING JOINTS

A. All joints that require filling shall be thoroughly cleaned, and any excess mortar or concrete shall be cut out with proper tools. Joint filling shall not be started until after final curing and shall be done only when the concrete is completely dry. The cleaning and filling shall be carefully done with proper equipment and in a manner to obtain a neat looking joint free from excess filler.

3.21 APPLICATION OF DAMPPROOFING.

A. Care shall be taken to confine all coatings to the areas to be covered to prevent coating of parts of the structure that will be exposed to view in the completed structure. Dampproofing shall be applied to the full face of concrete which is in contact with the earth.

The cured, patched, cleaned, and dry surfaces shall be coated as follows:

1. Paint with two coats of primer for absorptive treatment at a rate of 1/8 gal/yd^2 per coat. The second coat shall not be applied until the first coat has thoroughly dried. The material shall not be heated.
2. After the second prime coast has thoroughly dried, one seal coat shall be applied by brush or roller at a rate of 1/8 gal/yd^2 of surface. When necessary, this material may be heated, but not in excess of 150 degrees F.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT (NOT USED)

TESTING REQUIREMENTS

ASTM C 31	Making and Curing Test Specimens in the Field
ASTM C 39	Compressive Strength of Cylindrical Concrete Specimens
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM C 138	Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 143	Slump of Hydraulic Cement Concrete
ASTM C 231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 666	Resistance of Concrete to Rapid Freezing and Thawing
ASTM C 1077	Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1260	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

MATERIAL REQUIREMENTS

ASTM A 185	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 33	Concrete Aggregates
ASTM C 94	Ready-Mixed Concrete
ASTM C 150	Portland Cement
ASTM C 171	Sheet Materials for Curing Concrete
ASTM C 172	Sampling Freshly Mixed Concrete
ASTM C 260	Air-Entraining Admixtures for Concrete

ASTM C 309 Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C 494 Chemical Admixtures for Concrete

ASTM C 595 Blended Hydraulic Cements

ASTM C 618 Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete

ASTM D 1751 Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

ASTM D 1752 Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

AASHTO T 26 Quality of Water to be Used in Concrete

END OF SECTION P-610

SECTION P-611 PRECAST CONCRETE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Extent of structural precast concrete work is shown on plans. All concrete structures shown on the contract plans are designed as cast-in-place structures. Contractor may use precast Concrete Structures instead of cast-in-place structures as shown on contract plans. Precast Concrete Structure shall be designed, fabricated and installed according to this specification. Structural precast concrete includes precast concrete manholes.

PART 2 - MATERIALS

2.1 GENERAL

A. Only approved materials, conforming to the requirements of these specifications, shall be used in the work. They may be subjected to inspection and tests at any time during the progress of their preparation or use. The source of supply of each of the materials shall be approved by the Engineer before delivery or use is started. Representative preliminary samples of the materials shall be submitted by the Contractor, when required, for examination and test. Materials shall be stored and handled to insure the preservation of their quality and fitness for use and shall be located to facilitate prompt inspection. All equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed therein.

In no case shall the use of pit-run or naturally mixed aggregates be permitted. Naturally mixed aggregate shall be screened and washed, and all fine and coarse aggregates shall be stored separately and kept clean. The mixing of different kinds of aggregates from different sources in one storage pile or alternating batches of different aggregates will not be permitted.

2.2 COARSE AGGREGATE. The coarse aggregate for concrete shall meet the requirements of ASTM C 33.

2.3 FINE AGGREGATE. The fine aggregate for concrete shall meet the requirements of ASTM C 33.

PART 3 - SUBMITTALS

3.1 GENERAL. Submit the following documents:

A. Product Data: Submit manufacturer's specifications and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.

B. Mix Designs: Submit written reports of proposed concrete mix.

C. Shop Drawings: Submit shop drawings showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross-section; location, size, and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection.

Indicate layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints including accessories and construction at openings in precast units. Include erection procedure for precast units and sequence of erection.

D. Provide complete design calculations prepared by a registered engineer, licensed in the Commonwealth of Virginia.

PART 4 - CONSTRUCTION METHODS

4.1 PROPORTIONING AND DESIGN OF MIXES. Prepare design mixes for each type of concrete required. Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option. Proportion mixes by either laboratory trail batch or field experience methods, using materials to be employed on the project for each type of concrete required, complying with ACI 318.

Produce standard-weight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the concrete having compressive strength of 5000 psi minimum at 28 days. Cure compression test cylinders using same methods as used for cast-in-place concrete work.

4.2 FORMWORK. Provide forms and, where required, form facing materials of metal, plastic, wood, or other acceptable material that is non-reactive with concrete and will produce required finish surfaces. Accurately construct forms, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and when prestressed, pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL 116.

4.3 PLACING REINFORCEMENT. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Clean reinforcement of loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

4.4 FABRICATION. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116, and as specified for types of units required. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or placing of concrete. Cast-in holes for openings in accordance with final shop drawings. Coat surfaces of forms with bond-breaking compound before reinforcement is placed.

4.5 PLACING CONCRETE. Place concrete in a continuous operation to prevent formation of seams or planes of weakness in precast units, complying with requirements of ACI 304. Provide permanent markings to identify pick-up points and orientation in structure, complying with markings indicated on final shop drawings.

4.6 SURFACE FINISH. Finish for Formed Surfaces: Provide finishes for formed surfaces of precast concrete as indicated for each type of unit, and as follows:

Standard Finish: Normal plant run finish produced in forms that impart a smooth finish to concrete.

4.7 CURING. Curing by low-pressure steam, by steam vapor, by radiant heat and moisture, or other similar process may be employed to accelerate concrete hardening and to reduce curing time.

4.8 DELIVERY, STORAGE, AND HANDLING. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation.

Provide certification letter to accompany all deliveries that all precast concrete units comply with approved shop drawings and specifications.

PART 5 - QUALITY ASSURANCE AND QUALITY CONTROL

5.1 QUALITY ASSURANCE. Codes and Standards: Comply with provisions of latest editions of following codes, specifications, and standards, except as otherwise indicated:

A. ACI 301 "Specifications for Structural Concrete in Buildings."

B. ACI 318 "Building Code Requirements for Reinforced Concrete."

C. Concrete Reinforcing Steel Institute "Manual of Standard Practice."

D. Prestressed Concrete Institute MNL 116, "Manual for Quality Control for Plants and Production of Precast Concrete Products."

E. Prestressed Concrete Institute Design Handbook.

F. Design by Fabricator: Design precast units to support superimposed dead loads and live load as indicated on plans and as required for compliance with Building Code requirements.

G. Acceptable precast concrete manufacturer shall have PCI certified plant. Precast manufacturer shall submit QC plan for Engineer's approval.

5.2 QUALITY CONTROL. The precast manufacturer shall allow Owner's representative access to materials storage areas, concrete production equipment, and concrete placement and curing facilities. Precast units having dimensions greater than required will be rejected if appearance or function of the structure is adversely affected, or if larger dimensions interfere with other construction. Repair or remove and replace rejected units as required to meet construction conditions.

Strength of Units: The strength of precast concrete units will be considered potentially deficient if the manufacturing processes fail to comply with any of the requirements which may affect the strength of the precast units, including the following conditions.

Failure to meet compressive strength test requirements.

Concrete curing and protection of precast units against extremes in temperature, not as specified.

Precast units damaged during handling and erection.

Testing Precast Units: Where there is evidence that strength of precast concrete units does not meet specification requirements; the concrete testing service shall take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C 42.

Defective Work: Precast concrete units which do not conform to specified requirements, including strength, tolerances, and finishes, shall be replaced with precast concrete units that meet requirements of this section.

Precast unit shall reach minimum eighty-five percent of design strength before handling or lifting.

5.3 INSTALLATION GENERAL. Install precast units without exceeding following tolerance limits specified in PCI MNL-127 "Recommended Practice for Erection of

PART 6 – METHOD OF MEASUREMENT AND BASIS OF PAYMENT (not used)

END OF SECTION P-611

SECTION P-620 RUNWAY AND TAXIWAY PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This item shall consist of the painting of numbers, markings, and stripes on the surface of runways, taxiways, and aprons, as well as removal of existing wind rose marking in accordance with these specifications and at the locations shown on the plans, or as directed by the Engineer.

PART 2 - MATERIALS

2.1 MATERIALS ACCEPTANCE

A. The Contractor shall furnish manufacturer's certified test reports for materials shipped to the project. The certified test reports shall include a statement that the materials meet the specification requirements. The reports can be used for material acceptance or the Engineer may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the Engineer upon arrival of a shipment of materials to the site.

2.2 PAINT

A. Paint shall be Waterborne in accordance with the requirements of paragraph 620-2.2 a. Paint shall be furnished in White (37925), Yellow (33538 or 33655), and Black (37038) in accordance with Federal Standard No 595.

1. Waterborne**.** Paint shall meet the requirements of Federal Specification TT-P-1952D, Type II.

2.3 REFLECTIVE MEDIA

A. Glass beads shall meet the requirements for Federal Specification TT-B-1325C, Type I, gradation A. Glass beads shall be treated with all compatible coupling agents recommended by the manufacturers of the paint and reflective media to ensure adhesion and embedment.

PART 3 - CONSTRUCTION METHODS

3.1 WEATHER LIMITATIONS

A. The painting shall be performed only when the surface is dry and when the surface temperature is at least 45°F and rising and the pavement surface temperature is at least 5°F above the dew point. Maximum and minimum surface temperatures shall be based on paint manufacturer's recommendations. Markings shall not be applied when the pavement temperature is greater than 120°F.

3.2 EQUIPMENT

A. Equipment shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, a bead and/or silica sand dispensing machine and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the job.

The mechanical marker shall be an atomizing spray-type marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at the required coverage and shall apply markings of uniform cross sections and clear-cut edges without running or spattering and without over spray.

3.3 PREPARATION OF SURFACE

A. Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance, or other foreign material that would reduce the bond between the paint and the pavement. The area to be painted shall be cleaned by sweeping and blowing or by other methods as required to remove all dirt, laitance, and loose materials. Areas which cannot be satisfactorily cleaned by blowing /brushing shall be scrubbed as directed with a water solution of trisodium phosphate (10% $Na_3 PO_4$ by weight) or an approved equal solution. After scrubbing, the solution shall be rinsed off and the surface dried prior to painting. Paint shall not be applied to Portland cement concrete pavement until the areas to be painted are clean of curing material. Sandblasting or high-pressure water may also be used as long as pavement is not damaged. Damage shall be repaired by contractor at his expense to the approval of the engineer.

3.4 LAYOUT OF MARKINGS

A. The proposed markings shall be laid out in advance of the paint application. All markings shown on the plans shall receive glass beads.

3.5 APPLICATION

A. Paint shall be applied at the locations and to the dimensions and spacing shown on the plans. Paint shall not be applied until the layout and condition of the surface has been approved by the Engineer.

The edges of the markings shall not vary from a straight line more than 1/2 inch (12 mm) in 50 feet (15 m) and marking dimensions and spacings shall be within the following tolerances:

Dimension and Spacing	Tolerance
36 inches or less	±1/2 inch
greater than 36 inches to 6 feet	± 1 inch
greater than 6 feet to 60 feet	± 2 inches
greater than 60 feet	± 3 inches

The paint shall be mixed in accordance with the manufacturer's instructions and applied to the pavement with a marking machine at the rate(s) shown in Table 1. The addition of thinner will not be permitted. A period of time consistent with manufacturer's recommendation shall elapse between placement of a bituminous surface course or seal coat and application of the paint.

TABLE 1. APPLICATION RATES FOR PAINT, GLASS BEADS, AND SILICA SAND

Paint Type	Paint Square feet per gallon, ft^2/gal	Glass Beads, Type I, Gradation A Pounds per gallon of paint--lb./gal.
Waterborne (Permanent)	115	7 lb/gallon
Waterborne (Temporary)	325	None

Glass beads shall be distributed upon the marked areas at the locations shown on the plans to receive glass beads immediately after application of the paint. A dispenser shall be furnished which is properly designed for attachment to the marking machine and suitable for dispensing glass beads. Glass beads shall be applied at the rate(s) shown in Table 1. Glass beads shall not be applied to black paint. Glass beads shall adhere to the cured paint or all marking operations shall cease until corrections are made.

All emptied containers shall be returned to the paint storage area for checking by the Engineer. The containers shall not be removed from the airport or destroyed until authorized by the Engineer.

A 30-day waiting period is required prior to permanent for pavement marking. All markings shall be painted using temporary marking until the waiting period has passed. Glass beads are not required for temporary markings. The final application should occur after the waiting period has passed. The final marking application must be at full strength in order to adequately set the glass bead.

3.6 PROTECTION AND CLEANUP

A. After application of the paint, all markings shall be protected from damage until the paint is dry. All surfaces shall be protected from excess moisture and/or rain and from disfiguration by spatter, splashes, spillage, or drippings of paint. The Contractor shall remove from the site all debris, waste, loose or un-adhered reflective media, and by-products generated by the surface preparation and application operations to the satisfaction of the Engineer. The Contractor shall dispose of these wastes in strict compliance with all applicable state, local, and Federal environmental statutes and regulations.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT (NOT USED)

TESTING REQUIREMENTS

ASTM C-146	Chemical Analysis of Glass Sand
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM C 146	Chemical Analysis of Glass Sand

ASTM C 371	Wire-Cloth Sieve Analysis of Nonplastic Ceramic Powders
ASTM D 92	Test Method for Flash and Fire Points by Cleveland Open Cup
ASTM D 711	No-Pick-Up Time of Traffic Paint
ASTM D 968	Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 1213-54(1975)	Test Method for Crushing Resistance of Glass Spheres
ASTM D 1652	Test Method for Epoxy Content of Epoxy Resins
ASTM D 2074	Test Method for Total Primary, Secondary, and Tertiary Amine Values of Fatty Amines by Alternative Indicator Method
ASTM D 2240	Test Method for Rubber Products-Durometer Hardness
ASTM G 15453	Operating Light and Water-Exposure Apparatus (Florescent Light ApparatusUV-Condensation Type) for Exposure of Nonmetallic Materials.
Federal Test Method	Paint, Varnish, Lacquer and Related Materials; Methods of Inspection,
Standard No. 141D/GEN	Sampling and Testing

MATERIAL REQUIREMENTS

ASTM D 476	Specifications for Dry Pigmentary Titanium Dioxide Pigments Products
Code of Federal Regulations	40 CFR Part 60, Appendix A – Definition of Traverse Point Number and Location
Code of Federal Regulations	29 CFR Part 1910.1200 – Hazard Communications
Fed. Spec. TT-B-1325C	Beads (Glass Spheres) Retroreflective
AASHTO M 247	Glass Beads Used in Traffic Paints
Fed. Spec. TT-P-1952D	Paint, Traffic and Airfield Marking, Waterborne
Commercial Item Description (CID) A-A-2886A	Paint, Traffic, Solvent Based
Federal Standard 595	Colors used in Government Procurement

END OF SECTION P-620

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION X-22 PAVEMENT REMOVAL

PART 1 – GENERAL

1.1 DESCRIPTION

A. This item consists of removing and disposing of existing portland cement concrete (PCC) pavement, including aggregate or stabilized base material directly under the pavement (unless otherwise noted).

PART 2 – MATERIALS (NOT USED)

PART 3 – CONSTRUCTION METHODS

3.1 Existing pavements to be removed shall be broken into pieces of such size easily handled by power-driven machinery or other suitable means.

3.2 Where only a portion of the existing pavement is to be removed, special care shall be exercised to avoid damage to that portion of the pavement to remain in place. The existing pavement shall be cut full depth to the neat lines shown on the plans or established by the Engineer, and any existing pavement beyond the neat lines so established which is damaged or destroyed by these operations shall be replaced at the Contractor's entire expense.

3.3 Pavement including base materials which are removed shall be legally disposed of off Airport property at the Contractor's expense.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT (not used)

END OF SECTION X-22

THIS PAGE INTENTIONALLY LEFT BLANK

ITEM X-85 SAWCUTTING

PART 1 – GENERAL

1.1 DESCRIPTION

A. This item shall consist of sawcutting the edge of existing bituminous concrete or Portland cement concrete pavements to provide a uniform joint alignment in sound material or to provide a sealant reservoir as shown on the Plans or as directed by the Engineer.

PART 2 - EQUIPMENT

2.1 EQUIPMENT

A. Saws shall be power-driven, self-propelled, wheel or track-mounted, and capable of cutting to depth of at least three (3) inches in one pass. The use of a cutting wheel mounted on a roller, grader or similar equipment, or the use of pneumatically driven hand-held tools, will only be approved if the Contractor can demonstrate to the satisfaction of the Engineer that such equipment can consistently produce satisfactory results. Multi-bladed arbor saws shall be used to construct sealant reservoirs.

PART 3 – CONSTRUCTION METHODS

3.1 The Contractor shall establish the line to be cut using chalkline or similar means in accordance with the details shown on the plans or as directed by the Engineer. The finished cut shall be reasonably true to line, smooth, and vertical.

3.2 The existing bituminous concrete paving material beyond the saw cut shall be removed as indicated on the Plans or to the depth of the cut and disposed of off airport property.

3.3 All dust, chips, slurry or waste material shall be carefully picked-up and removed from the and disposed of off airport property.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT (not used)

END OF SECTION X-85

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 021500 STORM SEWER BYPASS PUMPING

PART 1 - GENERAL

1.1 DESCRPTION

A. The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals to construct, maintain, and operate sand bag dams, plugs, hoses, piping, and pumps to bypass stormwater flow as necessary to perform the Work. The flow shall be diverted by pumping around the construction location to a downstream inlet, headwall, manhole or other approved storm sewer structure.

1.2 RELATED SECTIONS

A. Section 02651, Television Inspection.

1.3 QUALITY ASSURANCE

A. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction. The CONTRACTOR shall be responsible for damage due to storm sewer backup or overflow onto unpaved areas, adjacent ditches, and waterways.

1.4 SUBMITTALS

A. CONTRACTOR shall submit, prior to installation, a detailed Stormwater Bypass Pumping Plan and description outlining all details and provisions of the temporary stormwater bypass pumping system. The Plan shall be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to assure proper operation of the bypass pumping system, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in the Contract Documents. No bypass pumping shall begin until all provisions and requirements have been reviewed and approved by the COTR.

B. The Storm Sewer Bypass Pumping Plan shall include but not be limited to the following:

1. Staging areas for pumps.

2. Flow stoppage system, including pipe and channel plugging method and types of plug.

3. Number, size, material, location, and method of installation of pump suction piping.

4. Number, size, materials, method of installation, and location of installation of discharge piping.

5. Bypass pump sizes, capacities, number quantities and power requirements.

6. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted).

7. Size and location of standby power generator, if required.

8. Downstream discharge plan.

9. Any thrust and restraint block sizes and locations.

10. Any temporary pipe supports and anchoring required.

11. Calculations for selection of bypass pumping pipe size.

12. Schedule for and installation of and maintenance of bypass pumping lines.

13. Plan indicating location of bypass pumping lines.

14. Wet weather operations.

15. Backup equipment.

PART 2 – PRODUCTS

2.1 MATERIALS

A. For all pumping operations using eight-inch or larger pumps, design piping, joints, and accessories to withstand at least twice the maximum system pressure or fifty pounds per square inch (PSI), whichever is greater.

B. Pumps shall be self-priming type or submersible electric, in good working order, with a working pressure gauge and a flow meter on the discharge. The CONTRACTOR must supply all power. All pumps used must be constructed to allow dry running for extended periods of time. Pump and pump generators intended for use beyond normal working hours shall be fitted with day tanks sufficiently sized to allow for 24 hours of uninterrupted operation at full throttle, and autodialer capable of notifying CONTRACTOR whenever high sump level conditions or low fuel conditions are experienced.

C. CONTRACTOR shall provide stand-by pumps of adequate capacity.

PART 3 – EXECUTION

3.1 FIELD QUALITY CONTROL AND MAINTENANCE

A. Any time the bypass pumping system is operating, an experienced operator shall be available to monitor the operation, adjust pump speed, valves, etc., and make minor repairs to the system and report problems. CONTRACTOR shall provide Authority with names and numbers of contacts included in the autodialer. The bypass pumping operator shall be the primary contact for the system autodialer. Outside of normal working hours, CONTRACTOR shall be able to respond on-site to an autodial alert within 60 minutes of alert.

B. During bypass pumping, do not allow stormwater to be leaked, dumped, or spilled in or onto any area outside of the existing storm sewer system including but not limited to trenches and excavations. Leakage of stormwater sewage from pumps or hoses is cause for immediate stoppage of the work.

C. In the event of accidental spill or overflow, immediately stop the discharge and take action to clean up the spill, and promptly notify the AUTHORITY and COTR.

D. In the event of rain, the CONTRACTOR shall coordinate the operation of bypassing with the COTR.

E. Spare part for each type of pump and piping shall be kept on site as required.

3.2 INSTALLATION AND REMOVAL

A. CONTRACTOR shall locate bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the COTR.

B. During all bypass pumping operations, the CONTRACTOR shall protect existing structures and equipment from damage inflicted by any equipment. The CONTRACTOR shall be responsible for all physical damage to the existing structures and equipment caused by human or mechanical failure.

C. When working inside existing structures, the CONTRACTOR shall exercise caution and comply with OSHA requirements when working in the presence of gases, combustible or oxygen-deficient atmospheres, and confined spaces.

D. The bypass pipeline must be located off streets and sidewalks and on shoulders of roads. When the bypass pipeline crosses streets and driveways, the CONTRACTOR must place the bypass pipelines in COTR-approved bump ramps.

E. When bypass pumping operations are complete, piping shall be drained into the storm sewer prior to disassembly. CONTRACTOR shall take precautions, including flushing line, to prevent the spill of storm water onto ground surface.

3.3 HYDROSTATIC TESTING

A. CONTRACTOR shall perform hydrostatic testing of all bypass piping on bypass systems using 8-inch or larger pumps.

B. Test Procedure:

1. Fill pipeline slowly to minimize air entrapment and surge pressures.

2. Examine exposed joints and valves, and correct visible leakage.

3. Hold test pressure for a minimum of 15 minutes.

C. Test Criteria: Pipeline shall hold test pressure for specified time period with zero drop in pressure.

PART 4 – METHOD OF MEASUREMENT AND BASIS OF PAYMENT (not used)

END OF SECTION 021500

SECTION 026510 STORM SEWER TELEVISION INSPECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall provide all labor, materials, tools, equipment and incidentals as shown, specified, and required to perform television (TV) inspection of the existing, and rehabilitated storm sewer piping within the scope of work. Provide TV inspection of the north-south Glycol lines as shown on the plans to assess existing conditions of the pipe.

1.2 DEFINITIONS

A. Pre-Construction Inspection: TV inspection of storm sewer to determine the location of construction and structural features and to ascertain that the condition of the pipe meets acceptable standards for the proposed rehabilitation.

B. Post-Construction Inspection: TV inspection of repaired or rehabilitated storm sewer main, to verify (in association with other specified testing procedures) that all repairs have been performed appropriately.

1.3 REQUIREMENTS

A. The CONTRACTOR shall be aware that this Contract requires work in active storm sewers and shall follow all federal, state and local requirements for safety in confined spaces.

1.4 RELATED SECTIONS

A. Section 02150, Storm Sewer Bypass Pumping.

B. Section 02760, Cleaning of Storm Sewers.

1.5 PERFORMANCE REQUIREMENTS

A. Inspection shall be performed by a NASSCO ***Pipeline Assessment Certification Program*** (PACP) certified operator and shall meet the coding and reporting standards and guidelines as set by PACP. All report annotations, pipe conditions and pipe defects shall be identified properly using P ACP codes as defined by PACP, and severity ratings shall be calculated according to PACP.

B. Quality of inspection recording shall be acceptable to COTR when viewed on a standard computer monitor.

1.6 SUBMITTALS

A. Pre-Construction Inspection: Submit 1 copy on a 400mbs USB 2.0 external hard drive of Digital Inspection Recordings.

B. Post -construction Inspection: Submit 2 copies of Written Inspection Reports in bound report with project name on binder spine. Submit 1 copy on a 400mbs USB 2.0 external hard drive of the following:

1. Digital Inspection Recordings.

2. Electronic Inspection Reports.

C. Copies of PACP certificate for inspectors completing the work.

1.7 REFERENCE STANDARDS

A. NASSCO prepared ***Pipeline Assessment and Certification Program,*** Second Edition Reference Manual, Latest Edition. This manual includes a standard TV inspection form and storm sewer condition codes.

Part 2 – PRODUCTS

2.1 TELEVISION EQUIPMENT

A. Closed Circuit TV Equipment: Select and use closed-circuit television equipment that will produce a color recording.

B. Pipe Inspection Camera: Produce a video recording using a pan-and-tilt, radial viewing, pipe inspection camera that pans ± 27S degrees and rotates 360 degrees. Use a camera with an accurate footage counter that displays on the TV monitor the exact distance of the camera from the centerline of the starting manhole. Use a camera with camera height adjustment so that the camera lens is always centered at one-half the inside diameter, or higher, in the pipe being televised. Provide a lighting system that allows the features and condition of the pipe to be clearly seen. A reflector in front of the camera may be required to enhance lighting in large diameter pipe. The camera shall be operative in 100 percent humidity conditions. The camera, television monitor and other components of the video system shall be capable of producing a minimum SOO-line resolution colored video picture. Picture quality and definition shall be to the satisfaction of the COTR.

C. TV Studio: TV studio is to be contained in an enclosed truck, trailer or van. It shall have room and seating for the operator and the COTR and also room for at least one standing visitor with the doors closed. The studio shall have air conditioning and heating. Normal operation of all equipment, including the TV camera, monitor, and winches is to be from a control panel in the studio. When joint testing and sealing is to be performed, the equipment shall be contained in the same unit as its TV equipment and shall be operated from the same control panel.

D. Recording: All recordings are to be in digital format except for Joint Testing Observations which may be recorded digitally.

1. Image Capture -Digitized picture images shall be stored and be exportable as JPEG formats.

2. Video Capture -Full time live video and audio files shall be captured for each pipe segment. The files shall be stored in industry standard MPEG format viewable from a USB 2.0 external hard drive on an external personal computer that utilizes MicroSoft Media Player, version 9.0 to view the recording. The MPEG video shall be ISO-MPEG Level 1 (MPEG-l) coding with a resolution of 352 pixels (x) by 240 pixels (y) and an encoded frame rate of 29.97 frames per second. System shall perform an automatic disk image/file naming structure to allow saved video/data sections to be "Burned" to DVDR format. It shall have the capability of "burning" a minimum of 120 minutes of recording to the DVDR media. The video recording shall be free of electrical interference and shall produce a clear' and stable image. The audio recording shall be sufficiently free of background and electrical noise as to produce an oral report that is clear and discernable. The digital recordings and inspection data shall be cross-referenced to allow instant access to any point of interest within the digital recording.

PART 3 – EXECUTION

3.1 TELEVISION INSPECTION

A. Storm sewer lines and manholes are required to be clean in accordance with Section 027600, Cleaning of Storm Sewers, prior to TV inspection. Any storm sewer line or manhole found to be dirty during the TV inspection process will be cleaned by the CONTRACTOR.

B. Televise the storm sewer line to document the condition of the line. Notify the COTR 48 hours in advance of any TV inspection so that the COTR may observe inspection operations. Provide a color recording showing the completed work.

C. For mainline inspections, inspections shall be from center of the starting structure to the center of the ending structure. Distances along the pipe should be measured from the center of the upstream structure. Marking on cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Measurement meters shall be accurate to two-tenths of a foot over the entire length of the storm sewer line section being inspected. Prior to recording the location of defects, construction features, and service connections, slack in the cable of the television inspection camera shall be taken up to ensure metering device is designating proper footage. Accuracy of the measurement meters shall be checked daily by use of a walking meter, roll-a-tape, or other suitable device.

D. Center the camera in the middle of the pipe.

E. Move the camera through the line (in the downstream direction whenever possible) at a uniform rate not to exceed 30 feet per minute.

F. Stop at every joint for three seconds. Where infiltration or other defects are evident, use pan and

tilt to document the pipe's condition. Stop elsewhere when necessary to ensure proper documentation of the storm sewer's condition.

G. Capture color still shots of video recordings for all defects encountered.

H. Use manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the storm sewer conditions to move the camera through the storm sewer line.

I. TV inspection recordings shall be continuous for each pipe segment.

J. CONTRACTOR is responsible for adjusting light levels, cleaning fouled or fogged lens, and allowing vapor to dissipate from camera lights in order to produce acceptable recordings. All TV inspector recordings that do not meet the requirements shall be re-televised at no additional cost to the Authority.

3.2 FLOW CONTROL

A. Adequately control the flow in the section being televised. Plugging or bypassing of the flows may be used to accomplish this. Recordings made where the depths of stormwater flow shown below are exceeded will be rejected:

Pipe Diameter (Inches)	Depth of Flow (% of Pipe Diameter)
6-10	10
12-24	15
Over 25	20

B. Whenever flows in a storm sewer line are blocked, plugged, pumped, or bypassed, sufficient precautions must be taken to protect the storm sewer lines from damage that might be inflicted by excess storm sewer surcharging. Further, precautions must be taken to ensure that storm sewer flow control operations do not cause flooding or damage to public or private property being served by the storm sewers involved. No overflows are permitted. The CONTRACTOR is responsible for all damages.

C. CONTRACTOR is responsible for all damages to CONTRACTOR owned and operated equipment, Authority facilities, and privately owned facilities caused by malfunction plugs, pumps or other CONTRACTOR owned or operated equipment. In the event of a failure or malfunction of CONTRACTOR equipment, CONTRACTOR is responsible for all work necessary to restore facilities to pre-construction condition including but not limited to excavation and restoration of storm sewer lines and roadways required to retrieve malfunctioning cameras, plugs, and hoses.

D. It is anticipated that portions of the storm sewer are bowed or bellied and as a result the camera will be submerged. Wherever the camera encounters a submerged condition, or where the stormwater flow depth exceeds the maximum allowable, reduce the flow depth to an acceptable level by performing the survey TV inspection during minimum flow hours, or by pulling a camera with swab, high-velocity jet nozzle or other acceptable dewatering device. Recordings made while floating the camera are not acceptable unless approved by COTR.

3.3 PASSAGE OF TV CAMERA

A. If during TV inspection of a pipe segment the camera is unable to pass an obstruction even though flow is unobstructed, televise the pipe segment from the opposite direction in order to obtain a complete recording of the line. CONTRACTOR shall also measure the distance between the manholes (centerline to centerline) with a tape or wheel to accurately determine the total length of the manhole segment.

3.4 INSPECTION DELIVERABLES

A. Written Inspection Reports

1. Provide printed location records to clearly identify the location of each defect, in relation to adjacent structures, using a standard stationing system zeroed on the upstream manhole. Record all information requested using proper NASSCO PACP defect codes. The reports shall include at least the minimum amount of information required by PACP, including required PACP header information. Color still shot images of all defects encountered shall be included with each pipe segment.

B. Electronic Inspection Reports

1. Provide a PACP certified database listing all PACP required data fields for each pipe segment.

C. Inspection Recordings

1. Provide digital inspection recordings for all recordings, unless otherwise specified in Paragraph 1.6.

2. Recording shall be of a quality sufficient for COTR to evaluate the condition of the storm sewer and verify cleaning and joint testing. If COTR determines that the quality is not sufficient, CONTRACTOR shall re-televise the storm sewer segment and provide a new recording and report at no additional compensation. Camera distortions, inadequate lighting, dirty lens, or blurred/hazy picture will be cause for rejection. Payment for televised inspection will not be made until COTR approves the recordings and reports.

3. Multiple projects may be included on a given hard drive, but the files must be organized in individual project folders. TV Inspection recordings shall not be edited.

4. Digital recordings: Each pipe segment must be its own electronic file. Electronic recording file must allow snap scrolling to allow easy and quick access of the entire recording.

5. CONTRACTOR shall maintain a master copy of all recordings and Inspection Reports submitted for two years after delivery of reports and recordings.

6. Label each hard drive with the following information:

a. File Number.

b. CONTRACTOR'S Name.

c. Project Name.

d. Contract Number.

e. Inspection Type: Post Cleaning, Repair.

f. Tape Number.

g. Date Televised.

h. Pipe Segments.

PART 4 – METHOD OF MEASUREMENT AND BASIS OF PAYMENT (not used)

4.1 No separate measurement for Television Inspection will made.

END OF SECTION 026510

SECTION 027600 CLEANING OF STORM SEWERS

PART 1 – GENERAL

1.1 DESCRIPTION

A. The CONTRACTOR shall provide all labor, materials, tools, equipment and incidentals as shown, specified, and required to clean the pipelines and manholes.

B. The cleaning work required includes, but is not limited to, the following:

1. Field locating all curb inlets, grated inlets, manholes, headwalls, outfalls, and other structures on the Drawings along the sewer to be cleaned.

2. Normal and heavy cleaning of existing curb inlets, grated inlets, manholes, headwalls, outfalls, and other structures identified on the Drawings.

3. Cutting of roots, intruding sealing ring material and objects wedged in pipe joints.

4. Removal of debris from the sewers.

5. Pressure washing of structure walls, rungs, channel and bench.

6. Disposal of waste and sediment.

7. Cleaning up as the Project progresses and after the completion of all Project activities.

8. All other work required for the complete and satisfactory cleaning of the pipelines and structures.

1.2 DEFINITIONS

A. Cleaning -cleaning accomplished using water jets to scour and remove debris, etc. from grated inlets, manholes, within the project scope in 1 to 3 complete passes of the nozzle. This work shall be classified as preparatory sewer cleaning.

B. Root cutting -removal of roots larger than fine roots (as defined by PACP), and intruding sealing ring material using cutting device. This work shall be classified as preparatory sewer cleaning.

1.3 RELATED SECTIONS

A. Section 02150, Storm Sewer Bypass Pumping.

B. Section 02651, Storm Sewer Television Inspection.

1.4 GENERAL PRECAUTIONS

A. The CONTRACTOR shall be aware that this Contract requires work in active sewers and shall follow all federal, state and local requirements for safety in confined spaces.

B. Take precautions to protect mains, curb inlets, grated inlets, headwalls, outfalls, and manholes from damage that might be inflicted by the improper selection of the cleaning process or improper use of the equipment. CONTRACTOR is responsible for restoration or repair of any facility, public or private, which is damaged by CONTRACTOR actions.

C. When using hydraulically propelled devices, take precautions to ensure that the water pressure created does not cause damage or flooding to public or private property.

D. Do not surcharge the sewer beyond the elevation that could cause overflow into area waterways, homes, or buildings or onto the ground.

E. Do not discharge process water or water used for cleaning laden with solids to downstream sections of the storm sewer system without approval of the COTR. All debris shall be removed and properly disposed at a location directed by the COTR.

1.5 SUBMITTALS

A. Plan for disposal of debris and sediment removed from the sewer lines.

B. Sewer cleaning equipment, including performance data on pump, hose diameter and length, tank capacity, and intended nozzles and root cutters to be employed.

C. Valid waste disposal permit as issued by the proposed licensed disposal facility as approved by the COTR.

PART 2 – PRODUCTS

2.1 JETTING EQUIPMENT

A. The equipment shall be provided with a minimum of 500 feet of I-inch inner diameter high-pressure hose with a selection of high velocity nozzles, as required for the cleaning operation. The pumps shall be capable of delivering a minimum 60 gpm at 1,200 psi at the nozzle head. A relief valve, adjustable from 0 to 1,500 psi minimum, shall regulate pressure to the nozzle. The unit shall carry its own water tank, minimum of 1,000 gallons, auxiliary engines and pumps, and a hydraulically-driven hose reel. The equipment shall also include a high velocity washing hose for ancillary cleaning of the walls, rungs, channel and bench of the manhole. The hose shall have an adjustable nozzle capable of producing flow from a fine spray to a solid stream. All controls shall be located so that the equipment can be operated above ground.

B. The nozzles shall produce a scouring action from 15 to 45 deg in all size sewers to be cleaned. CONTRACTOR shall use nozzles matched to the pumps and the site-specific cleaning requirements.

2.2 VACUUM EQUIPMENT

A. The CONTRACTOR shall provide equipment capable of removing all sand, dirt, rocks, roots, and other debris from the sewer to allow unobstructed remote television internal inspection of all internal surfaces, subsequent pressure testing and grouting of sewer joints, installation of cured-in-place pipe liners and other rehabilitation techniques intended. CONTRACTOR shall provide and utilize screens to prevent scoured debris from migrating downstream of the limits of the work.

2.3 CUTTING EQUIPMENT

A. CONTRACTOR shall provide all equipment capable of mechanically removing roots and intruding seal material. Devices shall include a root saw, spring blade root cutter chuck, chaincutter, or approved equal.

PART 3 – EXECUTION

3.1 SEWER CLEANING

A. After determining the requirements for cleaning and video inspection, the CONTRACTOR shall thoroughly clean all pipeline reaches in order to permit an unrestricted inspection by closed circuit television. Particular emphasis shall be afforded to the removal of accumulated grease, roots, sand, rocks, sludge and other debris so that the video inspection will show clearly all portions of the pipe being inspected. Pressure shall normally be between 1500 psi and 1800 psi during cleaning operations in the sewer, unless otherwise directed by the COTR.

B. Cleaning of upstream reaches of sewers shall be completed before the downstream reaches are cleaned.

C. Cleaning equipment shall be inserted in the downstream access point of a given reach, and the debris shall be pulled downstream. Reverse setups may be used if all debris is removed (i.e., no material is passed to the adjacent pipe segment).

D. Winching equipment used shall be rigged so as not to damage the existing pipeline or manholes.

E. During cleaning, the CONTRACTOR shall restrict the flow level in the pipe to a maximum of 30 percent of the pipe diameter. Particular care should be taken to avoid flooding other connected structures during cleaning operations.

3.2 INLET AND MANHOLE CLEANING

A. CONTRACTOR shall plug the downstream pipe; wash the wall, bench, channel and rungs of the

downstream structure to remove accumulated debris, sediment, grit, etc. No discharge of water laden with solids is permitted to be discharged to downstream segments. All solids and debris shall be removed from the structure and disposed.

3.3 ROOT AND INTRUDING SEAL MATERIAL REMOVAL

A. Roots shall be removed. All roots that could prevent the sealing of a packer, the proper application of chemical sealants or installation of a cured-in-place pipe liner shall be removed. Roots shall be removed by suitable mechanical cutting devices or by hydraulic procedures such as with high-pressure jet cleaners. No roots of length greater than one and a half inches (1 1/2-inch) shall remain following root removal procedures.

B. Objects wedged in pipe joints and intruding sealing ring material that interferes with the rehabilitation of sewer lines shall be removed.

3.4 DEBRIS REMOVAL

A. The CONTRACTOR shall remove all bricks, rocks, debris, sludge, dirt, sand, grease, roots, and other materials from the sewer and manhole and collect and remove the resulting debris from the downstream manholes of the sewer section being cleaned. CONTRACTOR shall insert screens in, at a minimum, the final three sections of sewer to be cleaned.

B. Waste and debris cleaned from the sewers shall be removed at the downstream structure by pumps or other means. Under no circumstances shall solids be dumped onto the ground surface, street, stream, or ditches. All solids and semi-solids shall be placed in a watertight container so that no spillage or leakage will occur, covered to minimize odors, and disposed by the CONTRACTOR. The CONTRACTOR is responsible for all operations and costs associated with removal, transportation, and disposal of debris collected during the cleaning operations.

3.5 DISPOSAL

A. CONTRACTOR is required to maintain and have available for inspection upon request a valid waste disposal permit as issued by the licensed disposal facility as approved by the COTR.

3.6 FIELD QUALITY CONTROL

A. Acceptance of pipeline cleaning shall be made upon the successful completion of the television inspection documenting that all required debris and roots are removed to the satisfaction of the COTR. If television inspection shows debris, solids, sand, or grit remaining in the line, the CONTRACTOR shall be required to reclean and reinspect the pipeline at no additional compensation.

PART 4 – METHOD OF MEASUREMENT AND BASIS OF PAYMENT (not used)

END OF SECTION 027600

SECTION 31 25 14 - STORM WATER POLLUTION PREVENTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Contract and Special Provisions, Supplementary Conditions, latest version of Virginia Erosion and Sediment Control Handbook and other Division-01 Specifications apply to this Section.

1.2 SUMMARY

A. This Section includes preparation for and submitting for approval for a Storm Water Pollution Prevention Plan (SPPP).

1. Provisions for furnishing, installing and removal of silt fence, filter boxes, storm drain inlet protection, straw bale barriers, construction entrances, sediment traps, diversion berm, dust control and other erosion control measures during construction, and temporary and permanent soil stabilization measures, as noted on the contract plans and in the approved SPPP. All measures and practices shall be in accordance with the latest version of the Virginia Erosion and Sediment Control Handbook and for preventing contamination of storm water from construction activities in accordance with the Commonwealth Of Virginia Regulation 9VAC 25-180 (i.e., temporary fuel storage, fueling operations, equipment maintenance, hazardous material and waste handling, good housekeeping practices, etc.).

B. Related Sections

1. Division 01 Section “Wetlands Restoration” for protection of wetlands.

2. Division 01 Section “Quality Requirements” for quality issues.

1.3 DEFINITIONS

A. CWA- Clean Water Act means the law passed by the Congress of the United States in 1972 controlling the Discharge of Pollutants into the Nation's waterways.

B. BMP- Best Management Practices are defined as any one or group of management practices, activities, policies, equipment, and structures that will: prevent pollutants from entering the environment, minimize pollutants from entering the environment, and mitigate, reduce, and treat prior to the pollutant entering the environment.

C. NPDES- National Pollutant Discharge Elimination System is the national program for issuing, modifying, revoking, reissuing, terminating, monitoring and enforcing permits pursuant to sections 402, 318, and 405 of the CWA.

D. VDEQ- Virginia Department of Environmental Quality is the agency of the Commonwealth of Virginia that manages the Commonwealth of Virginia's environmental regulations.

E. VPDES- Virginia Pollutant Discharge Elimination System is the Commonwealth of Virginia program and regulations that describe the proper management of discharges of pollutants into the waters of the Commonwealth

F. DCR- The Commonwealth of Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, regulates land disturbing activities and erosion and sedimentation compliance.

1.4 Submittals

A. Storm water Pollution Prevention Plan (SPPP) - Prepare and submit for written approval by the Authority in accordance with the information provided below. Do not initiate ground-disturbing activities until the Authority has approved the SPPP. In addition, the SPPP will serve as the Soil Erosion and Sediment Control Plan required as a condition of the Authority's issuance of a Construction Permit by the Authority's Building Codes Department. Issuance of this Construction Permit is required prior to initiation of any project construction.

B. The SPPP may utilize plans, details, notes and other information provided in the construction documents, however, such information shall not, in itself, be construed to meet the requirements of this Section. Provide additional details to ensure that the SPPP accurately reflects means and methods for construction.

C. Prepare the SPPP on regular 8 ½ X 11 inch paper. Include attachments of the plans showing locations of erosion and sediment control devices and BMPs. Submit four bound copies to the COTR for review and approval.

D. Plan Certification with Virginia Pollution Discharge Elimination System Regulation (9VAC 25-180) and DCR (4VAC50-30).

1. Submit with Plan Certification the following certification statement signed by an officer of the company of Contractor and signed by all its subcontractors:

"I certify under penalty of law that I understand the terms and conditions of the General Permit for Discharges from Construction Activities that authorizes the storm water discharges from construction activities associated with the site identified by the permit."

2. The above certification shall be executed on the Contractor's letterhead. Include the name, title, address, and telephone number of contractor and all subcontractors, and the

date the certification is made. The Certification shall be attached to the SPPP and submitted to the COTR.

E. Once the SPPP has been approved by the COTR, submit a Virginia Storm Water Management Program (VSMP) permit application to the Virginia Department of Conservation and Recreation (DCR) to obtain the VSMP permit. Submit payment of $500 (or most current permit cost fee –confirm with project COTR) with the permit application. The Contractor shall include the cost of the VSMP in his proposal

F. Be responsible for submitting the Notice of Project Termination (NPT) shown in Appendix II for all construction activities within this particular construction project. Contractor shall notify the Authority and provide a copy to the COTR upon completion of this construction project.

G. Submit the name, and a copy of the certificate of competence issued by the Department of Conservation and Recreation for the person in charge of and responsible for carrying out the land-disturbing activity prior to conducting any land-disturbing activities.

H. Prepare the SPPP narrative and associated drawings in accordance with the following outline:

1. Site Description: A detailed description of the construction activities, physical features of the site, and other pertinent information shall be included in this Section.

   a. A description of the nature of the construction activities;

   b. A description of the intended sequence of major activities which disturb soils for major portions of the site (e.g. grubbing, excavation, grading);

   c. Estimate of the total area of land disturbing activities. Land disturbing areas greater than 2,500 square feet require the implementation and enforcement of a SPPP.

   d. Describe the quality of any discharge water from the site;

   e. A description of the existing vegetative cover at the site, include an estimate of the total buffer area that is covered by the vegetation before construction activities commence.

   f. The name of the receiving water(s), their tributaries, and the ultimate receiving water(s). A description of the aerial extent of wetlands present at the site and other sensitive habitats present on site describe measures that will be used to protect wetlands.

   g. Include in the plan a schedule of the planned start and completion of construction activities, major grading activities, and other activities that may require stabilization measures to be initiated at the site.

2. Potential Pollution Sources:

   a. Describe potential pollution sources. Description should include, but not be limited to, the following:

      1) Vehicle Fueling: A description of the location and number of all above ground storage tanks (ASTs) and any storage containers that will be used for the purpose of fueling vehicles or storing any materials used during construction activities (indicate location on the site map).

      2) Storage Tanks: ASTs storing regulated substances and greater than 660 gallons shall be registered with the Department of Environmental Quality. All ASTs shall be properly equipped and follow the AST requirements. For example, requirements include that ASTs be double walled or have 110% secondary containment devices that will not collect rainwater. Tanks shall have spill containment buckets and be properly labeled, etc. Earthen berms shall not be permitted.

      3) Materials Storage: A description of the storage location and a minimum quantity of all hazardous and non-hazardous materials that might pollute storm water. Pollutants such as, but not limited to, paints, solvents, hydraulic fluids, engine oil, form oil, etc. that will be used during the course of construction activities. All containers of materials of any size that are used on site and their associated secondary containment shall be covered to prevent rainwater from coming in contact with the containers. Earthen berms shall not be permitted. All drums and containers shall be removed from the site as they become empty.

      4) Sanitary Waste Facility: A description of the location and the number of sanitary waste facilities (e.g. portable chemical toilets) and method of disposal for the subject waste during the course of construction activities on site.

      5) Equipment Maintenance: A detailed description of how and where equipment will be maintained. This shall include fluid changes, servicing, breakdowns, etc. The plan shall provide a standard operating procedure that shall be used for the protection of the environment while maintaining the equipment.

      6) The SPPP shall include a drum and container management plan. The plan shall describe the methods and location for the containment, protection, and storage of all solvents, chemicals, petroleum products, and all toxic material as defined by the EPA brought on site. All drums and containers shall be stored within a secondary containment system and shall be covered to prevent rainwater from entering the secondary containment.

3. Best Management Practices (BMPs) And Control Measures. The purpose of this Section is to identify all appropriate BMPs and control measures that shall be implemented at the construction site. This Section of the plan shall clearly describe the construction activities in sequence and their associated BMPS, control measures, and Erosion and Sediment (E&S) controls that are applicable. This Section shall indicate the timing to achieve the above-referenced sequencing relative to the installation of BMPs, E&S, and the control measures.

   a. The components of this Section of the plan shall, at a minimum, include but not be limited to the following:

      1) Stabilization Practices: All stabilization practices, including interim and permanent stabilization measures as well as specific scheduling of the Implementation of the practices, shall be included in this Section. Where possible, this portion of the plan shall describe all existing vegetation that is preserved for the purpose of site stabilization. Stabilization measures include, but are not limited to the following:

         a) Vegetative buffer strips

         b) Sod stabilization

         c) Geotextile

         d) Mulching

         e) Temporary Seeding

         f) Permanent Seeding

         g) Protection of trees

         h) Preservation of mature vegetation

         i) Other measures/stabilization practices

      2) Structural BMPS: This Section shall adequately describe the structural BMPs and practices that will divert and mitigate storm water runoff from soils, sediments, exposed materials, ASTs, and containers of hazardous/non-hazardous materials. Structural BMPs include, but are not limited to the following list:

         a) Silt fences

         b) Earth dikes

         c) Drainage swales

d) Sediment traps

e) Subsurface drains

f) Secondary containment for ASTs and containers

g) Pipe slope drains

h) Coverage for ASTs and containers

i) Level spreaders

j) Storm drain inlet protection

k) Reinforced soil retaining systems

l) Rock outlet protection/wheel washers

m) Gabions

n) Construction rock entrance

o) Temporary or permanent sediment basins

p) Other BMPs and structural controls.

3) The installation of these structural BMPs may be subject to the CWA Section 404 "Permitting Requirements". Be responsible for determination whether the above-permitting requirements apply to any of the structural BMPs.

4) Provide wheel washers and construction rock entrances for all projects where constructions traffic enters or exits paved surfaces. Be responsible for ensuring that all wheel washers and construction rock entrances are designed and constructed to adequately meet the expected construction traffic demand.

5) Temporary or Permanent Sediment Basins

a) If the project site involves common drainage areas that serve 3 acres or more of disturbed area(s), a temporary or permanent sediment basin is required. Such a basin shall provide 134 cubic feet of storage per acre drained. Where 134 cubic feet of storage per acre drained or equivalent is not attainable due to site constraints, smaller sediment basins and sediment traps shall be used as approved by the COTR on a case-by-case basis.

b) To prevent the movement and erosion of soils, structural measures should be placed on all upland areas.

4. Operational Practices (Good Housekeeping Practices). This Section shall include measures and BMPs including good housekeeping practices that address the following sources of pollution:

a. The plan shall contain measures that prevent trash, innocuous solid materials, building materials, garbage, and debris from entering the Authority's storm sewer system or directly into a stream or waterway.

b. Provide a daily program of vacuum or hand sweeping or other acceptable means of cleaning sediments that are tracked or transported onto the public roads from the construction sites shall be implemented. The roads may be washed only after the sediments have been removed.

5. Inspection And Maintenance of BMPs

a. Provide a schedule of inspection of all structural BMPs, the necessary maintenance and corrective action to correct all discrepancies found on site. Designate qualified personnel that have adequate knowledge of E&S requirements and storm water management and pollution prevention requirements, to inspect all structural control measures and BMPs at "least every seven calendar days and within 24 hours of the end of a storm event that is .5 inches or greater."

b. At a minimum develop a checklist for these inspections that conforms to the inspection checklist of Appendix I. Areas where final stabilization has been established need only be inspected once every month. Provide the completed inspection checklist and a report summarizing the corrective actions taken by the contractor to the COTR according to the following schedule of frequencies:

c. Every seven calendar days: Under the normal circumstances.

d. Every 24 hours: After a rainfall of 0.5 inches or greater, of intensity.

e. Every 30 days: for the areas where final stabilization has been accomplished.

f. Correct any and all discrepancies immediately upon discovery. The SPPP shall be revised as necessary to reflect any modifications to strengthen the BMPs and other structural controls in order to address the discrepancies. The above inspections and findings shall be subject to Authority field verification. Be responsible for responding to all regulatory inquiries from the Virginia Department of Environmental Quality-Water Division (VDEQ-Water), Virginia Department of Conservation and Recreation (DCR), and the Environmental Protection Agency (EPA) Region III. Be responsible for addressing the outcome of all compliance

monitoring inspections conducted by the above regulatory agencies. Take all corrective actions as required by VDEQ-Water, DCR or EPA Region III.

6. Non-Storm water Discharge. This SPPP is for the sole purpose of preventing pollution associated with storm water runoff (Act of God: rain, snow, etc.). Plan shall identify all non-storm water components, process waste water discharges, and any other non-storm water influent that may exist in this particular construction site. Plan shall ensure that all of the above non-storm water discharges are appropriately eliminated, permitted or addressed through other acceptable regulatory permitting mechanisms.

7. Detailed Composite SPPP Map. Prepare the following:

   a. Drainage pattern and approximate slopes anticipated after completing major grading activities on site

   b. Soil disturbance areas

   c. Location of all Best Management Practices (BMPs), structural controls, non-structural controls, good housekeeping practices (GHP) and other erosion and sediment (E&S) control measures to be used during the course of construction activities

   d. Locations where stabilization is expected to be used, including the types of vegetative cover which will be employed on site

   e. Location of all receiving waters, including their tributaries and the ultimate receiving waters (including wetlands/sensitive habitats)

   f. Location of all points of discharge to existing storm sewers and outfalls

   g. Existing and planned paved areas, impervious surfaces, and buildings

   h. Location of all post-construction BMPs and Storm water management practices that will address the long-term water quality improvement needs for the site, if applicable.

   i. Location of any fuel storage, materials storage and sanitary waste and other potential pollution sources and their associated BMPs. shall be reflected on the site map.

   j. Two site maps shall be developed, one indicating pre-construction and during construction site conditions and the second indicating final site conditions. Maps shall be to the same scale.

1.5 Quality Assurance

A. Prepare and submit the SPPP with input from each subcontractor.

PART 2 - PRODUCTS

2.1 General

A. Provide erosion and sediment control devices and products as indicated, in accordance with the SPPP and in accordance with the latest updated version of the Virginia Erosion and Sediment Control Handbook.

PART 3 - EXECUTION

3.1 Implementation

A. Implement and maintain the approved SPPP throughout the life of the contract in accordance with provisions of the Virginia Erosion and Sediment Control Handbook and applicable contract documents.

B. Exercise every reasonable precaution, including temporary and permanent measures, throughout the duration of the project to control erosion and prevent or minimize pollution of rivers, streams, lakes and other receiving waters. Apply siltation and stabilization control measures to material, subject to erosion, exposed by any activity associated with construction including but not limited to local material sources, stockpiles, disposal areas, and haul roads.

C. Initiate stabilization measures as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased but no later than 14 days after the construction activities have temporarily or permanently ceased. Except as provided in the following paragraphs:

1. If snow cover and or severe weather conditions preclude initiation of the stabilization measures by the 14th day after construction activities have ceased, either temporarily or permanently, the stabilization practices shall be initiated as soon as practicable.

2. If construction activities resume on a portion of the site within 21 days from the date that construction activities have temporarily ceased, then stabilization practices need not be initiated on that particular portion of the site by the 14th day after construction activities have temporarily ceased.

D. Be solely responsible for complying with the soil erosion, sedimentation control and good housekeeping requirements of this Contract, and for otherwise preventing contamination of storm water from construction activities. Be solely responsible for any and all fines, penalties or damage that result from the Contractor’s failure to comply.

3.2 Erosion and Siltation Control:

A. Control erosion and siltation through the use of the devices and measures specified herein, in the approved SPPP or as is otherwise necessary. The Authority reserves the right to require

other temporary measures not specifically described herein to correct an erosion or siltation condition.

B. Maintenance: Maintain erosion and siltation control devices and measures in a functional condition at all times. Inspect temporary and permanent erosion and sedimentation control measures after each rainfall and at least daily during periods of prolonged rainfall. Correct deficiencies immediately. Make a daily review of the location of erosion and sediment control devices to ensure that they are properly located for effectiveness. Where deficiencies exist, make corrections immediately as approved or directed by the COTR.

PART 4 - CONTRACTOR'S QUALITY CONTROL

4.1 Field Quality Control

A. Conform to all applicable provisions of Division 01 Section "Quality Requirements". Be responsible for periodic inspections for conformance with the approved SPPP. The results of the periodic inspections shall be submitted to the COTR upon completion.

PART 5 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT (not used)

APPENDIX I

SPPP INSPECTION CHECKLIST

BMP	Proper Installation Yes, No. or NA	Proper Operation Yes or No	Housekeeping Practices Good-Poor	Potential Hazard Yes or No	Discharge: Storm water Non-storm water	Effectiveness of BMP	Observations	Comments
1. Drainage Swale								
2. Gabion								
3. Silt Fence								
4. Dry Pond								
5. Cattle Grate								
6. Earth Dike								
7. Sediment Trap								
8. Hay Bale								
9. Subsurface Drains								
10. Pipe Slope Drains								

BMP	Proper Installation Yes, No. or NA	Proper Operation Yes or No	Housekeeping Practices Good-Poor	Potential Hazard Yes or No	Discharge: Storm water Non-storm water	Effectiveness of BMP	Observations	Comments
11. Level Spreaders								
12. Storm Drain Inlet Protection								
13. Reinforced Soil Retaining Basins								

SPPP INSPECTION CHECKLIST

BMP	Proper Installation Yes, No. or NA	Proper Operation Yes or No	Housekeeping Practices Good-Poor	Potential Hazard Yes or No	Discharge: Storm water Non-storm water	Effectiveness of BMP	Observations	Comments
14. Temporary or Permanent Sediment Basins								
15. Construction Rock Entrance								
16. Rock Outlet Protection								
17. Secondary Containment for all ASTs								

BMP	Proper Installation Yes, No. or NA	Proper Operation Yes or No	Housekeeping Practices Good-Poor	Potential Hazard Yes or No	Discharge: Storm water Non-storm water	Effectiveness of BMP	Observations	Comments
18. Evidence of oil, fuel or other material spills or releases on site								
19. Other BMPs								
20. Other BMPs								

Please list any discrepancies or items that are not in compliance in the space provided below.

Please list the corrective actions necessary to abate the above-listed discrepancies.

Note: All corrective actions must take place within 7 days of the discovery of the above discrepancies and non-compliance item(s).

Inspector:

Signature: _____ Date: _____

APPENDIX II

Metropolitan Washington Airports Authority

Notice of Project Termination

For

Storm water Discharges from Construction Activities

Note: This form shall be completed by the construction contractors upon final stabilization of the site, upon elimination of all storm water, or when the construction contractor has changed within the same construction project. The contractor shall submit a completed copy of this form to the Authority, at the address provided below and a copy to PMC's Resident Engineer within 30 days after final stabilization has been achieved or when it is no longer the construction contractor for this project. (An officer of the company shall sign this certification)

Completed form shall be submitted to:

Manager, Building Codes/Environmental Branch

Engineering Division

Ronald Reagan Washington National Airport

Washington, D.C. 20001

Copy to: Parsons Management Consultants

For DCA Projects

Hangar 6 Construction Management Program

Ronald Reagan Washington National Airport

Washington, D.C. 20001

Attn: Project's Resident Engineer

For IAD Projects

Parsons Management Consultants

23835 Wind Sock Drive

Chantilly, VA 20166

Attn: Project's Resident Engineer

Contract Number:

Contractor Information:

Contractor's name and mailing address:

Subcontractor(s) name and mailing address:

Location of Construction Site:

Project Name

Address

City _____State _____Zip Code _____

Latitude _____ Longitude _____

If there is a change in the contractor(s) please provide the new contractor's information here:

Certification:

"I certify under penalty of law that disturbed soils at the identified project have been finally stabilized and temporary erosion and sediment control measures have been removed or will be removed at an appropriate time and that all storm water discharges associated with construction activities in this project have been eliminated, or that I am no longer the contractor for this construction site."

Print name:

Title:

Signature:

Date:

(This certification shall be signed by an officer of the company)

APPENDIX III

METROPOLITAN WASHINGTON AIRPORTS AUTHORITY

WASHINGTON DULLES INTERNATIONAL AIRPORT

HAZARDOUS MATERIALS SPILL NOTIFICATION CHECKLIST

Note: This checklist shall be completed by all tenants of Washington Dulles International Airport (IAD) in the event of a hazardous material spill (under CERCLA, CWA, CAA, TSCA and/or a release of hazardous waste under RCRA). It is the responsibility of the tenants to notify all pertinent regulatory agencies within the time frame prescribed under the respective statutes and regulations.

1. Tenant Name:
2. Facility location within IAD where spill occurred:
3. Facility Environmental Manager, Foreman, or person in charge:
4. Time and date of release:
5. Amount of release material:
6. Description of how the release occurred and whether material reached a floor drain (if this situation occurred, describe amount of material that entered drain):
7. Type of material released (include common and chemical name; attach MSDS and/or Waste Manifest):
8. In the event of a release, verbal notification to IAD Fire Department and IAD Environmental Coordinator must be made immediately as follows:

   Fire Department:

   (703) 572-2970

   IAD Government

   Programs Engineer

   (703) 572-0210

END OF SECTION 312514

SECTION 334100.1 – CURED-IN-PLACE PIPE

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes requirements for providing all labor, materials, equipment, tools, transportation, and supplies necessary to rehabilitate the specified lengths of gravity glycol collection lines by means of the Cured In-Place Pipe (CIPP) process in accordance with this specification and the contract drawings.

B. Related Sections:

1. Section 021500 “Storm Sewer Bypass Pumping”

2. Section 026510 “Storm Sewer Television Inspection”

3. Section 027600 “Cleaning of Storm Sewers”

C. The work to be performed shall consist of, but not be limited to, the following:

1. Cleaning, televising, and videotaping the existing glycol collection line segments and service connections prior to reconstruction.

    a. Contractor shall be responsible for confirming the inside diameter and condition of each manhole-to-manhole segment to be rehabilitated.

    b. The cleaning process shall include the removal of all loose debris, solids and roots.

    c. The television inspection shall be performed using a closed circuit television (CCTV) color camera recorded in VHS format. A pivot head camera shall be used for all pipelines that are 6-inches in diameter or greater to allow detailed lateral inspection.

2. Bypass pumping shall be performed during those activities, which will otherwise restrict existing flows and/or services.

    a. Contractor shall provide bypass pumping and/or diversion when required for acceptable completion of the liner installation.

    b. Contractor shall provide the complete setup and maintenance of all bypass facilities required to perform the work. Contractor shall fully man bypass pumping during its duration.

    c. Bypass pumping shall be performed in such a manner so as not to damage any adjacent pavements or appurtenances. The Contractor shall take all necessary precautions to insure that the surrounding areas are not subjected to ponding, a backup or spill.

d. Pumped storm water shall be in an enclosed hose or pipe that is adequately protected from damage.

e. Storm runoff from the diverted Glycol Collection Lines shall be redirected into the nearest storm sewer system.

3. The complete reconstruction, continuous from manhole-to-manhole, of the specified existing glycol collection lines by the cured-in-place pipe rehabilitation method.

4. Reinstatement of all existing lateral and drop service connections without excavation.

5. Re-televising and videotaping of rehabilitated line. Re-televising shall be completed in the same direction as prior to rehabilitation.

6. Performance of acceptance testing.

7. Provision of a 2-year warranty on all materials and workmanship.

1.2 REFERENCES

The following is a list of the Standards referenced in this Section. All references to any standard listed below shall be to the most recent version in effect at the time of contract award.

A. American Society for Testing and Materials (ASTM)
   1. ASTM C581: Standard Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass-Fiber-Reinforced Structures Intended for Liquid Service
   2. ASTM D638: Standard Test Method for Tensile Properties of Plastics
   3. ASTM D790: Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
   4. ASTM D3681: Standard Test Method for Chemical Resistance of Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe in a Deflected Condition
   5. ASTM F1216: Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin Impregnated Tube

B. Others
   1. Metropolitan Washington Airports Authority (“MWAA” or “the Authority”) Design Manual, 2010.

1.3 QUALITY ASSURANCE

A. All prospective bidders shall be primarily engaged in the water and sewer construction/rehabilitation field and have been actively engaged in this field for at least 5 years. In addition, prospective bidders shall have successfully completed at least 10 previous sewer rehabilitation projects, of similar size and scope, using the CIPP reconstruction process. Prospective bidders must demonstrate experience on projects of similar size and complexity. Prospective bidders shall include evidence in regards to their work history as described above as part of their bid package including references.

1. References must include the project title, location, total cost, pipe diameters, linear feet, and number of service connections.

2. References must contain client contact information; include client name, address and telephone number(s).

3. Personnel directly involved with the installation of the CIPP shall be trained by the manufacturer in the procedures for sewer rehabilitation using the CIPP method.

B. Quality assurance for all CIPP lining materials furnished by the Contractor shall meet requirements of this specification. The manufacturer and Contractor shall be responsible for the provisions of all test requirements specified herein as applicable. In addition, all CIPP materials to be installed under this contract may be inspected at the plant for compliance with these specifications by an independent testing laboratory approved by the COTR. The Contractor shall require the manufacturer's cooperation in these inspections.

C. Inspection of CIPP materials may also be made by the COTR after delivery. The CIPP liner shall be subject to rejection at any time on account of failure or unacceptable installation, even if any CIPP material may have been accepted as satisfactory at the place of manufacture. CIPP materials rejected after delivery shall be marked for identification and shall be removed from the work site at once.

D. Both the Contractor and liner manufacturer shall have ISO 9000 Certifications or approved equal for its quality control and assurance programs. Proof of certification shall be provided with bid package.

E. Care shall be taken in shipping and handling to avoid damaging the CIPP materials. Extra care will be necessary during cold weather construction. Any CIPP materials damaged in shipment or during storage shall be replaced as directed by the COTR.

F. Any CIPP liner showing a split or tear, or which has received a blow that may have caused damage, even though no such damage can be seen, shall be marked to indicate such split; tear, etc. The COTR, at its discretion, may reject the liner and order removal of damaged material at once from the work site at no additional cost to the Authority.

G. While stored, CIPP materials shall be adequately supported and protected. CIPP materials shall be stored in a manner as recommended by the manufacturer.

H. All CIPP lining placed shall be guaranteed by the Contractor and manufacturer for a period of three (3) years from the date of acceptance. During this period, defects discovered in the CIPP lining or workmanship, as determined by the COTR, shall be repaired or removed and replaced in a satisfactory manner at no cost to the Authority.

1.4 SUBMITTALS

A. In addition to those submittals identified in the General Provisions, the following items shall be submitted by the Contractor:

1. Submit to the COTR a copy of the weekly work schedule. With each weekly work schedule, submit design data and specifications data sheets listing all parameters used in the CIPP design and thickness calculations based on Appendix X1 of ASTM F-1216. Submit a completed Professional Engineer Certification form (included at end of Cured-In-Place Pipe specification) for all CIPP design data.

2. Submit certified test reports to demonstrate compliance of the proposed CIPP with the specified ASTM standards.

    a. Certified copies of all test reports on the properties of the selected resin, fiber tube, and later, on the liner coupons performed by, and/or for the Contractor, shall be submitted to the COTR. Examples are the manufacturer's resin data test results and the infrared spectrum analysis of the resin. Results of additional product testing(s), normally performed for "in-house quality control" and process improvement, shall also be provided to the COTR, at no cost to the Authority. The Contractor shall inform the COTR in writing, the name and designation of all in-house quality control test(s) and the sampling frequency of the tests on the resin and liner materials. The COTR shall also have the right to require the testing to be done at designated liner locations(s) within the scope of the Contract.

    b. The COTR may request Contractor to test random samples, at no cost to the Authority. All samples shall be labeled before shipment for testing, and a duplicate piece shall be provided to the COTR, for inspection and/or testing by an independent laboratory, if required by the COTR.

3. Submit the manufacturer's storage and handling instructions for the liner tube and resins.

4. Submit an installation, heating, curing, and cool-down schedule plan for each manhole-to-manhole section. Copies of the "wet-out" and "cure" reports in an approved format shall be submitted to the COTR immediately after the certified curing schedule is completed. The reports shall be attached to the Contractor's daily report. It shall be incumbent upon the Contractor to adhere to the resin manufacturer's data criteria, guidelines, and recommendations. A copy of the resin manufacturer's data shall be submitted to the COTR. Any variance in the guidelines or recommendations after the contract date shall require the COTR's written approval prior to implementing any such variances.

5. Information on seals and grouts.

6. Submit bypass pumping and/or diversion plans for review by the COTR at least 10 working days prior to start of work. Plans shall identify the liner insertion and bypass pumping locations and methods with sufficient detail to assure that the work can be accomplished without spill. The bypass pumping plan must be specific and complete, including such items as schedules, locations, elevations, calculations, capacities of equipment, material, method of noise control for each pump and/or generator, methods and means for road crossings and all other incidental items necessary and/or required to insure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and in compliance with any requirements and permit conditions specified in these Contract Documents. The bypass pumping plan shall include an emergency response plan to be followed in the event of a

failure of the bypass pumping system. The Contractor shall notify the COTR 24 hours prior to commencing with the bypass pumping operation. The Contractor's plan for bypass pumping shall be satisfactory to the COTR before the Contractor shall be allowed to commence bypass pumping or line rehabilitation.

7. Records and tapes documenting line cleaning and television inspection work.

8. A description of methods for avoiding liner stoppage during installation and plans for protecting downstream collection lines that have previously been lined.

9. Actual resin volume used, and test results of infrared spectrum analysis conducted on each lot of resin.

10. Product specifications for lubricant, if necessary.

11. Notification of suspected inactive service connections.

12. Updated list of Punch List Items.

PART 2 PRODUCTS

2.1 CHEMICAL RESISTANCE

A. The liner shall be fabricated from materials which, when cured, will b chemically resistant to withstand internal exposure to storm water run-off, glycol, aviation fuel and lubricants, and external exposure to soil bacteria.

B. The manufacturer shall submit results of chemical resistance testing performed on specimens of the cured in place pipe. Tests shall be performed in accordance with ASTM F-1216.

C. The chemical corrosion resistance of the actual resin system (neat plus modifications) selected by the contractor shall be tested and submitted by the resin manufacturer in accordance with ASTM C-581. Exposure to the chemical solutions listed in the following table shall result in a loss of not more than twenty percent (20%) of the initial physical properties when tested in accordance with ASTM C-581, for a period of not less than one (1) year.

Chemical Solution	**Concentration (%)**
Tap Water (pH 6-9)	100
Nitric Acid	5
Phosphoric Acid	10
Sulfuric Acid	10

Gasoline	100
Vegetable Oil	100
Detergent	0.1
Soap	0.1

2.2 SAMPLES -INSPECTION AND TESTING

A. The COTR may direct the Contractor to obtain cured samples and test them in accordance with the listed ASTM Standards for determining and meeting properties.

B. At the time of resin impregnation, each lot shall be inspected for defects. The resin shall not contain fillers, except those required for viscosity control, fire retardant, or to extend the pot life. Thixotropic agents that will not interfere with visual inspection may be added for viscosity control. Also, the opaqueness of the plastic coating shall not interfere with visual inspection. Resins may contain pigments, dyes, or colors that do not interfere with visual inspection of the cured-in-place liner pipe or its required properties. Additives may be incorporated that enhance physical and chemical resistant features. For testing purposes, a lot shall consist of all the tube and resin on a full continuous length of impregnated liner.

2.3 LINER DESIGN

A. The Contractor shall determine the recommended liner thickness for each manhole-to-manhole section. The minimum acceptable liner thickness shall be 6 mm. Liners shall be designed to withstand internal and/or external pressures in accordance with the applicable provision of ASTM F-1216. Liner thickness calculations shall be performed based on a fully deteriorated pipe condition. For the purpose of design, groundwater shall be assumed to be at the ground surface. The design life of the CIPP shall be 50 years. Thickness design calculations shall be prepared and certified by a Virginia registered Professional Engineer. The certification shall be provided using the form included in these documents.

B. The design thickness of the installed liner shall be accurately measured and certified by the Contractor. The actual thickness of the installed **structural wall layer** of the cured-in-place liner shall not be less than the design thickness. Overall thickness greater than design shall not be allowed if this results in reduction of hydraulic capacity of the line being rehabilitated.

C. The tube shall be designed to a size that, when cured, will fit tightly against the internal circumference of the original conduit, so there are no wrinkles and no annular spaces between the host pipe and the cured-in-place pipe; this tight fit minimizes loss of original pipe size. Allowance for longitudinal and circumferential stretching of the tube during installation shall be made by the Contractor.

D. The Contractor shall design the length of the tube to effectively carry out installation and sealant at the end points. All dimensions shall be field verified prior to fabrication and installation of the liner.

2.4 LINE FABRICATION

A. The liner shall consist of one or more layers of flexible needled felt, or an equivalent woven or non-woven material, capable of carrying resin, withstanding installation pressures and curing temperatures, and compatible with the resin system utilized. The liner shall be continuous and of sufficient length to extend from manhole-to-manhole, fit irregular pipe sections, and of size to fit tightly against the existing pipe walls. Allowances for longitudinal and circumferential stretching of the liner during installation shall be made by the Contractor.

B. The reinforcing material of the tubing shall be of required thickness. A suitable mechanical strengthener membrane or woven jacket may be used to control longitudinal stretching during installation as the inflation tube may be left on the internal surface of the liner after curing. The minimum thickness of a bonded polyurethane membrane and inner liner, if used, shall be 0.2 mm and shall not affect the structural dimension requirements of the cured liner. The liner fabric content shall be determined by the Contractor to ensure that the cured liner is of the required strength and thickness.

C. If fiberglass reinforcement is used, the reinforcement shall be type "C" fiberglass for maximum corrosion resistance.

2.5 RESINS

A. Resins used shall be compatible with the liner system employed; the resins shall not contain fillers, unless approved by the Engineer, except those required for viscosity control or fire retardation. The material supplied may be unsaturated polyester or epoxy thermoset resins able to cure to final properties per manufacturer's specifications. The resin shall contain the proper catalyst mix ration and shall be sufficiently mixed.

B. The resin system to be used shall be manufactured by an approved company selected by the CIPP process manufacturer. Relevant information from the resin manufacturer shall include, but may not be limited to, the following: specifications, characteristics, and properties, ASTM C-581 test results, methods of application, and infrared spectrography analysis of the resin used for each lot. This data shall be submitted to the COTR for approval prior to rehabilitation of the glycol collection line. The Contractor shall also submit a written certification, from the resin manufacturer, that the resin material to be used is compatible with the proposed application. Certification shall also address curing temperature and curing schedule (i.e., duration of the temperature at all stages of curing) The Contractor is hereby notified that field installation practices shall be checked against the aforementioned certification. No variance shall be allowed without prior written approval of the COTR.

2.6 MATERIAL PROPERTIES

A. The cured liner shall meet or exceed the following material properties:

Material Property	Test Method	Minimum Value
Initial Flexural Strength	ASTM D-790	4,500 psi
Long-term Flexural Strength	ASTM D-790	50% of initial
Initial Flexural Modulus of Elasticity	ASTM D-790	250,000 psi
Long-term Flexural Modulus of Elasticity	ASTM D-790	50% of initial
Tensile Strength	ASTM D-638	2,500 psi
Tensile Modulus	ASTM D-638	320,000 psi

2. 7 SEALS AND GROUTS

A. The Contractor shall submit documentation that the seal material is compatible with the liner material.

B. The Contractor shall submit the manufacturer's documentation for the grout design mixes and grout testing reports.

2.8 WORKMANSHIP

A. The finished lining shall be continuous over the entire length of an installation segment (between two manholes) and free of foreign inclusions, wrinkles, dry spots, lifts, pinholes and delamination. The lining shall be impervious and free of any leakage from the pipe to the surrounding ground or from the ground to the inside of the lined pipe. The inner surface shall have a smooth finish and be free of cracks and crazing. Some minor waviness that in the COTR's opinion will not appreciably decrease the flow cross-section or affect the flow characteristics shall be permissible.

B. The CIPP Liner shall be sealed with an expandable water stop, such as Hydrotite or equivalent at all manholes where the liner has been cut. The Contractor shall repair or seal all leaks around the liner manholes.

C. Any defects that, in the opinion of the COTR, will affect the integrity or strength of the lining or the hydraulic characteristics of the liner system shall be repaired or the liner replaced at no cost to the Authority.

D. The Contractor shall repair any manhole benches or inverts that have been damaged during the liner installation.

PART 3 EXECUTION

3.1 GENERAL

A. The Contractor shall visit all line segments proposed for rehabilitation and notify the COTR in writing of any site conditions, such as limitations to access, which would prevent the accomplishment of the work.

B. The Contractor shall deliver the uncured resin impregnated liner to the site, provide all equipment required to install the liner into the conduit, expand the liner in accordance with the manufacturer's standard procedures, and cure it in place. The liner shall not be impregnated with resin more than a period of time greater than recommended by manufacturer before the proposed time of installation and shall be stored in accordance with the manufacturer's recommendations.

C. The Contractor shall notify the COTR a minimum of four (4) days in advance if/when wastewater and/or water service interruption will take place and the approximate duration.

D. Work performed shall be in accordance with the MWAA Safety Manual, local, state, and federal standards and requirements. Safety and maintenance of traffic are the responsibility of the Contractor. Specific adherence to Confined Space Entry Regulations shall be followed by the Contractor.

3.2 MAINTENANCE OF STORM SEWAGE FLOWS

A. The Contractor shall be responsible for storm sewer bypassing around the pipe to be televised or lined. The Contractor's personnel shall be present at the jobsite whenever bypass pumping is being performed. Pump and bypass lines shall be of adequate capacity and size to handle flow without affecting the service connections upstream of the sewer .line being lined. The Contractor shall be responsible for cleanup, repair, and any property damage costs and claims resulting from overflow or backup caused by inadequate pumping or any other reason related to the Contractor's lining work. Pumps and equipment shall be continuously monitored by a qualified mechanic capable of starting, stopping, refueling, and maintaining this equipment during the rehabilitation work.

B. All pumps used shall be fully automatic self-priming units that do not require the use of foot valves or vacuum pumps in the priming system. The pumps may be electric or diesel powered. All pumps shall be constructed to allow dry running for long periods of time to accommodate the cyclical nature of storm sewer flows.

C. The Contractor shall test and verify that the standby pump, piping and all associated equipment is operational before starting bypass operations. The standby pump shall be capable of pumping the entire flow at the required total dynamic head.

D. The standby pumping facility shall include a generator to provide power to the pump and a standby pump of equal capacity, should the primary pump fail.

E. The Contractor shall take appropriate steps to ensure that all pumps, piping, and hoses used for bypass pumping are protected from vehicular traffic and pedestrian traffic.

3.3 CLEANING OF SEWER

A. Prior to any CIPP reconstruction process, it shall be the responsibility of the Contractor to clean debris out of the sewer line in accordance with the Section 027600 “Cleaning of Storm Sewers”. In addition, prior to television inspection and video recording, the sewer shall be cleaned to such a condition that the video camera can adequately discern structural defects, misalignments, and points of infiltration. Prior to pipe rehabilitation, all sand, rocks, gravel, mud, grease, and other debris that could interfere with or otherwise adversely impact the success of the rehabilitation shall be removed. Protruding laterals shall be cut prior to rehabilitation.

B. Solids and debris resulting from the cleaning operation shall be collected and removed from the downstream manhole and disposed of at a site selected and approved by the COTR.

3.4 TELEVISION INSPECTION

A. After the glycol collection line section to be lined has been cleaned, and after liner installation and reinstatement of lateral connections, the line shall be inspected with a television camera in accordance with Section 026510 “Storm Sewer Television Inspection.”

3.5 SEWER PREPARATION PRIOR TO LINER INSTALLATION

A. Any protruding pieces of concrete, "dropped" joints or broken pipe shall be corrected by point repairs so that the host pipe is left in a clean, smooth condition ready for lining, unless otherwise jointly determined by the Contractor and the COTR that the defect will not compromise the integrity of the liner. Prior to liner installation, all active leaks of a magnitude to compromise the liner shall be stopped using chemical grout. If conditions, such as broken pipe and major blockages, are found that would prevent proper cleaning, or where additional damage could result if cleaning were attempted or continued, the Contractor shall notify the COTR. The COTR may or may not; (1) direct the Contractor to provide a cost proposal for point repair, (2) sub-contract the point repair to others, (3) perform the point repair. The COTR reserves the right to proceed in the manner which, in their opinion, best serves the interest of the Authority.

3.6 LINER INSTALLATION, CURING, AND COOL-DOWN:

A. The installation process may use water, air, winch, or any other suitable means to fully extend the liner to the termination point, expand the liner to equal the conduit inside diameter, and dimple the service connections. Care shall be taken during the installation not to over stress the liner material. The Contractor shall present to the COTR, for review, a description of the methods for avoiding liner stoppage due to conflict and friction with such points as the manhole entrance and the bend into the pipe entrance, and within the pipe. In cases where the upstream/downstream sewer segments have previously been lined, the Contractor shall submit a plan for protecting the upstream/downstream rehabilitated (lined) section.

B. The Contractor shall carefully measure the main line glycol collection pipe for, and custom cut, adapt (if necessary), etc., the liner tube to fit the pipe to be rehabilitated.

C. The Contractor shall impregnate the liner tube with the appropriate resin system under controlled conditions, in accordance with the manufacturer's recommendations. The resin shall be properly stored and have the proper mix ratio in accordance with the manufacturer's recommendations. The volume of resin used should be sufficient to fill all voids in the tube material at nominal thickness and diameter. The volume should be adjusted by 5 to 10 percent excess resin for the

change in resin volume due to polymerization and to allow for any migration of resin into the cracks and joints in the host pipe. The Contractor shall submit the actual resin volume used. The Contractor shall test each lot of resin used by conducting infrared spectrum analysis on field samples.

D. During inversion, the pressure holding the tube tight against the host pipe shall be maintained between the minimum and maximum pressures, as specified by the tube manufacturer, until the inversion has been completed. If the Contractor plans to use a lubricant during inversion, the product specifications shall be submitted to the COTR for review and approval prior to use. The lubricant shall not cause any upset to downstream wastewater treatment plants.

E. Contractor shall allow the liner to cure in accordance with the liner and resin manufacturers' recommendations. The installed liner tube may be cured utilizing heated air, water, or steam. The Contractor shall provide a suitable heat source and re-circulation equipment capable of delivering the heated medium to the far end of the liner quickly and uniformly to raise the temperature of the inserted liner to that required to start the exothermic reaction of the resin and effectively cure the resin as determined by the catalyst system employed.

F. Submit an installation, heating, curing, and cool-down schedule plan for each manhole-to-manhole section one (1) week prior to scheduled installation. Temperatures shall be measured throughout installation and curing at both ends of the tube by accurate measuring devices.

G. Temperature in the pipe during the cure period shall be as recommended by the resin manufacturer. The heat source shall be fitted with suitable monitors to gauge the temperature in and out of the line, to determine when uniform temperature is achieved throughout the length of the liner. Another such gauge shall be placed between the tube and the host pipe in the downstream manhole, at or near the bottom, to determine the temperature during cure. The temperature shall be maintained for the period required to properly cure the resin as recommended by the resin system manufacturer and as determined by the existing pipe material, diameter, length, liner thickness, and ground conditions (moisture level, temperature, and thermal conductivity of the soil).

H. The new pipe shall be cooled at temperatures recommended by the liner manufacturer before relieving the pressure or static head. Cool-down shall be accomplished such that a vacuum will not be developed which may damage the installed line.

I. The liner pipe shall be cut off in the manhole at a suitable location. The finished product shall be continuous from manhole-to-manhole segment and be free from pinholes, cracks, thin spots, dry spots, uncured resin, delamination, and lifts. There shall be no visible infiltration through the liner or from behind the liner at manholes and service connections. Should the liner not achieve a tight seal to the inside manhole wall, a proper seal shall be made, to a watertight condition, by use of extra fiber felt and a suitable resin system, or other approved methods. Pipe entries and exits shall be smooth, free of irregularities, and watertight. No visible leaks shall be present. The Contractor shall remove leaks or fill voids between the host pipe and the liner by grouting or other method, if necessary. During the warranty period, any defects that will affect the integrity or strength of the product shall be repaired at the Contractor's expense, in a manner acceptable to the COTR.

J. The Contractor shall submit "Wet Out" and "Cure" Reports documenting the specific details of the liner's impregnation and saturation with resin and the installation of the CIPP liner. A copy of all "wet out" and "cure" records shall be made available to the COTR upon request and shall be turned over to the COTR on a weekly basis and prior to request for payment. Payment for a work

order will not be made until the related "wet out" and "cure" reports are provided. Request for work order payment without "wet out" and "cure" reports will be rejected. At a minimum, reports shall include, in addition to Contractor and Contract identification:

1. Line segment identification and location.
2. Wet out date.
3. Sample identification (s) and technician.
4. Installation (in sewer) date.
5. Host glycol collection pipe inside diameter.
6. Liner thickness.
7. Liner length.
8. Liner and resin batch numbers.
9. Resin type.
10. Wet out length.
11. Quantity of resign and catalyst utilized.
12. Roller Spacing.
13. Wet out technicians.
14. Time wet out started and completed.
15. Vacuum setting.
16. Applicable remarks.
17. Boiler and liner heating fluid pressure and temperature versus time log during cure period.
18. Cool-down report.

3.7 SERVICE CONNECTIONS

A. The re-connection of active service connections shall be completed, unless otherwise specified, without excavation, from the interior of the pipeline by means of a television camera directed cutting device. All re-cut service connections shall be neat and smooth and free of all burrs, frayed edges, or any restrictions preventing free flow. Service connections shall be trimmed and wire-brushed to 100% of the original opening. No coupons, debris, or shavings shall be left inside the service connections or the lined pipe. The COTR will provide the Contractor with the approximate location of house service connections. During the pre-rehabilitation television inspection of the line, the Contractor will confirm if service connections are active or inactive.

Upon identifying a suspected inactive connection, the Contractor shall notify the COTR who will investigate and inform the Contractor if the connection is active and to be cut. It is the intent of these specifications not to re-connect inactive connections.

B. The Contractor shall maintain and provide a minimum of two (2) complete working cutters plus spare key components on site prior to commencing inversion.

C. The Contractor shall maintain a crew or a plumber capable of responding on short notice (one hour) to such emergencies that may occur as a result of the lining process. The Contractor shall provide a minimum of two 24-hour telephone numbers to be contacted in case of an emergency.

D. The Contractor will be responsible for all costs incurred due to deficiencies related to the lining procedure. In the event a service connection is not properly reinstated, the Contractor shall rectify the defect without cost to the Authority.

E. The Contractor shall stop all visible leaks, including those at service connections, to achieve an acceptable watertight seal.

F. During televising, the camera shall slowly scan the entire edge of the service connections (360 degrees).

3.8 REPAIRS - INSPECTION AND TESTING

A. Each rehabilitated length of CIPP shall be inspected by the Contractor via television inspection. The CIPP shall conform to the standards of workmanship described herein. If any pinholes, thin spots, dry spots, de-laminations, lifts, miss cut laterals, cuts where no lateral exist, or other defects or inferior workmanship are found, the defect and inferior workmanship shall be corrected by the Contractor to the satisfaction of the COTR at no additional cost.

B. The Contractor shall submit a method to the COTR, for approval, to obtain representative samples from the installed liners for testing to verify compliance with installed material specifications.

C. The COTR will select sections of reconstructed sewer, comprising approximately 20 percent (20%) of the total project length, for testing. For each segment selected, the Contractor shall provide a certified testing of three (3) CIPP specimens for the flexural and tensile properties. Flat plate samples shall be provided. The following test procedures should be followed:

1. Finished wall thickness (designed) shall be defined as the thickness of the structural layer. Samples of the finished wall shall be evaluated (tested) for true finished wall thickness by deducting the thickness of any plastic films from the measurements.

2. Short Term Flexural (Bending) Properties- the initial tangent flexural modulus of elasticity and flexural strength should be measured for gravity pipe applications in accordance with ASTM D-790 and shall meet the requirements. Plastic coating thickness shall not be included in determination of sample thickness.

3. Tensile Properties- the tensile strength and tensile modulus should be measured for gravity pipe applications in accordance with ASTM D-638 and shall meet the requirements.

D. Testing shall be performed by· an independent laboratory proposed by the Contractor and approved by the COTR. All expenses for the certified testing of specimens under this contract shall be paid by the Contractor.

E. Structural wall layer thickness shall not be less than design thickness. Overall thickness greater than design shall not be allowed if the hydraulic capacity of the pipe is reduced. The thickness shall be measured accurately using properly calibrated micrometers.

F. Specimens taken as part of section 3.8.C above shall be subject to delamination tests by aggressively prying and separating into layers with a knife or sharp-edged instrument. No separation shall be possible. Results shall be included in the laboratory's report.

G. Liners that do not pass these inspections and materials test will not be accepted and shall be replaced by the Contractor at his own cost.

3.9 CLEAN-UP

A. The Contractor shall keep the work area in a neat and orderly condition by frequent removal of debris. Upon completion of the lining process at each location, all debris and used material shall be promptly removed from the area. The area shall be left in a condition similar to, or better than, before the work was performed.

3.10 PROPERTY DAMAGE

A. Any damage to the COTR's infrastructure or to private or public property shall be immediately repaired or rehabilitated to the COTR's satisfaction at no additional expense to the COTR. The property owner and the COTR shall be notified of any problems and repairs, in writing, immediately.

3.11 PUNCH LIST ITEMS

A. The Contractor shall correct any problems found within 60 days of discovery. If a problem is not corrected within 60 days, the COTR will charge the Contractor a penalty of $500.00 per day. The Contractor shall maintain an updated list of Punch List Items, and submit it to the COTR once a week.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT (NOT USED)

END OF SECTION 334100.1