SWEET TEA
Ft. Gordon, Georgia

RECORD SPECIFICATIONS

VOLUME 1
DIVISIONS 1-4

FEBRUARY 05, 2010

Hensel Phelps / Kiewit Joint Venture
Black & Veatch - Gensler - Ecos Environmental Design
CMI - M.C. Dean - Brittingham & Associates

Contract Number: W912HN-07-C-0006

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SECTION 01010

GENERAL PROJECT DESCRIPTION AND DESIGN REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE

This section provides general scope information and design/construction requirements for this project. The design and construction requirements within this RFP represent the minimum quantity and quality acceptable for the proposal and project. The Contractor shall design and construct the NSA/CSS (National Security Administration/Central Security Service) Georgia facility at Fort Gordon, GA, resulting in a complete and useable facility.

1.1.1 Site Development

a. Base bid shall include the following:

1. Clearing and grubbing for the entire project.

2. Complete demolition for the entire project.

3. Complete and balance grading of the site for the entire complex (based on a balanced cut and compacted fill).

4. Complete installation of the storm drainage pipe and structure system for entire complex.

5. Complete site development within the base bid boundaries shown on the contract drawings.

6. Complete utility installation within the base bid boundaries shown on the contract drawings.

7. Complete installation of utility runs servicing utility lines installed within the base bid boundaries.

8. Complete landscaping for buildings within the base bid boundaries.

9. Complete erosion control measures for all disturbed area as required.

1.1.2 Survey

The scope of work for the NSA/CSS Georgia facility at Fort Gordon, GA, includes providing additional survey as required in order to complete this project but not provided at phase II of the proposal.

1.2 SITE DESIGN

The Civil drawings and specifications provided from the NSA/CSS Hawaii facility (HRSOC) are from a preliminary design for these facilities done elsewhere. The HRSOC drawings and specifications convey the functional intent and the quality requirements for this facility with the following

general exception for site features.

1.2.1 General Arrangement

The NSA/CSS Georgia site plan provided has been coordinated and approved with the User and Base Master Planning. The general arrangement of Buildings and Site Components is mandatory. The Proposers will further develop this site plan and provide additional site features such as retaining walls, steps, and handrail, etc. The proposers' objective will be to balance the earthwork (cut and fill quantities) for the entire complex after compaction and minimize impact to the environment surrounding the project site.

1.2.2 Anti-terrorism/Force Protection

Building setback and exclusive stand-off zone requirements shall meet the antiterrorism/force protection requirements as stated in Appendix E of this RFP.

1.3 BUILDINGS' DESIGN

The drawings and specifications provided from the HRSOC facility are 100 percent documents from a design for these facilities done elsewhere. The HRSOC drawings and specifications convey the functional intent and the quality requirements for these facilities with the following general exceptions for all buildings.

1.3.1 Structural Systems

The structural systems indicated are not mandatory (floor to floor dimensions and ceiling heights are mandatory minimums). Changes to accommodate proposed structural systems are allowed only if they have no adverse effect on use or aesthetics of spaces, minimum room areas, as conveyed by the provided NSA/CSS Georgia floor plans, and MEP coordination requirements established by the HRSOC design are met.

1.3.2 Interior Color Schemes

The interior color schemes are not mandatory.

1.3.3 Exterioro Facade

The geometry and character of the exterior elevations (including rooflines, fenestration patterns and detailing) are mandatory and must be maintained to comply with the users' Architectural vision for the facility. Materials for the construction of the exterior façade (precast and metal panels) are not mandatory.

1.3.4 Fire Protection

The fire protection analyses are superceded by the fire protection analysis at Appendix I, which is the criteria for this project.

1.3.5 Sustainable Design

This project has a sustainable design goal of achieving 50 points (Gold)using SPiRiT (Sustainable Project Rating Tool) for the main operations building. See Appendix L for Spirit Requirements Summary Table.

1.3.6 Mandatory Requirements

Additional information regarding required changes, allowable options, and preferences are contained elsewhere in this RFP. Unless stated otherwise, all otherthe following features of the HRSOC documents are mandatory:

a. Furniture System power and telecommunication connection infrastructure.

b. Electronic Security raceway and cabling system.

c. Audio-Visual Systems rough-in and infrastructure.

d. SCADA System.

e. Direct Digital Control System.

f. Facility Commissioning; (including Commissioning Plan).

g. Lighting Design; including coordination with A/V design concept.

h. Lighting Controls.

i. Raised Floor System; quality and details.

j. Division 15 Specifications.

k. Division 16 Specifications.

Requirements stated in this RFP have precedence over HRSOC documents.

1.4 SYSTEM OF MEASUREMENT

Project proposal and final design plans and specifications may be in English inch-pound units or the metric SI system of measurements. The plans and site survey drawings provided in the RFP are in English units. The Offerors may present their plans in either English or metric units of measure.

1.5 DESIGN REQUIREMENTS AND CRITERIA

The proposal documents shall include adequate information in the form of narratives, drawings, calculations, catalog cuts, etc., to enable the Government to adequately review the proposal. (See Section 00100 for Proposal Submittal Requirements.) Proposal documents shall include all requirements listed in the contract clauses and compliance with the format requirements is encouraged to facilitate review and award.

1.5.1 Submittals

The design, following award, will include a 60 percent and final design submittal and corrected final design submittals. See Section 01012, DESIGN AFTER AWARD.

1.5.2 Drawing Standards

The proposal drawings may be done with any CADD software. Once the contract is awarded all drawings will be initiated and done in Microstation version 8 software (or later version) in accordance with NSA/MPO RSOC CADD

Standards. All building types will have a complete set of drawings. Common details used throughout will be copied to each set so that it can stand alone. Stating that a building is a mirror image of another is not acceptable. Drawings for each building type will be grouped together so that it will be a complete set. Site development and utilities shall be in a set by itself.

1.5.3 Referenced Standards

Codes, reference documents and criteria referenced within this RFP, although not attached, are an integral part of this RFP. Each proposer shall be responsible for securing any necessary reference at his own expense and resources. Requirements of this RFP may delete, revise, add to, or substitute for criteria contained in the referenced documents and this RFP shall be deemed the controlling authority of any changes to the other referenced documents and criteria.

1.5.4 Appendices

Information provided in the Appendices to this RFP is intended to provide additional design requirements and information. See Table of contents for a list of Appendices.

1.6 SPECIFICATION INTENT

The intent of the specification sections referenced in this RFP is to describe the requirements for quality, function, and materials, and types of construction in sufficient detail to enable engineering and design to be completed by the Contractor. In the appendices following, each engineering and design discipline describes design intent and outlines the parameters to which the Contractor shall design.

1.7 COORDINATION BETWEEN DISCIPLINES

The Contractor shall be responsible for the coordination between design, engineering and construction disciplines in order to fulfill the requirements of this contract and to provide for a complete, integrated and functional design.

1.8 QUALILTY OF WORK

Construction documents shall be sufficient to afford a clear understanding of the construction work required. The work shall be organized in a manner that will assure thorough coordination between the details on the drawings, and between the drawings and the specifications. The Contractor shall crosscheck all work until all conflicts have been reconciled. The US Army Corps of Engineers, Savannah District Design Manual, current edition, and Savannah District Guide Specifications are available on the Internet at:
http://en.sas.usace.army.mil/Click on Engineering Criteria.
Unified Facilities Guide Specifications (UFGS) are available on the internet at: http://www.hnd.usace.army.mil/TECHINFO/
or
http://www.ccb.org/ufgs/ufgs.htm
SPECSINTACT software which is used to edit the guide specifications is available free of charge at the same site.
They shall be used as the basis for format and preparation of construction documents.

1.9 DESIGN REQUIREMENTS

1.9.1 General

a. The project shall be designed and constructed in accordance with the criteria contained herein using industry standard materials and efficient practices. Specific technical requirements by discipline are identified in the Savannah District Design Manual for Construction. This manual is found under the "NOTES" button of the automated menu on disk 1 of this solicitation. The manual includes the recent update splitting architectural and interior design chapters. The Contractor shall use materials and equipment accepted within the construction industry. The building design and the materials selected shall be high quality, durable and easily maintained.

b. The Contractor shall prepare complete construction documents for all work designed as required by the RFP. The construction documents to be prepared include, but are not limited to, construction drawings, specifications, submittals, and design analyses as required in Section 01012, DESIGN AFTER AWARD. The Contractor's Designers of Record shall develop construction document technical specifications for all areas of work. The design documents may be provided in English units or hard metric.

c. The Contractor shall be responsible for the professional quality, code compliance, technical accuracy and coordination of all designs, drawings, specifications and other documents or publications upon which the design and construction are based.

d. The project specifications shall be prepared using current UFGS guide specifications. Unless noted otherwise, if there is more than one UFGS guide specification for the same thing, use the one with an "A" suffix. If a UFGS guide specification cannot be found, contact the Savannah District to see if a guide specification exists. If a guide specification does not exist, the Design/Build Contractor will prepare a job-specific specification. The UFGS shall be edited and adapted by the designer for this project, incorporating UFGS instructions and recommendations in the notes to specifier contained in the guide specifications. The designer is to delete inapplicable portions of the guide specification and revise and/or supplement, as required, the applicable portions to provide a complete project specification. Editing of specifications shall be for bracketed options and project requirements as stated in the RFP only. Specifications shall be submitted at final design submittal in hard copy form that shows the text added and deleted with additions underlined and deletions lined through but still readable. This feature is available in SPECSINTACT. In Microsoft Word this feature is located under "Tools", "Track Changes" and "Highlight Changes". A partial list of UFGS specifications required for this project is located in each discipline Appendix. Other UFGS sections shall be added and submitted by the Design/Build Contractor as needed to address all other portions of the work in the accepted proposal. Use the Division 01 GENERAL REQUIREMENTS specifications that are provided in this RFP. No changes to these Division 01 sections.

1.10 RFP DESIGN AND TECHNICAL CRITERIA

All design and construction document drawings and specifications shall be prepared to comply with the RFP. The RFP describes the design work that

shall not be changed and shall be included in the construction documents. All remaining design work shall be performed by the Contractor based on the design criteria as required by the RFP. No deviations from the criteria will be allowed unless prior approval is obtained from the Contracting Officer's Representative. Only questions or problems encountered by the Contractor in following criteria shall be promptly submitted with recommendations to the Contracting Officer's Representative for approval.

1.10.1 Conflicts in RFP Criteria

a. Where the various elements of the RFP are in conflict, the following priority shall be used to establish precedence, unless specifically noted otherwise:

1. RFP Specifications and Appendices.

a) The order of precedence for programmatic information within the RFP document:

Programmatic Data (Appendix B).

Block and Stack Plans (Appendix B).

Floor Plan Drawings.

2. RFP Drawings.

3. HRSOC Specifications Mandatory HRSOC features and functions identified in Paragraph 1.3.6.

4. Savannah District Design Manual for Construction technical requirements.

5. Fort Gordon Installation Design Guide.

b. The HRSOC drawings and specifications are furnished as a reference to illustrate convey required functional and quality features. They are not assumed to be correct or complete or to meet all RFP requirements. The Contractor is responsible for producing complete, coordinated design documents. The intent of including the HRSOC documents (plans and specifications) as reference material is to portray one design solution that meets NSA’s technical standards and requirements. Offerors are advised to carefully consider any deviations from the HRSOC documents, particularly in the areas of Mechanical and Electrical Systems, relative to NSA’s technical standards and requirements as referenced in the RFP. Meeting these technical standards and requirements are mission critical for this facility and are a minimum requirement for the construction of this project. Resolution of conflicts and correction of errors and omissions in the HRSOC documents, as well as incorporation of all requirements in this RFP, shall be accomplished at no additional cost as part of Contractor's design development for this project.

1.11 APPLICABLE BUILDING CODES AND STANDARDS

The codes and criteria references of Appendix "Q" pertain to this project. The codes of the most current edition shall be used as standards for building construction and life safety design. Where there is a conflict between the RFP and building codes, the most stringent shall apply. When

codes are in conflict, the most stringent shall apply. The list in Appendix "Q" is not intended to be a complete list. All work shall be designed and constructed to meet all state and federal codes, standards and laws. Refer to the technical specifications for other standards and references not listed there.

1.12 ENGLISH OR METRIC DESIGN

The design shall be developed using either the hard metric system of units or English units of measure. The site survey is done in English units. The Contractor shall coordinate. Specifications requiring metric measurements may contain requirements for equipment (e.g. printers, HVAC systems) described in inch-pound (I-P) units in which case no metric substitution will be allowed. Specifications requiring metric measurements shall include references to related non-metric industry and/or Government standards. The Contractor shall resolve discrepancies, such as mismatches or product unavailability, arising from use of both metric and non-metric measurements and discrepancies between the measurements in the specifications and the measurements in the drawings. Submittals for Government approval or for information only shall cover the SI or I-P products actually being furnished for the project. The Contractor shall submit the required drawings and calculations in the same units used in the contract documents describing the product or requirement unless otherwise instructed or approved. The Contractor shall use ASTM E 380 and ASTM E 621 as the basis for establishing metric measurements required to be used in submittals if the design is done in metric.

1.13 GENERAL CONSTRUCTION REQUIREMENTS

1.13.1 Government-Furnished Government-Installed Equipment (GFGI

All existing loose furniture, equipment, computers and related hardware, video projectors, VCR's, TV's, drink machines, vending machines, microwaves, and refrigerators (other than those furnished with food service equipment) are Government furnished and installed. The Contractor shall provide rough-in, utility connections, all required infrastructure and space for these items. When wall or ceiling-mounted equipment such as TVs, VCRs, monitors or projectors are required, the Contractor shall provide brackets with appropriate structural support for this equipment. GFGI items include:

a. Telecommunications Cable/Fiber, Testing, Terminations, inside 5' building perimeter.

b. Modular workstation furniture systems and components.

c. Audio-Visual Systems and components (Contractor shall coordinate rough-in requirements with the Government's Audio-Visual Systems consultant).

d. Electronic Security Systems (Intrusion Detection, CCTV, Access Control) (Contractor shall coordinate rough-in and cabling requirements with the Government's Electronic Security designer).

1.13.2 Government-Furnished Contractor-Installed Equipment (GFCI)

Not applicable.

1.13.3 Permits

The Contractor shall secure and pay for all required construction and operating permits required to construct the NSA/CSS Georgia facility. Required permits shall include, but not be limited to:

a. Building Permit - Department of Public Works, Fort Gordon, GA.

b. Air Quality Permit for Diesel Engine Generator Operation - Georgia Department of Natural Resources.

c. National Pollutant Discharge Elimination System Permit for construction site storm water discharge - Georgia Department of Natural Resources (see Section 01355 ENVIRONMENTAL PROTECTION)

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

SECTION 01012

DESIGN AFTER AWARD (DESIGN/BUILD)

PART 1 GENERAL

1.1 DESIGN REQUIREMENTS

a. The Contractor shall furnish and be responsible for a complete set of design documents as called for in Section 01010, DESIGN and CONSTRUCTION REQUIREMENTS and as called for hereinafter.

b. Within 30 days after Notice to Proceed, the Contractor shall submit, for approval, a complete design schedule with all submittals and review times indicated in calendar dates. The Contractor shall update this schedule monthly. No design submittals will be reviewed or evaluated until after receipt and acceptance of the proposed design/review schedule. As a minimum, design submittals are required at the preliminary (60%), final(100%), and at the design complete (Corrected final) stage. The requirements of each design stage are listed hereinafter. The Contractor shall reflect the number and schedules for the design submittals phases in the progress charts. As a maximum, the 60%, 100%, and design complete submittals shall be made in one consolidated package which includes each of the major categories listed in paragraph "Contents of Design Submittals".

c. To facilitate fast-track design-construction activities the contractor shall submit a 100% Site/Utility Design as the first design submittal. Following review, resolution, and incorporation of all Government comments, and submittal of a satisfactory set of site/utility design documents, the Contracting Officer shall issue a limited Notice to Proceed (NTP) which shall allow the contractor to proceed with site development activities within the parameters set forth in the accepted design submittal. Submittal review, comment, and resolution times from this specification apply to this initial 100% Site/Utility Design Submittal. No on-site construction activities shall begin prior to receipt of a construction NTP by the contractor.

d. The Contractor shall submit the design of the buildings at different stages of design to the Government for review. The drawings shall be grouped by building type, each set complete by itself. All submittals required at each stage of design shall be submitted as a complete package at one time. No partial submittals will be reviewed.

1.2 DESIGNER OF RECORD

The Contractor shall identify, for approval, the Designer of Record for each area of work. One Designer of Record may be responsible for more than one area. All areas of design disciplines shall be accounted for by a listed, registered Designer of Record. The Designer(s) of Record shall stamp, sign, and date all design drawings under their responsible discipline at each design submittal stage (see SCR - "Registration of Designers").

1.3 DEFINITION OF DESIGN SUBMITTALS

1.3.1 Corrected Proposal Submittal

The Contractor shall submit 10 copies of corrected drawings and technical proposal notebooks which incorporate any corrections on clarification items or deficiencies noted during negotiations for distribution to the Users and Government agencies. Submit the drawings in half side to the project manager within 30 days after contract award. This item only applies to the successful proposer after contract award, and only if there were requests for clarification or deficiencies were noted.

1.3.2 Site/Utility Design Submittal (100%)

This submittal is provided to allow the contractor to concentrate initial efforts for the site/utility portions of the project. By allowing this work to be separated, the contractor is given the opportunity to fast track and begin construction on the site/utility work prior to completion of the building designs. More specific submittal requirements by stage and discipline are identified in the Savannah District Design Manual. This is available on the Internet (under "Engineering Criteria") at: http://en.sas.usace.army.mil

This submittal shall consist of the following:

a. Design analysis, developed to 100%, site work and utility work only. (Design analysis shall include the Contractor's "Final" geotechnical report if pavement designs are included in the submittal. Refer to Appendix P for requirements. Refer to Paragraph 1.3.3 if this portion of the design is not included in the initial submittal).

b. 100% complete site/utility drawings.

c. Final site/utility specifications.

d. Environmental permits, as required. When environmental permits are not required, the Contractor shall provide a statement with justification to that effect.

e. If pavement designs are included with this submittal, "final" geotechnical report as specified in Appendix P. Locations of both Contractor and Government geotechnical explorations shall be shown on the grading drawings. All logs of the geotechnical explorations and laboratory test data shall be shown on their drawings.

1.3.3 Preliminary Conformance Review Submittal (60%)

a. This submittal is intended to insure that the Contractor's design is proceeding in accordance with the terms of the solicitation and the Contractor's original proposal as well as in a timely manner. This submittal shall consist of the following:

1. Design analysis, developed to 60%.

2. 60% complete drawings.

3. Program Test Fit Plans to demonstrate that the floor plans, as

designed, will accommodate the areas and adjacencies as defined in the space program located in Appendix B. The Program Test-Fit plans shall be based on the nominal net square feet per programmed "seat", as defined in Appendix B.

4. Draft specifications

5. Site Utility design information need not be included in this submittal package except where interface to the interior building systems is required.

6. "Final geotechnical report as specified in Appendix P. Locations of both Contractor and Government geotechnical explorations shall be shown on the grading drawings. All logs of the geotechnical explorations and laboratory test data shall be shown on their own drawing sheets.

1.3.4 Final Design Submittal (100%)

a. The review of this submittal is to insure that the design is in accordance with directions provided the Contractor during the design process as well as the original solicitation and the contractor's proposal. The Contractor shall submit the following documents for Final Design Review:

1. 60% review comments and responses annotated.

2. The Design Analysis submitted for Final Design Review shall be in its final form. The Design Analysis shall include all backup material previously submitted and revised as necessary. All design calculations shall be included. The Design Analysis shall contain all explanatory material giving the design rationale for any design decisions which would not be obvious to an engineer reviewing the Final Drawings and Specifications.

3. The Contract Drawings submitted for Final Design Review shall include the drawings previously submitted which have been revised and completed as necessary. The Contractor is expected to have completed all of his coordination checks and have the drawings in a design complete condition. The drawings shall be complete at this time including the incorporation of any design review comments generated by the previous design reviews. The drawings shall contain all the details necessary to assure a clear understanding of the work throughout construction. Shop drawings will not be considered as design drawings. All design shall be shown on design drawings prior to submittal of shop drawings. Each discipline has unique Final Design submittal requirements. Respective chapters of the Savannah District Design Manual should be reviewed to determine the exact nature of these requirements.

1.3.5 Example for HVAC Controls

a. HVAC Controls System Drawings (MC-Plates) shall be submitted at the final design stage and shall include the following:

1. HVAC Controls System Legend.

2. Control System Schematic.

3. Equipment Schedule.

4. Valve Schedule.

5. Damper Schedule

6. Sequence of Operations.

7. I/O Summery table and Data Terminal Strip Diagram.

8. Wiring Diagram.

9. Communications Network and Block Diagram.

10. Metering of Utilities (gas, electrical and water).

11. DDC Panel locations.

b. The control drawings shall use the Corps of Engineers standard control drawings. These drawings are available at the following website: http://www.sas.usace.army.mil/eng/EngWeb/hvac.htm or on the SAS_STD CD available from the project manager.

c. The Draft Specifications on all items of work submitted for Final Design Review shall consist of legible marked up guide specification sections.

d. Site Utility design information need not be included in this submittal package except where interface to the interior building systems is required.

1.3.6 Design Complete Submittal (Corrected Final)

a. After the Final Design Review, the Contractor shall revise the Contract Documents by incorporating any comments generated during the Final Design Review and shall prepare final hard copy Contract Specifications. The Contractor shall submit the following documents for the design complete submittal:

1. Design analysis, in final 100% complete form.

2. 100% complete drawings.

3. Final specifications.

4. Final review comments and responses.

1.3.7 Electronic Submission

All CADD files in native MicroStation format, as well as all prepared technical specifications shall be provided on CD-ROM. Two copies are required.

1.3.8 Structural Interior Design (SID)

1.3.8.1 Definition

a. The Structural Interior Design (SID) shall involve the selection and sampling of all applied finishes including material, color, texture and

patterns necessary to complete the building's interior architectural features. This information shall be submitted in 3" D-ring binders, 8-1/2" x 11" format.

b. Present architectural finish samples in an orderly arrangement according to like rooms/areas receiving like finishes. Each like room receiving like finishes will be noted as a Color Scheme. Each Color Scheme shall have a written description of material used. This written description shall use the same material abbreviations and notes that appear on the Room Finish Schedule and Legend in the contract drawings. Present prewired workstation finishes on a color board separate from the architectural finishes. Submit the SID binders concurrently with the architectural design submittals.

1.3.8.2 Preliminary Submittals

The Contractor shall submit three complete sets of the initial SID package. The design philosophy shall use a warm neutral background color with appropriate accent colors. All SID proposals shall be reviewed and approved by the Government. The Interior Designer shall revise the SID binders after each review and update the SID to satisfy review comments. Each submittal will follow this method of review until the Government approves the completed SID package.

1.3.8.3 Final Submittal

After approval of the Preliminary Submittal, the Contractor shall submit three (3) complete sets of the approved and final Structural Interior Design packages. Once the Contractor has submitted the SID and the Government has approved the submittal, all materials, finishes, colors, textures and pattern submitted and approved for this project are then considered as part of the contract and the Contractor shall furnish all approved SID finishes. No deviations will be considered.

1.3.8.4 Format

a. Submit all SID information and samples on 8 1/2"x 11" modules with only one foldout. The maximum foldout width shall be approximately 25 inches. No foldouts on the top or bottom of the pages. Place the project title, base, architectural firm, page number and date on the bottom of each page or module.

b. The module shall support and anchor all samples. Anchor large or heavy samples with mechanical fasteners, velcro or double sided foam tape. Rubber cement or glue will not be acceptable.

c. Assemble the 8 1/2" x 11" pages and modules in a 3" D-ring binder. Holes for placement of the modules in the binder shall be 3/8" in diameter. Each binder shall be identified on the outside spine and front cover by title, project number, percentage phase and date.

d. Material and finish samples shall indicate true pattern, color and texture. Carpet samples shall be large enough to indicate a complete pattern or design.

e. Where paint manufacturers color names and numbers are used, indicate the finish of the paint such as gloss, semi-gloss, flat and so on.

f. Signage may include emblems, striping, letters, numbers and logos.

The interior designer shall consider visual appearance, organization, location, structural supports (if required) and relation to other base graphics. Indicate on a separate signage sheet the location and message for all signage. Submit a sample of the signage material finish and color with the structural finishes.

g. No photographs or colored photocopies of materials will be accepted or approved.

h. The SID Binder shall include the following information at each design submittal in this order:
SECTION 01012 Page 6 (Revised by Amendment No. 0008)
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Phase 2.

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SEQUENCE OF SID SUBMITTAL

1. Title page
2. Table of contents
3. Design objectives - A statement of design objectives explaining the interior design philosophy of the facility shall be provided in the SID. Design objectives and the proposed method of accomplishing the objectives. Shall cover, when applicable, energy efficiency, safety, health, maintenance,
image, personal performance of occupants and functional flexibility.
4. Interior floor plan
5. Interior sample finish boards
    Scheme A
    Scheme B
    Scheme C

Example all restrooms could be noted as color scheme "A", all general open office finishes could be noted as color scheme "B" and the main lobby could be noted as color scheme "C".

6. Room finish schedule
7. Signage
8. Signage plan
9. Integration and layout of ACSIM specific furniture. Plan must show suitability of proposed space to suit the furniture to be provided.

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1.4 GOVERNMENT APPROVED DESIGN SUBMITTALS

The approval of submittals by the Contracting Officer shall not be construed as a complete check, but will indicate only that the design is in conformance with the contract requirements. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor is responsible for the design and construction of all work.

1.5 MAILING OF SUBMITTALS

All submittals to the Government during design shall be mailed using overnight mailing service. The addresses to where each copy shall be mailed are listed below. Each submittal shall have a transmittal letter

accompanying it which indicates the date, design percentage, type of submittal, list of items submitted, transmittal number and point of contact with telephone number.

MAILING LIST

Code Number	Agency	Mailing Address
1	SAS-PM-MC DIST	Commander U.S. Army Engineer District, Savannah ATTN: CESAS-PM-MJ/(Charles Grainger) P.O. Box 889 Savannah, GA 31402-0889 Street Adress: 100 West Oglethorpe Avenue Savannah, GA 31401-3640
2	DPW	Directorate of Public Works, Ft. Gordon Engineering Plans & Services Division ATTN: Vincent Grewartz Building 14500, 15th Street Ft. Gordon, GA 30905
3	NSA-MD	NSA 9800 Savage Road Suite 6609 ATTN: Rick Haskett Fort George G. Meade, MD
4	NSA-CSS	Commander NSA/CSS Georgia 116th MI Group (Bldg 2432) 9th Avenue and 15th Street Fort Gordon, GA 30905-5320
5	SAS-CD	Ft. Gordon Area Office ATTN: Phil Payne Bldg. 14600 15th Street & Barnes P.O. Box 7496
6	USAISEC	USAISEC FDEO 1435 Porter Streeet ATTN: Jerry Kimberley Ft. Detrick, MD 21702-5047
7	JACOBS	JACOBS Facilities, Inc. 501 North Broadway St. Louis, MO 63102 ATTN: Jerry Kroupa

The following table lists the number of copies of design submittal requirements for this project:

(1) COE	Corrected Proposal 10 1/2 Size drawings

MAILING LIST

SAS 10 Revised Proposal Notebooks

	#	Item 60%	#	Item Final	#	Item Corrected Final
(1)	3	Design Anal.	3	Design Anal.	8	Design Anal.
COE	3	Drawings	3	Drawings	8	Drawings
SAS	3	Spec.	3	Spec.	8	Spec.
			3	Ann. Comments	8	Ann. Comments
	2	Permit Appl.	2	Permit Docum.	2	CD's w/all electronic files
	1	SID	1	SID		
(2)	2	Design Anal.	2	Design Anal.	1	Design Anal.
DPW	2	Drawings	2	Drawings	5	Drawings
	2	Spec.	2	Spec.	5	Spec.
			2	Ann. Comments	5	Ann. Comments
	2	Permit Appl.	2	Permit Docum.	2	Drawings, full size
	1	SID	1	SID	2	CD's w/ all electronic files
(3)	5	Design Anal.	5	Design Anal.	2	Design Anal.
NSA-MD	5	Drawings	5	Drawings	2	Drawings
	5	Spec.	5	Spec.	2	Spec.
			2	Ann. Comments	2	Ann. Comments
	2	Permit Appl.	2	Permit Docum.	2	Permit Docum.
	1	SID	1	SID	2	CD's w/all electronic files
(4)	5	Design Anal.	5	Design Anal.	2	Design Anal.
NSA-GA	5	Drawings	5	Drawings	2	Drawings
	5	Spec.	5	Spec.	2	Spec.
			2	Ann. Comments	2	Ann. Comments
	2	Permit Appl.	2	Permit Docum.	2	Permit Docum.
	1	SID	1	SID	2	CD's w/all electronic files

MAILING LIST

(5)	5	Design Anal.	5	Design Anal.	2	Design Anal.
SAS-CD	5	Drawings	5	Drawings	2	Drawings
	5	Spec.	5	Spec.	2	Spec.
			2	Ann. Comments	2	Ann. Comments
	2	Permit Appl.	2	Permit Docum.	2	Permit Docum.
	1	SID	1	SID	2	CD's w/all electronic files
(6)	8	Design Anal.	8	Design Anal.	8	Design Anal.
JACOBS	8	Drawings	8	Drawings	8	Drawings
	8	Spec.		Spec.	8	Spec.
			8	Ann. Comments	8	Ann. Comments
	2	Permit Appl.	2	Permit Docum.	2	Permit Docum.
	1	SID	1	SID	2	CD's w/all electronic files

1.6 GOVERNMENT REVIEWS

a. The Government will take thirty (30) days to review and comment on each design submittal. For each design review submittal, the COR will furnish, to the Contractor, a single consolidated listing of all comments from the various design sections and from other concerned agencies involved in the review process. The review will be for conformance with the technical requirements of the solicitation and the Successful Offeror's (Contractor's) RFP proposal. If the Contractor disagrees technically with any comment or comments and does not intend to comply with the comment, he must clearly outline, with ample justification, the reasons for noncompliance within five (5) days after receipt of these comments in order that the comment can be resolved. The Contractor shall furnish disposition of all comments, in writing, with the next scheduled submittal. The Contractor is cautioned in that if he believes the action required by any comment exceeds the requirements of this contract, that he should take no action and notify the COR in writing immediately. Review conferences will be held for each design submittal at the Installation. The Contractor shall bring the appropriate design staff to the review conference. These conferences will take place the week after the receipt of the comments by the Contractor. Contractor is responsible for providing space for the review conference. The conference may be held at a nearby off-site location if necessary. Minimum size of conference space shall accommodate the Contractor's Representatives plus forth additional people.

b. ProjNet/DrChecks is the required method for preparing and annotating comments. This is an Internet based database available on the Internet at:

1. http://www.projnet.org/projnet/binKornHome/index.cfm.

2. User ID and password will be granted at the submittal stage.
c. If a design submittal is late by the approved schedule, the review will slip according. The review process will not be shortened. Submittals date revisions must be made in writing at least one (1) week prior to the effect submittal.

1.6.1 Post Review Conference Action

Copies of comments, annotated with comment action agreed on, will be made

available to all parties before the conference adjourns. Unresolved problems will be resolved by immediate follow-on action at the end of conferences. Valid comments will be incorporated. After receipt of final corrected design documents upon incorporation of backcheck comments the Project Manager will recommend issuance of a Construction Notice to Proceed (NTP). The Government, however, reserves the right to disapprove design document submittals if comments are significant. If final or backcheck submittal(s) are incomplete or deficient, and require correction by the Contractor and resubmittal for review, the cost of rehandling and reviewing will be deducted from payment due the Contractor at the rate of $ 5,000.00 per submittal.

1.7 COORDINATION

1.7.1 Written Records

The Contractor shall prepare a written record of each design site visit, meeting, or conference, either telephonic or personal, and furnish within five (5) working days copies to the Contracting Officer and all parties involved. The written record shall include subject, names of participants, outline of discussion, and recommendation or conclusions. Number each written record for the particular project under design in consecutive order.

1.7.2 Design Needs List

Throughout the life of his contract the Contractor shall furnish the COR a monthly "needs" list for design related items. This list shall itemize in an orderly fashion design data required by the Contractor to advance the design in a timely manner. Each list shall include a sequence number, description of action item, name of the individual or agency responsible for satisfying the action item and remarks. The list will be maintained on a continuous basis with satisfied action items checked off and new action items added as required. Once a request for information is initiated, that item shall remain on the list until the requested information has been furnished or otherwise resolved. Copies of the list will be mailed to both the Administrative Contracting Officer and the agencies tasked with supplying the information. It is highly recommended that the Corps' RFI system be utilized during the design phase for this purpose. Originally developed for the Construction phase but it works well for both. The system has report capability. User access and passwords will be furnished at the time needed with over the phone instructions.

1.8 DESIGN ANALYSIS

1.8.1 Media and Format

Present the design analysis on 8 1/2 inch by 11 inch paper except that larger sheets may be used when required for graphs or other special calculation forms. All sheets shall be in reproducible form. The material may be typewritten, hand lettered, handwritten, or a combination thereof, provided it is legible. Side margins shall be 1 inch minimum to permit side binding and head to head printing. Bottom margins shall be 1-1/4 inches, with page numbers centered 1 inch from the bottom.

1.8.2 Organization

Assign the several parts and sheets of the design analysis a sequential binding number and bind them under a cover indicating the name of the facility and project number, if applicable. The title page shall carry the

designation of the submittal being made. The complete design analysis presented for final review with the final drawings and specifications shall carry the designation "FINAL DESIGN ANALYSIS" on the title page.

1.8.3 Design Calculations

Design calculations are a part of the design analysis. When they are voluminous, bind them separately from the narrative part of the design analysis. Present the design calculations in a clean and legible form incorporating a title page and index for each volume. Furnish a table of contents, which shall be an index of the indices, when there is more than one volume. Identify the source of loading conditions, supplementary sketches, graphs, formulae, and references. Explain all assumptions and conclusions. Calculation sheets shall carry the names or initials of the author and the checker and the dates of calculations and checking. No portion of the calculations shall be computed and checked by the same person.

1.8.4 Automatic Data Processing Systems (ADPS)

When ADPS are used to perform design calculations, the design analysis shall include descriptions of the computer programs used and copies of the ADPS input data and output summaries. When the computer output is large, it may be divided into volumes at logical division points. Precede each set of computer printouts by an index and by a description of the computation performed. If several sets of computations are submitted, they shall be accompanied by a general table of contents in addition to the individual indices. Preparation of the description which must accompany each set of ADPS printouts shall include the following:

a. Explain the design method, including assumptions, theories, and formulae.

b. Include applicable diagrams, adequately identified.

c. State exactly the computation performed by the computer.

d. Provide all necessary explanations of the computer printout format, symbols, and abbreviations.

e. Use adequate and consistent notation.

f. Provide sufficient information to permit manual checks of the results.

1.9 DRAWINGS

a. Prepare all drawings on Computer-Aided Design and Drafting (CADD) so that they are well arranged and placed for ready reference and so that they present complete information. The Contractor shall prepare the drawings with the expectation that the Corps of Engineers, in the role of supervision, will be able to construct the facility without any additional assistance from the Contractor. Drawings shall be complete, unnecessary work such as duplicate views, notes and lettering, and repetition of details shall not be permitted. Do not show standard details not applicable to the project, and minimize unnecessary wasted space. Do not include details of standard products or items which are adequately covered by specifications on the drawings. Detail the drawings such that conformance with the RFP can be checked and to the

extent that shop drawings can be checked. Do not use shop drawings as design drawings. The Contractor shall use standard Corps of Engineers title blocks and borders on all drawings. Submit an index of drawings with each submittal. The COR will furnish the Contractor file number, drawing name prefix, and specifics for inclusion in the title blocks of the drawings.

b. Create all drawings using CADD methods in MicroStation format. Save all Design Complete CADD files as MicroStation V8 or later version. The Contractor shall use NSA RSOC/MPO CAD Standard and Computer-Aided Design and Drafting (CADD) Systems as guidance for standard details, cell libraries, title blocks, and layer/level assignments. Drawing features not addressed in this standard shall conform to EM 1110-1-1807 Standards Manual for U.S. Army Corps of Engineers drafting standards.

c. Only standard fonts provided by MicroStation are allowed to be used in the creation of CADD files. No fonts created by third parties or the designer are permitted.

d. The uses of Reference files and model files during the design stage is up to the discretion of the designers. All CADD files at Design Complete submittal shall be in separate folder by discipline or building, free standing, independent files by folder. All reference files shall be in the same folder as the design files. Example of folders, Civil, Building 1, Building 2, etc.

e. Submit all Design Complete CADD files on the following media:
- Read/Write CD-ROM Disk.

1.10 SPECIFICATIONS

a. The Contractor shall submit marked-up and final specifications as required. The specifications may be any one of the major, well known master guide specification sources such as MASTERSPEC from the American Institute of Architects, SPECTEXT from Construction Specification Institute or Unified Federal Guide Specifications (UFGS), etc. Use only one source for the project. Edit the specifications for this project and submit in marked-up or redlined draft version at the Final Review submittal stage. If the design is based on a specific product, the specification shall consist of the important features of the product. The specification shall be detailed enough such that another product meeting the specification could be substituted and it would not adversely impact the project. After incorporation of comments, submit a final, design complete specification package. Delete all marked-out or redlined text and type in all inserted text. If Unified Federal Guide Specifications (UFGS) and Savannah District Guide Specifications are used they are available on the Internet at:
http://www.hnd.usace.army.mil
and
http://en.sas.usace.army.mil/

b. Many of these specifications are in Specsintact format (*.sec). Specsintact software is available free of charge at:
http://si.ksc.nasa.gov/specsintact.

c. These specifications shall be edited and tailored by the Contractor to meet the requirements of the project under design.

1.10.1 Submittal Register

Develop the submittal requirements during construction during the design phase of the contract, by producing a Contractor Submittal Register during design. Attach a submittal register to each section of the specifications for the submittal requirements of that section. Prepare the Submittal Register on ENG Form 4288 or similar format spreadsheet with Excel. The Contractor shall be responsible for listing all required submittals necessary to insure the project requirements are complied with. The Register shall identify submittal items such as shop drawings, manufacturer's literature, certificates of compliance, material samples, guarantees, test results, etc that the Contractor shall submit for review and/or approval action during the life of the construction contract. The Contractor shall place all the Submittal Register pages in an appendix of the final specifications. See Section 01330 SUBMITTAL PROCEDURES (DESIGN BUILD) for submittal and submittal register definitions and procedures.

1.11 CONTENTS OF DESIGN SUBMITTALS

The 100% site/utility design submittal shall contain as a minimum, the following:

1.11.1 General Narratives

1.11.1.1 Site/Layout

Explanation of objectives and factors influencing siting decisions. General overview of major site features planned, such as building orientation, drainage patterns, parking provisions, traffic circulation, provisions for the handicapped, security requirements, etc. Rationale for locating major site elements. Set back requirements or specific clearance requirements. Locations of borrow and spoil areas.

1.11.1.2 Utility Systems

a. Design narrative for the natural gas, water supply, storm drainage, and wastewater systems relating to this project. Include an analysis of the existing distribution systems capability to supply sufficient quantity at adequate levels. If the existing distribution systems are inadequate, provide the design solution to augment the systems to provide the requirements for the new facilities.

b. All drawings included in the required technical data for the proposal submission (see Contract Clauses, TECHNICAL SUBMISSION REQUIREMENTS AND INSTRUCTIONS), shall be developed to 100 percent completion. In addition to the individual utility plans, submit a combined utility plan drawn to the same scale as the individual utility plans.

1.11.1.3 General Site Layout

Scale shall be included.

1.11.1.4 Geotechnical

a. Design analysis shall include the Contractor's "final" geotechnical report if pavement designs are included in the submittal. Refer to Appendix P for requirements. Refer to

Paragraph 1.11.6.f below if this portion of the design is not included in the initial submittal.

b. If pavement designs are included with this submittal, "final" geotechnical report as specified in Appendix P. Locations of both Contractor and Government geotechnical explorations shall be shown on the grading drawings. All logs of the geotechnical explorations and laboratory test data shall be shown on their own drawings.

1.11.2 Site Grading and Drainage Plans

Show locations of all sediment basins, diversion ditches, and other erosion control structures. Indicate the approximate drainage areas each will service. Indicate the materials, construction and capacity of each structure. Include limits of landscaping and seeded areas. General site grading and drainage shall be indicated by contour lines with an interval of not more than approximately one foot.

1.11.2.1 Road Alignment Plans

Scale shall be no greater than 1"=30' and profiles showing pavement and shoulder widths, azimuths and curve data, limits of grading, and erosion control. The materials to be used shall be indicated.

1.11.2.2 Traffic Control Plan

Traffic routing and signage shall be in accordance with the The Manual on Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation, Federal Highways Administration.

1.11.2.3 Parking Lots

Show the actual dimensions of parking lots and measurements from a known reference point rather than coordinates at corners. Show the number of parking spaces.

1.11.2.4 Sanitary Sewer Plan

Scale shall be no greater than 1"=30' and profiles showing pavement and shoulder widths, azimuths and curve data, limits of grading, and erosion control. The materials to be used shall be indicated.

1.11.2.5 Water Supply Line Plans

Scale shall be 1"=30' and profiles showing locations of valves, thrust blocks, connections, etc. Materials shall be indicated and specifications shall be provided for valves, pipes, etc.

1.11.3 Electrical Plan Requirements

1.11.3.1 Required Diagrams and Details on Site Electrical Drawings

a. Off-Site Electrical Distribution Plan.

b. Off-Site Primary Circuit Routing Plans.

c. Off-Site One Line Diagram. (If applicable.)

d. Off-Site Details. (Aerial Pole Line Construction, etc.) (If applicable).

e. On-Site Electrical Distribution Plan.

f. On-Site One Line Diagram.

g. On-Site Distribution Transformer Schedule: Provide with the following headings:

Transformer Designation.
Transformer Size (KVA).
Building(s) Served.
Primary Phase(s) and Circuit to which connected.

On-Site Details. (Site Lighting, Trenching, Pad Mounted Transformer, etc..)

i. Exterior Security Features, (IDS, ACS, CCTV).

1.11.4 Specifications

Provide final specifications which include all sections which apply to site/utility work.

1.11.5 Design Analysis

Design analysis shall include design calculations fully developed to support the design of the site and utility systems included in this submittal.

1.11.6 60 Percent Design Submittal

The 60 percent design submittal shall contain as a minimum, the following:

a. Landscape, Planting and Turfing

1. The landscape planting design narrative shall describe the analysis of existing site conditions, including an indication of existing plant materials that are to remain on the site. The statement of concept shall indicate specific site problems related to proposed development and the rationale for proposed plant locations. The narrative shall also include a list of suggested types and sizes of plant materials which are to be used, based upon the designated functional and visual criteria.

2. The drawings shall be prepared at a scale which corresponds with the site layout and grading plans and, likewise, shall include reference coordinates, north arrows, graphic scales and appropriate legends. An overall planting layout shall be developed and shall include enlarged detail plans of specific areas, as needed, to clarify requirements. The proposed layout shall indicate shade trees, evergreen trees, flowering trees, shrub masses, etc., according to designated functional and visual locations of planting. A legend which also indicates sizes of plants recommended for each of the above categories shall be included. The drawings and all subsequent plans shall indicate existing and proposed buildings, paved areas, signs, light standards, transformers, dumpster areas, storm drainage system,

and other structures and utilities.

3. Final design drawing(s) shall include a complete schedule of plant materials which indicates their botanical and common names, plan symbols, quantities, sizes, condition furnished, and pertinent remarks. Scale of drawing shall be prepared at 1" = 30'. Drawing shall correspond with the site layout and grading plans and reference coordinates, north arrows, graphic scales and appropriate legends. An overall planting layout shall be developed and shall include enlarged detail plans of specific areas as needed, to clarify requirements. Final design drawings, indicating proposed plants by a (+) mark for the plant location and a circle which is scaled at approximately 2/3 the ultimate growth spread (diameter) of plants, shall also include a complete schedule of plant materials which indicates botanical and common names, plan symbols, quantities, sizes, condition furnished, and pertinent remarks. Final drawings shall also include the basic details for installation of tree, shrub, and ground cover planting, as well as any other applicable details for clarification of specific project requirements.

b. Architectural

1. Design narrative shall provide a summary of functional space relationships, as well as circulation. There shall also be a general statement for the rationale behind the major design decisions.

2. Architectural Floor Plans shall indicate dimensions, columns lines, and detail references. Toilets and other specialized areas shall be drawn to 1/4" scale and shall show any needed interior features.

3. Finish schedule shall indicate material, finishes, colors and any special interior design features such as soffits, fascias, and lighting troughs, etc.

4. All required equipment shall be shown on the drawings with an equipment list.

5. List any special graphics requirements that will be provided.

6. Schedules shall be provided for both doors and windows. These schedules shall indicate sizes, types, and details for all items shown on floor plans.

7. Hardware sets using BHMA designations.

8. SID package.

9. Fire Protection and Life Safety Analysis. This analysis must be performed by a Registered Fire Protection Engineer (FPE). NICET certification is not sufficient to address this requirement.

c. Structural Systems

1. State the live loads to be used for design. Include roof and floor loads; wind loads, lateral earth pressure loads, seismic loads, etc., as applicable.

2. Describe the method of providing lateral stability for the structural system to meet seismic and wind load requirements. Include sufficient calculations to verify the adequacy of the method.

3. Furnish calculations for all principal roof, floor, and foundation members.

4. This submittal shall include drawings showing roof and floor framing plans as applicable. Principal members will be shown on the plans. A foundation plan shall also be furnished showing main footings and grade beams where applicable. Where beam, column, and footing schedules are used, show schedules and fill in sufficient items to indicate method to be used. Show typical bar bending diagram if applicable. Typical sections shall be furnished for roof, floor, and foundation conditions. Structural drawings for proposals and submittals shall be separate from architectural drawings.

5. Provide any computer analyses used. The software shall be widely accepted, commercially available programs and complete documentation of the input and output of the program must be provided.

6. Provide complete seismic analyses for all building structural components. Seismic calculations shall clearly demonstrate compliance with all requirements set forth in the Statement of Work.

d. Plumbing Systems

1. List all references used in the design including Government design documents and industry standards.

2. Provide justification and brief description of the types of plumbing fixtures, piping materials and equipment proposed for use.

3. Prepare detail calculations for systems such as sizing of domestic hot water heater and piping; natural gas piping.

4. Indicate locations and general arrangement of plumbing fixtures and major equipment.

5. Include plan and isometric riser diagrams of all areas including hot water, cold water, waste and vent piping. Piping layouts and risers should also include natural gas (and meter as required), fuel oil and other specialty systems as applicable.

6. Include equipment and fixture connection schedules with descriptions, capacities, locations, connection sizes and other information as required.

e. Fire Protection/Suppression

1. List all references used in the design including Government design documents and industry standards used to generate the fire protection analysis.

2. Classify each building in accordance with fire zone, building floor areas and height and number of stories. This information shall be contained in the fire protection analysis.

3. Discuss and provide description of required fire protection requirements including extinguishing equipment, detection equipment, alarm equipment and water supply. Alarm and detection equipment shall interface to requirements of Electronic Systems. This information shall be contained in the fire protection design analysis.

4. Prepare a plan for each floor of each building that presents a compendium of the total fire protection features being incorporated into the design. Provide the following types of information: The location and rating of any fire resistive construction such as occupancy separations, area separations, exterior walls, shaft enclosures, corridors, stair enclosures, exit passageways, etc. The location and coverage of any fire detection systems. The location and coverage of any fire suppression systems (sprinkler risers, standpipes, etc.). The location of any other major fire protection equipment. Indicate any hazardous areas and their classification.

5. Prepare a schedule describing the internal systems with the following information: fire hazard and occupancy classifications, building construction type, GPM/square foot sprinkler density, area of operation and other as required.
6) Hydraulic calculations based on water flow test shall be prepared for each sprinkler system to insure that flow and pressure requirements can be met with current water supply. Include copies of contractor water flow testing done to certify the available water source.

f. Geotechnical

1. "Final" geotechnical report as specified in Appendix P. Locations of both Contractor and Government geotechnical explorations shall be shown on the grading drawings. All logs of the geotechnical explorations and laboratory test data shall be shown on their own drawing sheets.

2. Certification of geotechnical design as required by Appendix P.

1.11.7 Electronic Systems

a. Electronic Systems responsibilities include the following:

1. Fire Detection and Alarm System.

2. Fire Suppression System Control.

3. Public Address System.

4. Special Grounding Systems.

5. Cathodic Protection.

6. Intrusion Detection, Card Access System and CCTV.

7. Central Control and Monitoring System.

b. The design analysis shall include all calculations required to support design decisions and estimates at this stage of design. The analysis shall include specific criteria furnished, conference minutes and cost analyses of all systems considered.

c. Design of the fire alarm and detection system shall include layout drawings for all devices and a riser diagram showing the control panel, annunciator panel, all zones, radio transmitter and interfaces to other systems (HVAC, sprinkler, etc.).

d. Specify all components of the Fire Suppression (FS) System in the FS section of the specifications. Provide a clear description of how the system will operate and interact with other systems such as the fire alarm system. Include a riser diagram on the drawings showing principal components and interconnections with other systems. Include FS system components on drawing legend. All components shown of floor plans shall be designated as FS system components (as opposed to Fire Alarm components). Show the location of FS control panels, HVAC control devices, sensors, and 120V power panel connections on the floor plans. Indicate zoning of areas by numbers (1, 2, 3) and detectors subzoned for cross zoning by letter designations (A and B). Differentiate between ceiling mounted and underfloor detectors with distinct symbols and indicate subzone of each.

e. Show location of telephone outlets (including pay phones) on the plans. Include legend and symbol definition to indicate height above finished floor. Show Telephone Conduit System Riser Diagram. Size conduit on Riser Diagram. Show conduit runs between backboard and outlets on the floor plans. Underground telephone distribution conduit shall be shown on either the electrical or electronic site plan.

1.11.8 Grounding System

a. The specifications and drawings shall completely reflect all of the design requirements. The specifications shall require field tests (in the construction phase), witnessed by the Contracting Officer, and User Representatives to determine the effectiveness of the grounding system. The design shall include drawings showing existing construction. Verification of the validity of any existing drawings and/or any other data furnished by the Government shall be the responsibility of the engineering services firm.

b. Provide a statement describing the extent of any exterior work such as telephone lines, cable television (TV) distribution cables, duct banks, etc., outside of 5 feet from the building line.
c. Provide the name of the licensed corrosion engineer or NACE specialist. Provide the following for cathodic protection systems:

1. Clearly define areas of structures or components in soil or water to be protected.

2. Type system recommended, comparison of systems, cost estimates showing all equipment alternatives.

3. Calculations on all systems that are considered showing all information and descriptions.

d. Design of Cathodic Protection

1. The design shall clearly provide a thorough and comprehensive specification and drawing. The design plans and specifications shall show extent of the facilities to be protected, location and type of anodes, location of test points, details for sectionalizing an underground piping system. This design shall be complete enough to purchase equipment and build without design changes to meet criteria of protection.

2. Exterior work to be shown on electrical site plan.

3. Existing and new communications service lines, both overhead and underground, shall be properly identified.

4. Show removals and relocations, if any.

5. Provide a descriptive narrative of all electronic systems that are required for project. Define any hazardous areas (as defined in the National Electric Code) and indicate the type of equipment proposed for use in such areas. Show the location of all electronic system panels, etc., on the floor plans. Show the proposed riser diagrams for all systems. Sizes of all conduit, wires, cables, panels, etc. Provide a complete symbol legend for all devices or equipment shown on the plans. For work requiring removals or demolition, the designer shall show by use of drawings or narrative, how demolition work is to be done.

1.11.9 Electrical and Mechanical Systems

Provide all information as required on the 100% design submittal developed to 50% completion.

1.11.10 Specifications

a. Draft of specifications for housing units, including index and trade sections.

b. The 100% design submittal shall contain, as a minimum, the following section 1.11.11 through 1.11.16 for all submittals.

c. A complete set of construction documents plans and specifications at the same level of detail as if the project were to be bid including a complete list of equipment, fixtures and materials to be used. The final drawings are an extension of the reviewed 60% drawings and are to include the 60% comments and responses. All details shall be shown on the drawings.

d. The design analysis is an extension of the reviewed 60% design analysis and supports and verifies that the design complies with the requirements of the project.

e. Submit marked-up specifications. The specifications shall be coordinated with the drawings and describe in detail all items shown on the drawings.

f. Include "Final Geotechnical Report as specified in Appendix P if changes are made after the Preliminary Conformance Review Submittal (60 percent).

1.11.11 Architectural

All architectural drawings shall be coordinated with the other engineering disciplines. Ensure that the plans are in compliance with the applicable codes. It will be the Contractor's responsibility to implement the comments generated from any design review submittal as well as verify the consistency between plans and specification. The evaluation of the Contractor's submittals shall be based on degree to which the submittal meet the requirements set forth in this document and the specifications.

1.11.11.1 Composite Floor Plans of Customer Access Outlets

a. A CAO is a chassis to house SCI/Unclassified voice, data and video as well as power. The CAO will be mounted in groups of 4 in a 2 by 2 grid. The composite floor plan shall include a matrix of these groups of CAOs such that all workstations configurations can be located within 15 feet of the CAOs.

b. Design Discipline: General.

c. Document Type: Request for Proposal.

d. Spec Section: Division 1, Section 01012 Page 20 Para. 1.11.12.1.

e. Drawing Sheet/Detail: N/A.

f. SID package.

1.11.11.2 Fire Protection and Life Safety Analysis

This analysis must be performed by a Registered Fire Protection Engineer (FPE). NICET certification is not sufficient to address this requirement.

1.11.11.3 Structural Design

a. Furnish complete checked calculations for all structural members. Incorporate any changes required by comments on 50% Design Submittal.

b. Prior to this submittal, structural drawings shall be coordinated with all other design disciplines.

c. The final structural drawings shall contain the following information as a set of general notes:

1. The allowable soil bearing value.

2. The design stresses of structural materials used.

3. The design live loads used in the design of various portions of the structures.

4. The design wind speed.

5. The seismic zone and the "K", "C", "I" and "Z" values used in design.

d. All structural drawings and calculations shall be checked and

stamped by the designer of record (a registered Professional Engineer).

1.11.11.4 Fire Suppression System

Provide a file of the input data used in the computer program to design the fire suppression system as well as the output data.

1.11.12 Specific Mechanical and Plumbing Requirements

Required Plans, Diagrams, Schedules and Details on Unit Mechanical Drawings

1.11.12.1 Mechanical Floor Plan

a. The floor plans shall show all principle architectural features of the building which will affect the mechanical design. The floor plans shall also show the following:

1. Room designations.

2. Mechanical legend and applicable notes.

3. Location of all ductwork or piping (double line ductwork required).

4. Location and capacity of all terminal units (i.e., registers, diffusers, grilles, hydronic baseboards). Exhaust fan and range hood location.

5. Size of all ductwork and piping.

6. Thermostat location.

7. Location of heating/cooling plant (i.e., boiler, chiller, cooling tower, etc).

8. Location of all air handling equipment.

9. Return air paths (i.e., undercut doors, transfer grilles).

10. Flue piping size and location.

11. Piping diagram for forced hot water system (if used).

12. Fuel supply and return piping.

1.11.12.2 Equipment Schedule

Complete equipment Schedules shall be provided. Schedule shall also include:

a. Capacity.

b. Electrical characteristics.

c. Efficiency (if applicable).

d. d. Manufacturer's name.

e. Optional features to be provided.

f. Physical size.

1.11.12.3 Details

Construction details, sections, elevations, etc., shall be provided where required for clarification of methods and materials of design. Roof and exterior wall penetrations shall be detailed on the drawings.

1.11.12.4 Plumbing Floor Plan

The floor plan shall show all principal architectural features of the building which will affect the plumbing design. Separate plumbing plans will not be required if sufficient information can be shown on the mechanical plans to meet the requirements shown above. The floor plan shall also show the following:

a. Room designations.

b. Fixture Schedule.

c. Location of utility entrances.

d. Waste and water pipe location and size.

e. Fixture designations.

1.11.12.5 Design Analysis

Complete design calculations for mechanical systems. Include computations for sizing PM&E equipment, air duct design, and U-factors for ceilings, roofs and exterior walls and floors. Contractor shall employ commercially available energy analysis techniques to determine the energy performance of all passive systems and features. Use of hourly energy load computer simulation (e.g., TRNSYS, DOE 2.1 Blast, etc.) is required. These calculations can be used to size the mechanical systems. Based on the results of calculations, provide a complete list of the materials and equipment proposed for heating and plumbing, with the manufacturer's published cataloged product installation specifications and roughing-in data. The heating and cooling equipment data shall include the manufacturer's wiring diagrams, installation specifications, ARI certification, and the standard warranty for the equipment.

1.11.13 Specific Electrical Requirements

1.11.13.1 Required Plans, Diagrams, Schedules, and Details on Unit Electrical Drawings

a. Electrical Floor Plan

1. The floor plans shall show all principle architectural features of the building which will affect the electrical design. The floor plan shall also show the following:

Room designations.

Electrical legend and applicable notes.

Lighting fixtures, properly identified.

Location of smoke and CO detectors.

Location of telephone and cable TV outlets.

Switches for control of lighting.

Receptacles.

Location of SCADA and EMCS Devices.

Security infrastructure and devices.

b. Location and Designation of Panelboards

1. Plans should clearly indicate type of mounting required (flush or surface) and be reflected accordingly in specifications. Service entrance (conduit and main disconnect).

2. Location, designation and rating of motors and/or equipment which requires electrical service. Show method of termination and/or connection to motors and/or equipment. Show necessary junction boxes, disconnects, controllers (approximate only), conduit stubs, and receptacles required to serve the motor and/or equipment.

c. Building Riser Diagram (from pad-mounted transformer to unit load center panelboard) Indicate the types and sizes of electrical equipment and wiring. Include grounding and metering requirements.

d. Load Center Panelboard Schedule(s)

Schedule shall indicate the following information:

Panelboard Characteristics (Panel Designation, Voltage, Phase, Wires, Main.

Breaker Rating and Mounting.

Branch Circuit Designations.

Load Designations.

Circuit Breaker Characteristics. (Number of Poles, Trip Rating, AIC Rating) Special Features.

e. Lighting Fixture Schedule

(Schedule shall indicate the following information:)

Fixture Designation.

General Fixture Description.

Number and Type of Lamp(s).

Type of Mounting.

Special Features.

f. Details

Construction details, sections, elevations, etc., shall be provided where required for clarification of methods and materials of design.

g. Required Electrical Design Analysis

Design analysis and calculations for the electrical systems shall be prepared by a licensed professional engineer with experience in family housing, and shall be stamped as such. The design analysis shall be separately bound, in one or more volumes. Show functional and engineering criteria, design information, and calculations applicable to the project. The analysis shall be organized in a format appropriate for review, approval, and record purposes. The design calculations shall indicate methods and references identified, and shall explain assumptions and conclusions.

h. Voltage Drop (VD) Calculations

Select conductor sizes of primary feeders, site lighting circuits, service laterals, and unit feeder conductors. Calculate maximum length for each phase of each primary circuit, using a maximum allowable VD for each circuit. Calculate voltage drops for each conductor. Maximum allowable voltage drop for site lighting and service laterals is 3%. The combined voltage drop for the service laterals, unit feeders, and branch circuit cannot exceed 5%. Calculate the available fault current at the main breaker for the living unit panel. Provide a coordination study to support breaker selection.

1.11.14 Specifications

Provide final specifications. The Contractor shall make final identification of all materials and finishes at this stage.

1.11.15 Design complete submittal (Corrected Final)

1.11.15.1 Design Drawings

Drawings shall be 100% complete, signed and sealed by the designer of record. All previous review comments shall be incorporated.

1.11.15.2 Design Analysis

Complete design analysis for all design disciplines. The final Fire Protection and Life Safety Analysis shall be included in the Design Analysis.

1.11.15.3 Comment Response Package

a. Complete package showing all comments from all previous reviews and the respective response and disposition.

b. This submittal shall include all drawings and design information from the 100% site/utility submittal to form a complete design package.

1.12 DESIGN RELATED PRODUCTS

1.12.1 Architectural Renderings

Contractor shall provide the original and three copies of each ground level perspective artist's renderings of completed typical facilities with walks, parking, and landscaping. Renderings shall be no smaller than 14" x 18" or larger than 28" x 36", multi-colored, and shall be suitably titled, matted, and framed. Also, provide electronic PDF copies of:

1.12.2 DD Form 1354

Three (3) sets of DD Form 1354, Transfer and Acceptance of Military Real Property shall be prepared in accordance with DA Pamphlet 415-28 available at http://www.usapa.army.mil/gils/
and submitted to the Contracting Officer. The DD Form 1354 will require input from both the design agent and the Contractor. The form must be completed in English units.

1.12.3 Submittal Register, ENG FORM 4288

The Contractor shall complete and submit three (03) copies of a "preliminary" Eng Form 4288, Submittal Register to Contracting Officer. The "preliminary" Eng Form 4288, Submittal Register shall have the column "Submittal Identification", "Specification Paragraph Number", "Description of Submittal" "Type of Submittal", and "Remarks" completed; the Contractor shall identify whether the submittal is for "Government Approval" or for "Government Information" under the column "Remarks." The "final" Eng Form 4288, Submittal Register, shall be in accordance with clause CONTRACTOR SUBMITTALS AND SUBMITTAL CONTROL in this section.

1.12.4 Reproduction

Upon Government approval of 100% design documents, the original will be returned to the Contractor for reproduction purposes. The Contractor will be responsible for his own reproduction as well as reproduction for Government use. The Government will require twice the number of copies of the plans and specifications as were required for the review stages, no color boards will be required. The originals will be retained by the Contractor for recording of as-built conditions. Upon completion of the project, the original design documents corrected to reflect as-built conditions will be supplied to the Government. All documents will be returned to the Government upon completion of the Project.

1.13 PAYMENT DURING DESIGN

Payments, as authorized by the Authorized Representative Contracting Officer (COR), will be made monthly for the amount and value of the work and services performed by the Contractor. This estimate will be verified by the Contracting Officer utilizing the progress charts or the CONTRACTOR-PREPARED NETWORK ANALYSIS SYSTEM submitted by the Contractor and independent analyses of progress. See Contract Clause entitled PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS for additional information.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

SECTION 01312

QUALITY CONTROL SYSTEM

PART 1 GENERAL

1.1 GENERAL

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. The Contractor module, user manuals, updates, and training information can be downloaded from the RMS web site.This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

Administration
Finances
Quality Control
Scheduling
Import/Export of Data

1.1.1 Correrspondence and Electronic Communications

For ease and speed of communications, both Government and Contractor will, to the maximum extent feasible, exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

1.2 OTHER FACTORS

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01320 PROJECT SCHEDULE, Section 01330 SUBMITTAL PROCEDURES, and Section 01451 ContractorR QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

1.3 QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor shall be responsible to download, install and use the latest version of the QCS software from the Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on 3-1/2 inch high-density diskettes or CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

1.4 SYSTEM REQUIREMENTS

The following is the minimum system configuration that the Contractor shall have to run QCS:

QCS and QAS System

Hardware

IBM-compatible PC with 1000 MHz Pentium or higher processor

256+ MB RAM for workstation / 512+ MB RAM for server

1 GB hard drive disk space for sole use by the QCS system

3-1/2 inch high-density floppy drive

Compact Disk (CD) Reader 8x speed or higher

SVGA or higher resolution monitor (1024x768, 256 colors)

Mouse or other pointing device

Windows compatible printer. (Laser printer must have 4 MB+ of RAM)

Connection to the Internet, minimum 56k BPS

Software

MS Windows 2000 or higher

QAS-Word Processing software: MS Word 2000 or newer

Latest version of: Netscape Navigator, Microsoft Internet Explorer, or other browser that supports HTML 4.0 or higher

Electronic mail (E-mail) MAPI compatible

Virus protection software that is regularly upgraded with all issued manufacturer's updates

1.5 RELATED INFORMATION

1.5.1 QCS User Guide

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website; the Contractor can obtain the current address from the Government. In case of justifiable difficulties, the Government will provide the Contractor with a CD-ROM containing these instructions.

1.5.2 Contractor Quality Control(CQC) Training

The use of QCS will be discussed with the Contractor's QC System Manager during the mandatory CQC Training class.

1.6 CONTRACT DATABASE

Prior to the pre-construction conference, the Government shall provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by files attached to E-mail. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

1.7 DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in the QCS database throughout the duration of the contract. The Contractor shall establish and maintain the QCS database at the Contractor's site office. Data updates to the Government shall be submitted by E-mail with file attachments, e.g., daily reports, schedule updates, payment requests. If permitted by the Contracting Officer, a data diskette or CD-ROM may be used instead of E-mail (see Paragraph DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM). The QCS database typically shall include current data on the following items:

1.7.1 Administration

1.7.1.1 Contractor Information

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format via E-mail.

1.7.1.2 Subcontractor Information

The database shall contain the name, trade, address, phone numbers, and other required information for all subContractors. A subContractor must be listed separately for each trade to be performed. Each subContractor/trade shall be assigned a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subContractor administrative data in electronic format via E-mail.

1.7.1.3 Correspondence

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main) office shall be prefixed with "H". Letters shall be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

1.7.1.4 Equipment

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

1.7.1.5 Management Reporting

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective

of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC comments, Submittal Register Status, Three-Phase Inspection checklists.

1.7.2 Finances

1.7.2.1 Pay Activity Data

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

1.7.2.2 Payment Requests

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet and include it with the payment request. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment requests with supporting data by E-mail with file attachment(s). If permitted by the Contracting Officer, a data diskette may be used instead of E-mail. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

1.7.3 Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other Contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01451, ContractorR QUALITY CONTROL. Within seven calendar days of Government acceptance, the Contractor shall submit a data diskette or CD-ROM reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

1.7.3.1 Daily Contractor Quality Control (CQC)

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by Section 01451, ContractorR QUALITY CONTROL. Reports shall be submitted electronically to the Government using E-mail or diskette within 24 hours after the date covered by the report. Use of either mode of submittal shall be coordinated with the Government representative. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

1.7.3.2 Deficiency Tracking

The Contractor shall use QCS to track deficiencies. Deficiencies

identified by the Contractor will be numerically tracked using QC punch list items. The Contractor shall maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch list items will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of both QC and QA punch list items.

1.7.3.3 Three-Phase Control Meetings

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

1.7.3.4 Accident/Safety Tracking

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any accidents occurring on the jobsite. This brief supplemental entry is not to be considered as a substitute for completion of mandatory reports, e.g., ENG Form 3394 and OSHA Form 300.

1.7.3.5 Features of Work

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

1.7.3.6 QC Requirements

The Contractor shall develop and maintain a complete list of QC testing, transferred and installed property, and user training requirements in QCS. The Contractor shall update all data on these QC requirements as work progresses, and shall promptly provide this information to the Government via QCS.

1.7.4 Submittal Management

The Government will provide the initial submittal register in electronic format. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update shall be produced using QCS. RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

1.7.5 Schedule

The Contractor shall develop a construction schedule consisting of pay activities, in accordance with Contract Clause "Schedules for Construction Contracts", or Section 01320A, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually or by using the Standard Data Exchange Format (SDEF) (see Section 01320

PROJECT SCHEDULE). The updated schedule data shall be included with each pay request submitted by the Contractor.

1.7.6 Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data, and schedule data using SDEF.

1.8 IMMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

1.9 DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM

The Government-preferred method for Contractor's submission of updates, payment requests, correspondence and other data is by E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of computer diskettes or CD-ROM for data transfer. Data on the disks or CDs shall be exported using the QCS built-in export function. If used, diskettes and CD-ROMs will be submitted in accordance with the following:

1.9.1 File Medium

The Contractor shall submit required data on 3-1/2 inch double-sided high-density diskettes formatted to hold 1.44 MB of data, capable of running under Microsoft Windows 95 or newer. Alternatively, CD-ROMs may be used. They shall conform to industry standards used in the United States. All data shall be provided in English.

1.9.2 Disk or CD-ROM Labels

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

1.9.3 File Name

The Government will provide the file names to be used by the Contractor with the QCS software.

1.10 MONTHLY COORDINATION MEETING

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, the Contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions. The Contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an

acceptable QCS export file is received.

1.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. 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.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

SECTION 01320

PROJECT SCHEDULE

PART 1 GENERAL

1.1 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS, a Project Schedule as described below shall be prepared. The scheduling of design and construction shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. SubContractors, suppliers and Designers, working on the project shall also contribute in developing and maintaining an accurate Project Schedule. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.

3.2 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel will result in an inability of the Contracting Officer to evaluate Contractor's progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the disapproval of the entire Project Schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made.

3.3 PROJECT SCHEDULE

The computer software system utilized by the Contractor to produce the Project Schedule shall be capable of providing all requirements of this specification. Failure of the Contractor to meet the requirements of this specification shall result in the disapproval of the schedule. Manual methods used to produce any required information shall require approval by the Contracting Officer.

3.3.1 Use of the Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The Contractor shall provide the Project Schedule in the Precedence Diagram Method (PDM).

3.3.2 Level of Detail Required

The Project Schedule shall include an appropriate level of detail. Failure to develop or update the Project Schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the schedule. The Contracting Officer will use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the Project Schedule:

3.3.2.1 Activity Durations

Contractor submissions shall follow the direction of the Contracting Officer regarding reasonable activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods (usually less than 2 percent of all non-procurement activities' Original Durations are greater than 20 days).

3.3.2.2 Design and Permit Activities

Design and permitting activities, including necessary conferences and follow-up actions and design package submission dates, shall be integrated into the schedule.

3.3.2.3 Procurement Activities

Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, and delivery.

3.3.2.4 Critical Activities

The following activities shall be listed as separate line activities on the Contractor's project schedule:

a. Submission and approval of mechanical/electrical layout drawings.
b. Submission and approval of O & M manuals.
c. Submission and approval of as-built drawings.
d. Submission and approval of 1354 data and installed equipment lists.
e. Submission and approval of testing and air balance (TAB).
f. Submission of TAB specialist design review report.
g. Submission and approval of fire protection specialist.
h. Submission and approval of testing and balancing of HVAC plus commissioning plans and data.
i. Air and water balance dates.
j. Facility commissioning plan and dates.
k. Controls testing plan (including SCADA and EMCS).
l. Controls testing.
m. Performance Verification testing.
n. Other systems testing, if required.
o. Prefinal inspection.
p. Correction of punchlist from prefinal inspection.
q. Final inspection.

3.3.2.5 Government Activities

Government and other agency activities that could impact progress shall be shown. These activities include, but are not limited to: approvals, design reviews, environmental permit approvals by State regulators, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

3.3.2.6 Responsibility

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, Contractor work force, or government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

3.3.2.7 Work Areas

All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

3.3.2.8 Modification or Claim Number

Any activity that is added or changed by contract modification or used to justify claimed time shall be identified by a mod or claim code that changed the activity. Activities shall not belong to more than one modification or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number. Whenever possible, changes shall be added to the schedule by adding new activities. Existing activities shall not normally be changed to reflect modifications.

3.3.2.9 Bid Item

All activities shall be identified in the project schedule by the Bid Item to which the activity belongs. An activity shall not contain work in more than one bid item. The bid item for each appropriate activity shall be identified by the Bid Item Code.

3.3.2.10 Phase of Work

All activities shall be identified in the project schedule by the phases of work in which the activity occurs. Activities shall not contain work in more than one phase of work. The project phase of each activity shall be by the unique Phase of Work Code.

3.3.2.11 Category of Work

All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers, but is not limited, to the procurement chain of activities including such items as design package submissions design reviews, review conferences, permits, submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work Code.

3.3.2.12 Feature of Work

All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to, a work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work Code.

3.3.3 Scheduled Project Completion

The schedule interval shall extend from NTP to the contract completion date.

3.3.3.1 Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. The Contractor shall include as the first activity in the project schedule an activity called "Start Project". The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

3.3.3.2 Constraint of Last Activity

Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.3.3 Early Project Completion

In the event the project schedule shows completion of the project prior to the contract completion date, the Contractor shall identify those activities that have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. Contractor shall specifically address each of the activities noted in the narrative report at every project schedule update period to assist the Contracting Officer in evaluating the Contractor's ability to actually complete prior to the contract period.

3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.

3.3.4.1 Start Phase

The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and a zero day duration.

3.3.4.2 End Phase

The Contractor shall include as the last activity in a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the

completion date for the project, and a zero day duration.

3.3.4.3 Phase X

The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" activity shall be logically tied to the earliest and latest activities in the phase.

3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Program features which calculate one of these parameters from the other shall be disabled.

3.3.6 Out-of-Sequence Progress

Activities that have posted progress without all preceding logic being satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case approval of the Contracting Officer. The Contractor shall propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule.

3.3.7 Negative Lags

Lag durations contained in the project schedule shall not have a negative value.

3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data disk, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

3.4.1 Preliminary Project Schedule Submission

The Preliminary Project Schedule, defining the Contractor's planned operations for the first 60 calendar days shall be submitted for approval within 20 calendar days after the NTP is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed 60 calendar days after NTP.

3.4.2 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 40 calendar days after NTP. The schedule shall provide a reasonable sequence of activities which represent work through the entire project and shall be at a reasonable level of detail.

3.4.3 Periodic Schedule Updates

Based on the result of progress meetings, specified in "Periodic Progress Meetings," the Contractor shall submit periodic schedule updates. These submissions shall enable the Contracting Officer to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgement of the Contracting Officer or authorized representative is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

3.4.4 Standard Activity Coding Dictionary

The Contractor shall use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11, Appendix A. This exact structure is mandatory, even if some fields are not used.

3.5 SUBMISSION REQUIREMENTS

The following items shall be submitted by the Contractor for the preliminary submission, initial submission, and every periodic project schedule update throughout the life of the project:

3.5.1 Data Disks

Two data disks containing the project schedule shall be provided. Data on the disks shall adhere to the SDEF format specified in ER 1-1-11, Appendix A.

3.5.1.1 File Medium

Required data shall be submitted on CD ROM Disks, unless otherwise approved by the Contracting Officer.

3.5.1.2 Disk Label

A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Preliminary, Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number of person responsible for the schedule, and the operating system version used to format the disk.

3.5.1.3 File Name

Each file submitted shall have a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will ensure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for approval.

3.5.2 Narrative Report

A Narrative Report shall be provided with the preliminary, initial, and each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or

required to be taken. The narrative report is expected to relay to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through that analysis.

3.5.3 Approved Changes Verification

Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

3.5.4 Schedule Reports

The format for each activity for the schedule reports listed below shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float. Actual Start and Actual Finish Dates shall be printed for those activities in progress or completed.

3.5.4.1 Activity Report

A list of all activities sorted according to activity number.

3.5.4.2 Logic Report

A list of Preceding and Succeeding activities for every activity in ascending order by activity number. Preceeding and succeeding activities shall include all information listed above in paragraph Schedule Reports. A blank line shall be left between each activity grouping.

3.5.4.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates. Completed activities shall not be shown on this report.

3.5.4.4 Earnings Report

A compilation of the Contractor's Total Earnings on the project from the NTP until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements made in the field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by bid item and sorted by activity numbers. This report shall: sum all activities in a bid item and provide a bid item percent; and complete and sum all bid items to provide a total project percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

3.5.5 Network Diagram

The network diagram shall be required on the initial schedule submission and on monthly schedule update submissions. The network diagram shall

depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity number, description, duration, and estimated earned value shall be shown on the diagram.

3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.5.3 Critical Path

The critical path shall be clearly shown.

3.5.5.4 Banding

Activities shall be grouped to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

3.5.5.5 S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

3.6 PERIODIC PROGRESS MEETINGS

Progress meetings to discuss payment shall include a monthly onsite meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor shall describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project. The Contracting Officer will approve activity progress, proposed revisions, and adjustments as appropriate.

3.6.1 Meeting Attendance

The Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

3.6.2 Update Submission Following Progress Meeting

A complete update of the project schedule containing all approved progress, revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than 4 working days after the monthly progress meeting.

3.6.3 Progress Meeting Contents

Update information, including Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost-to-Date shall be subject to the approval of the Contracting Officer. As a minimum, the Contractor shall address the following items on an activity by activity basis during each progress meeting.

3.6.3.1 Start and Finish Dates

The Actual Start and Actual Finish dates for each activity currently in-progress or completed.

3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations shall be based on Remaining Duration for each activity.

3.6.3.3 Cost Completion

The earnings for each activity started. Payment will be based on earnings for each in-progress or completed activity. Payment for individual activities will not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

3.6.3.4 Logic Changes

All logic changes pertaining to NTP on change orders, change orders to be incorporated into the schedule, Contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, lag durations, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

3.6.3.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities include: 1) delays beyond the Contractor's control, such as strikes and unusual weather. 2) delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning the work necessary. 3) Changes required to correct a schedule which does not represent the actual or planned prosecution and progress of the work.

3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor requests an extension of the contract completion date, or any interim milestone date, the Contractor shall furnish the following for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract: justification, project schedule data, and supporting evidence as the Contracting Officer may deem necessary. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

3.7.1 Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request. The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, will not be a cause for a time extension to the contract completion date.

3.7.2 Submission Requirements

The Contractor shall submit a justification for each request for a change in the contract completion date of under 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

a. A list of affected activities, with their associated project schedule activity number.

b. A brief explanation of the causes of the change.

c. An analysis of the overall impact of the changes proposed.

d. A sub-network of the affected area.

Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

3.7.3 Additional Submission Requirements

For any requested time extension of over 2 weeks, the Contracting Officer may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within 4 days of the Contracting Officer's request.

3.8 DIRECTED CHANGES

If the NTP is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The proposed revisions to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, the Contractor shall advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

-- End of Section --

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Submittal

Contract Clauses "FAR 52.236-5, Material and Workmanship," paragraph (b) and "FAR 52.236-21, Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals."

1.1.2 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by SD numbers and titles as follows.

SD-01 Preconstruction Submittals

Certificates of insurance.
Surety bonds.
List of proposed subcontractors.
List of proposed products.
Construction Progress Schedule.
Submittal register.
Schedule of prices.
Health and safety plan.
Work plan.
Quality control plan.
Environmental protection plan.

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

This Data is intended to be incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

1.1.3 Approving Authority

Office or designated person authorized to approve submittal.

1.1.4 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.2 SUBMITTAL IDENTIFICATION

Submittals required are identified by SD numbers and titles as follows:

SD-01 Preconstruction Submittals
SD-02 Shop Drawings
SD-03 Product Data
SD-04 Samples
SD-05 Design Data
SD-06 Test Reports
SD-07 Certificates
SD-08 Manufacturer's Instructions
SD-09 Manufacturer's Field Reports

SD-10 Operation and Maintenance Data
SD-11 Closeout Submittals

1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.3.1 Government Approved

Government approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.3.2 Information Only

All submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.4 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.5 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1.6 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all

submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) System Manager and each item shall be stamped, signed, and dated by the CQC System Manager indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

3.2 SUBMITTAL REGISTER

The Contractor shall maintain a submittal register for the project in accordance with Section 01312 QUALITY CONTROL SYSTEM (QCS).

3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 15 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals. An additional 15 calendar days shall be allowed and shown on the register for review and approval of submittals for food service equipment and refrigeration and HVAC control systems.

3.4 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) attached to this section shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms are included in the RMS-QC software that the Contractor is required to use for this contract. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

3.5.1 Procedures

The Contractor shall submit eight (8) copies; each submittal requiring Government approval.

3.5.2 Deviations

For submittals which include proposed deviations requested by the

Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

3.6 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3.7 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. Four (4) copies of the submittal will be retained by the Contracting Officer and four (4) copies of the submittal will be returned to the Contractor.

3.8 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

3.9 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR

(Firm Name)

_____ Approved

_____ Approved with corrections as noted on submittal data and/or attached sheets(s).

SIGNATURE: _____

TITLE: _____

DATE: _____

-- End of Section --

SECTION 01335

SUSTAINABLE DESIGN AND DEVELOPMENT

PART 1 GENERAL

1.1 DESCRIPTION

a. This project has been designed for, and shall be developed for a sustainable rating of gold in accordance with SPiRiT 1.4.1. Table 1 identifies the SPiRiT credit items that are designed into or otherwise required for this project. No variations or substitutions to the SPiRiT credits identified for this contract shall be allowed without written consent from the Contracting Officer. Should there be a case where there is any problem meeting the full requirements of a SPiRiT credit identified for this project in Table 1, the Contractor must bring this to the attention of the Contracting Officer immediately.

b. The Contractor shall provide and assemble under separate cover documentation verifying compliance with SPiRiT requirements as listed in this specification and as otherwise identified within the Technical Specifications. Some SPiRiT credits are inherent in the design provided and require no further submittal or documentation. For these credits, the Contractor shall familiarize himself with the project features that relate to them so that no action contrary to the design intent is inadvertently taken during construction. Some SPiRiT credits involve material selection and are generally identified within the Technical Specification with the notation "SDD", though not specifically identified in all occurrences. Some SPiRiT credits are dependent on construction practices.

c. All SPiRiT credits identified in Table 1 under the columns "Material Selection" and "Construction Practices" shall be documented by the Contractor. Table 1 provides a general summary of types of action, submittals required and specification references. Detailed documentation on submittal requirements is contained in the Technical Specifications and paragraph 1.4 below. Some of the SPiRiT points may have common traits between items inherent in the design and those involving material selection or construction practices. In this case, the Contractor shall only document those items pertaining to material selection or construction practices.

d. In all cases where a material, product or execution requirement is identified as a sustainable feature ("SDD") elsewhere in the contract documents, additional data or certificates shall be submitted with the individual component or process validating the material or component to the respective SPiRiT credit item. This additional data or certificates shall be separable from the other submitted data and a copy shall be included in the SPiRiT Documentation Notebook in addition to the distribution indicated in the submittal register.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office

that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

SPiRiT Compliance Plan

A detailed plan identifying all construction practices, procurement data or cumulative calculations of components required for SPiRiT credit that must be identified and tracked during the course of construction. Plan shall indicate the SPiRiT credit being tracked or documented, individual components of the SPiRiT credit related items, dates of submittal of individual components of the SPiRiT credit related items, and proposed method of tracking in accordance with SPiRiT 1.4.1 and the Reference Guide Reference Guide.

SD-05 Design Data

SPiRiT Calculations

Calculations showing compliance with a required SPiRiT credit where identified in Table 1 through Table X or within the SPiRiT Compliance Plan. Calculations shall be current and available for review monthly. Final calculations should be included in the SPiRiT Documentation Notebook under the appropriate tab.

SD-11 Closeout Submittals

SPiRiT Documentation Notebook

The Contractor shall prepare a comprehensive notebook documenting compliance for each SPiRiT credit identified in Table 1. Notebook shall include product data for material selection where "SDD" is indicated, final calculations, certifications for construction practices, procurement data, cumulative calculations of components of materials throughout the project, and other items as identified in the SPiRiT Compliance Plan. Notebook must contain all required data to support full compliance with the indicated SPiRiT credit. SPiRiT credits that are indicated as inherent to the design will be documented by the designer of record.

SPiRiT Documentation Notebooks shall be formatted to match SPiRiT numbering system and tabbed for each point. Notebooks shall be kept current on a weekly basis and at least one set shall be available on the jobsite at all times. If the Contractor fails to maintain the SPiRiT Documentation Notebooks as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining these Notebooks. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of the Notebooks.

The original and one copy of each notebook shall be submitted at project closeout.

1.3 DOCUMENTATION REQUIREMENTS

SPiRiTLEED credits as identified in Table 1 through Table X shall be incorporated and documented as required by the Technical Specifications and in full compliance with the SPiRiT 1.4.1 and the LEED Reference GuideLEED Reference Guide. SPiRiT Credits not identified elsewhere in the Technical Specifications, or those requiring further instruction are listed below.

1.3.1 SPiRiT Credit 1.C5 Reduced Site Disturbance

Limits of disturbance and/or site restoration requirements are identified in the Contract Documents. The Contractor shall identify in his SPiRiT Compliance Plan controls that will be put in place to ensure compliance with the identified limits.

1.3.2 SPiRiT Credit 3.R1 Fundamental Building System Commissioning

Individual component commissioning requirements are specified in the Technical Specifications where required. The Contractor shall group all reports and results of commissioning into this requirement for Building Systems Commissioning. Refer to the SPiRiT 1.4.1, Sustainable Rating Tool and the Reference Guide Reference Guide.

1.3.3 SPiRiT Credit 4.C2 Construction Waste Management

Notwithstanding the requirements of Section 01572 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT, the Contractor shall include in his SPiRiT Compliance Plan a waste management plan that complies with the requirements of SPiRiT credit 4.C2 to the point level listed in Table 1 through Table X for recycling and/or salvage of at least 50 percent (by weight) of construction, demolition and land clearing waste. The plan should include proposed worksheets for tracking the value used and record keeping requirements for documentation to validate the final value. Refer to SPiRiT 1.4.1, Sustainable Rating Tool and the Reference Guide Reference Guide for definitions and requirements. For this credit performance is measured for the entire project and is not measured separately for each facility/facility type.

1.3.4 SPiRiT credit 4.C4 Recycled Content, Materials and Resources, Credit 4, Recycled Content

Notwithstanding the requirements of Section 01670 RECYCLED/RECOVERED MATERIALS promoting the use of recycled or recovered materials, the Contractor shall include in his SPiRiT Compliance Plan a method of tracking, record keeping and validation that a minimum of 25 percent (by dollar value) of building materials that contain in aggregate a minimum weighted average of 20 percent post-consumer recycled content material OR a minimum weighted average of 40 percent post-industrial recycled content material is used within this project.post-consumer recycled content constitutes at least 5 percent (by dollar value) of the materials in the project OR combined post-consumer and one-half post-industrial recycled content constitutes at least 10 percent (by dollar value) of the materials in the project. An additional 25 percent (50 percent total by dollar value) of building materials that contain in aggregate a minimum weighted average of 20 percent post-consumer recycled content material, OR, a minimum weighted average of 40 percent post-industrial recycled content material is required to gain the second point in this credit. An additional 5 percent (by dollar value) post-consumer recycled content (total 10 percent) of the materials in the project OR an additional 10

percent (by dollar value) combined post-consumer and one-half post-industrial recycled content (20 percent total) of the materials in the project is required to gain the second point in this credit. The plan should include proposed worksheets for tracking the value used and record keeping requirements for documentation to validate the final value. Recycled content worksheet at http://en.sas.usace.army.mil/ae/spreadsheet/4_C4%20Recycle%20Content%20Worksheet.xls may be used. Refer to the SPiRiT 1.4.1 and the Reference Guide Reference Guide for definitions, exclusions and requirements. For this point performance is measured for the entire project and is not measured separately for each facility/facility type.

1.3.5 SPiRiT credit 4.C5 Local/Regional Materials, Materials and Resources, credit 5, Local/Regional Materials

The Contractor shall include in his SPiRiT Compliance Plan a method of tracking, record keeping and validation that a minimum of 20 percent (by dollar value) of building products are manufactured regionally within a radius of 500 miles from the project site. The plan should include proposed worksheets for tracking the value used and record keeping requirements for documentation to validate the final value. Regional Material worksheet at http://en.sas.usace.army.mil "Engineering Criteria" may be used. Refer to the SPiRiT 1.4.1 and the Reference Guide Reference Guide for definitions, exclusions and requirements. For this point performance is measured for the entire project and is not measured separately for each facility/facility type.

1.3.6 SPiRiT Credit 4.C7 Certified Wood

The Contractor shall include in his SPiRiT Compliance Plan a method of tracking, record keeping and validation that a minimum of 50 percent of wood-based materials are certified in accordance with the Forest Stewardship Council guidelines for wood building components including but not limited to framing, flooring, finishes, furnishings, and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers. Refer to the SPiRiT 1.4.1 and the Reference Guide Reference Guide for definitions and requirements.

1.3.7 SPiRiT Credit 5.C3 Construction IAQ Management Plan

The Contractor shall include in his SPiRiT Compliance Plan a Construction Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building that, during construction, meets or exceeds the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995, AND protects stored on-site or installed absorptive materials from moisture damage, AND replaces all filtration media immediately prior to occupancy. Additionally, the plan shall provide for a minimum 2-week building flushout period with new filtration media at 100 percent outside air after construction ends and prior to occupancy. Additionally, the plan shall provide for conducting baseline indoor air quality testing in accordance with paragraph 1.4.9.1, "Baseline IAQ Testing Requirements", with testing done in a minimum of two (2) different locations. Refer to the SPiRiT 1.4.1 and the Reference Guide for definitions and requirements.

1.3.7.1 Baseline IAQ Testing Requirements

a. HVAC System Verification: To assure compliance with recognized standards for indoor air quality including NSA Standards, latest version, the Contractor's independent testing and balancing agency shall verify the performance of each HVAC system including space temperature and space humidity uniformity, outside air quantity, filter installation, drain pan operation and any obvious contamination sources.

b. Indoor Air Quality Testing: Upon verification of HVAC system operation, the Contractor shall hire an independent Contractor, subject to the approval by the Contracting Officer's Representative, with a minimum of 5 years' experience in performing the types of testing specified herein, to test levels of indoor air contaminants for compliance with specified requirements.

1) A test plan shall be submitted for approval of the Contracting Officer's Representative. The plan shall specify procedures, times, instrumentation and sampling methods that will be employed.

2) Contaminant levels shall be measured in areas agreed upon by the Contractor and the Contracting Officer's Representative. Areas with very high outside air ventilation rates such as laboratories are excluded from these testing requirements. The Contracting Officer's Representative is the sole judge of areas exempt from testing.

3) Collect air samples on three consecutive days during normal business hours (between the hours of 8:00 am and 5:00 pm) with building operating at normal HVAC rates. Average the results of each three-day test cycle to determine compliance or non-compliance of indoor air quality for each air handling zone tested.

4) Sample and record outside air levels of formaldehyde and TVOC contaminants at outside air intake of each respective air handling unit simultaneously with indoor tests to establish basis of comparison for these contaminant levels. Indoor testing will be done in the breathing zone; between 4 feet and 7 feet from the floor.

5) Acceptance of respective portions of buildings by the Government is subject to compliance with specified limits of indoor air quality contaminant levels.

c. Compliance: Indoor air quality shall conform to the following standards and limits:

1) Carbon Monoxide: Not to exceed 9 ppm.

2) Carbon Dioxide: Not to exceed 800 ppm.

3) Airborne Mold and Mildew: Simultaneous indoor and outdoor readings.

4) Maximum Air Concentration Standards: Indoor room air concentration levels, emission rates and qualities of the listed

contaminants shall not exceed the limits specified in Maximum Indoor Air Concentration Standards Table below.

d. Test Reports: Prepare test reports showing the results and location of each test, a summary of the HVAC operating conditions, a listing of any discrepancies and recommendations for corrective actions, if required.

1) Include certification of test equipment calibration with each test report.

e. If any test fails the standard, the Contractor is responsible to ventilate the building with 100 percent outside air until the building passes both air quality tests and duct inspections. Retesting shall be performed at no expense to the Government.

MAXIMUM INDOOR AIR CONCENTRATION STANDARDS TABLE

Indoor Contaminants	Allowable Air Concentration Levels*
Formaldehyde	<20 micrograms per cubic meter**
Total Volatile Organic Compound (TVOC)	<200 micrograms per cubic meter**
4-Phenylcyclohexene (4~PC)***	<3 micrograms per cubic meter
Total Particulates (PM)	<20 micrograms per cubic meter
Regulated Pollutants	<NAAQS

* All levels must be achieved prior to acceptance of the building.
** Above outside air concentrations.
*** 4-phenylcyclohexene is an odorous contaminant constituent in carpets with styrene-butadienelatex rubber (SBR).

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL

SPiRiT credits as identified in Table 1 below are contract requirements and shall be incorporated in full compliance with the SPiRiT 1.4.1 and the Reference Guide.

-- End of Section --

SECTION 01355

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 REFERENCES

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

U.S. AIR FORCE (USAF)

AFI 32-1053	(1999) Pest Management Program

U.S. ARMY (DA)

DA AR 200-5	(1999) Pest Management

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) Safety -- Safety and Health Requirements
WETLAND MANUAL	Corps of Engineers Wetlands Delineation Manual Technical Report Y-87-1

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

33 CFR 328	Definitions of Waters of the United States
40 CFR 152 - 186	Pesticide Programs
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 279	Standards for the Management of Used Oil
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 355	Emergency Planning and Notification
40 CFR 68	Chemical Accident Prevention Provisions
49 CFR 171 - 178	Hazardous Materials Regulations

1.2 DEFINITIONS

1.2.1 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally and/or historically.

1.2.2 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.3 Contractor Generated Hazardous Waste

Contractor generated hazardous waste means materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene etc.), waste thinners,excess paints, excess solvents, waste solvents, and excess pesticides, and contaminated pesticide equipment rinse water.

1.2.4 Installation Pest Management Coordinator

Installation Pest Management Coordinator (IPMC) is the individual officially designated by the Installation Commander to oversee the Installation Pest Management Program and the Installation Pest Management Plan.

1.2.5 Project Pesticide Coordinator

The Project Pesticide Coordinator (PPC) is an individual that resides at a Civil Works Project office and that is responsible for oversight of pesticide application on Project grounds.

1.2.6 Land Application for Discharge Water

The term "Land Application" for discharge water implies that the Contractor shall discharge water at a rate which allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" shall occur. Land Application shall be in compliance with all applicable Federal, State, and local laws and regulations.

1.2.7 Pesticide

Pesticide is defined as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, or intended for use as a plant regulator, defoliant or desiccant.

1.2.8 Pests

The term "pests" means arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds and other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.

1.2.9 Surface Discharge

The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers,creeks, and/or "waters of the United States" and would require a permit to discharge water from the governing agency.

1.2.10 Waters of the United States

All waters which are under the jurisdiction of the Clean Water Act, as defined in 33 CFR 328.

1.2.11 Wetlands

Wetlands means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and bogs. Official determination of whether or not an area is classified as a wetland must be done in accordance with WETLAND MANUAL.

1.3 GENERAL REQUIREMENTS

The Contractor shall minimize environmental pollution and damage that may occur as the result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract. The Contractor shall comply with all applicable environmental Federal, State, and local laws and regulations. The Contractor shall be responsible for any delays resulting from failure to comply with environmental laws and regulations.

1.4 SUBCONTRACTORS

The Contractor shall ensure compliance with this section by subcontractors.

1.5 PAYMENT

No separate payment will be made for work covered under this section. The Contractor shall be responsible for payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor. All costs associated with this section shall be included in the contract price. The Contractor shall be responsible for payment of all fines/fees for violation or non-compliance with Federal, State, Regional and local laws and regulations.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Environmental Protection Plan; G

The environmental protection plan.

1.7 ENVIRONMENTAL PROTECTION PLAN

Prior to commencing construction activities or delivery of materials to the site, the Contractor shall submit an Environmental Protection Plan for review and approval by the Contracting Officer. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during construction. Issues of concern shall be defined within the Environmental Protection Plan as outlined in this section. The Contractor shall address each topic at a level of detail commensurate with the environmental issue and required construction task(s). Topics or issues which are not identified in this section, but which the Contractor considers necessary, shall be identified and discussed after those items formally identified in this section. Prior to submittal of the Environmental Protection Plan, the Contractor shall meet with the Contracting Officer for the purpose of discussing the implementation of the initial Environmental Protection Plan; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's Environmental Plans. The Environmental Protection Plan shall be current and maintained onsite by the Contractor.

1.7.1 Compliance

No requirement in this Section shall be construed as relieving the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During Construction, the Contractor shall be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.

1.7.2 Contents

The environmental protection plan shall include, but shall not be limited to, the following:

a. Name(s) of person(s) within the Contractor's organization who is(are) responsible for ensuring adherence to the Environmental Protection Plan.

b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site, if applicable.

c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.

d. Description of the Contractor's environmental protection personnel

training program.

e. An erosion and sediment control plan which identifies the type and location of the erosion and sediment controls to be provided. The plan shall include monitoring and reporting requirements to assure that the control measures are in compliance with the erosion and sediment control plan, Federal, State, and local laws and regulations,including, but not limited to, State of Georgia Erosion and Sedimentation Control requirements(Green Book). A Storm Water Pollution Prevention Plan (SWPPP) may be substituted for this plan.

f. Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, security fences, inspection areas, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on the site.

g. Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plan shall include measures to minimize the amount of mud transported onto paved public roads by vehicles or runoff.

h. Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas including methods for protection of features to be preserved within authorized work areas.

i. Drawing showing the location of borrow areas.

j. The Spill Control plan shall include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355, and/or regulated under State or Local laws and regulations. The Spill Control Plan supplements the requirements of EM 385-1-1. This plan shall include as a minimum:

1. The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual shall immediately notify the Contracting Officer and the local Fire Department Facility Environmental Office in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a reportable quantity is released to the environment. The plan shall contain a list of the required reporting channels and telephone numbers.

2. The name and qualifications of the individual who will be responsible for implementing and supervising the containment and cleanup.

3. Training requirements for Contractor's personnel and methods of accomplishing the training.

4. A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.

5. The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup,

restoration, and material-placement equipment available in case of an unforeseen spill emergency.

6. The methods and procedures to be used for expeditious contaminant cleanup.

k. A non-hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris. The plan shall include schedules for disposal. The Contractor shall identify any subContractors responsible for the transportation and disposal of solid waste. Licenses or permits shall be submitted for solid waste disposal sites that are not a commercial operating facility. Evidence of the disposal facility's acceptance of the solid waste shall be attached to this plan during the construction. The Contractor shall attach a copy of each of the Non-hazardous Solid Waste Diversion Reports to the disposal plan. The report shall be submitted on the first working day after the first quarter that non-hazardous solid waste has been disposed and/or diverted and shall be for the previous quarter (e.g. the first working day of January, April, July, and October). The report shall indicate the total amount of waste generated and total amount of waste diverted in cubic yards or tons along with the percent that was diverted.

l. A recycling and solid waste minimization plan with a list of measures to reduce consumption of energy and natural resources. The plan shall detail the Contractor's actions to comply with and to participate in Federal, State, Regional, and local government sponsored recycling programs to reduce the volume of solid waste at the source.

m. An air pollution control plan detailing provisions to assure that dust, debris, materials, trash, etc., do not become air borne and travel off the project site.

n. A contaminant prevention plan that: identifies potentially hazardous substances to be used on the job site; identifies the intended actions to prevent introduction of such materials into the air, water, or ground; and details provisions for compliance with Federal, State, and local laws and regulations for storage and handling of these materials. In accordance with EM 385-1-1, a copy of the Material Safety Data Sheets (MSDS) and the maximum quantity of each hazardous material to be on site at any given time shall be included in the contaminant prevention plan. As new hazardous materials are brought on site or removed from the site, the plan shall be updated.

o. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines. If a settling/retention pond is required, the plan shall include the design of the pond including drawings, removal plan, and testing requirements for possible pollutants. If land application will be the method of disposal for the waste water, the plan shall include a sketch showing the location for land application along with a description of the pretreatment methods to be implemented. If surface discharge will be the method of disposal, a copy of the permit and associated documents shall be included as an attachment prior to discharging the waste water. If disposal is to a sanitary sewer, the plan shall include documentation that the Waste Water Treatment Plant Operator has

approved the flow rate, volume, and type of discharge.

p. A historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on the project site: and/or identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in the area are discovered during construction. The plan shall include methods to assure the protection of known or discovered resources and shall identify lines of communication between Contractor personnel and the Contracting Officer.

q. A pesticide treatment plan shall be included and updated, as information becomes available. The plan shall include: sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (i.e. pounds of active ingredient applied), equipment used for application and calibration of equipment. The Contractor is responsible for Federal, State, Regional and Local pest management record keeping and reporting requirements as well as any additional Installation Project Office specific requirements. The Contractor shall follow [DA AR 200-5 Pest Management, Chapter 2, Section III "Pest Management Records and Reports" for data required to be reported to the Installation] [AFI 32-1053 Sections 3.4.13 and 3.4.14 for data required to be reported to the Installation.]

1.7.3 Appendix

Copies of all environmental permits, permit application packages, approvals to construct, notifications, certifications, reports, and termination documents shall be attached,as an appendix, to the Environmental Protection Plan.

1.8 PROTECTION FEATURES

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey. Immediately following the survey, the Contractor shall prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. This survey report shall be signed by both the the Contractor and the Contracting Officer upon mutual agreement as to its accuracy and completeness. The Contractor shall protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference which their preservation may cause to the Contractor's work under the contract.

1.9 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations, requested by the Contractor, from the drawings,plans and specifications which may have an environmental impact will be subject to approval by the Contracting Officer and may require an extended review,

processing, and approval time. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

1.10 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with Federal, State or local environmental laws or regulations, permits, and other elements of the Contractor's Environmental Protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or equitable adjustments allowed to the Contractor for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 ENVIRONMENTAL PERMITS AND COMMITMENTS

The Contractor shall be responsible for obtaining and complying with all environmental permits and commitments required by Federal, State, Regional, and local environmental laws and regulations.

3.2 LAND RESOURCES

The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the Contractor shall identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. The Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, soil, or other materials displaced into uncleared areas shall be removed by the Contractor.

3.2.1 Work Area Limits

Prior to commencing construction activities, the Contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are not to be disturbed shall be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, any markers shall be visible in the dark. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

3.2.2 Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features

indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work area.

3.2.3 Erosion and Sediment Controls

The Contractor shall be responsible for providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum. The Contractor shall construct or install temporary and permanent erosion and sediment control best management practices (BMPs) as specified in Section 01356 STORM WATER POLLUTION PREVENTION MEASURES. BMPs may include, but not be limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. The Contractor's best management practices shall also be in accordance with the _____ National Pollutant Discharge Elimination System (NPDES) Storm Water Pollution Prevention Plan (SWPPP) which may be reviewed at the GA Environmental Office. Any temporary measures shall be removed after the area has been stabilized.

3.2.4 Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only when approved. Erosion and sediment controls shall be provided for on-site borrow and spoil areas to prevent sediment from entering nearby waters. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas.

3.3 WATER RESOURCES

The Contractor shall monitor construction activities to prevent pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation unless otherwise indicated. All water areas affected by construction activities shall be monitored by the Contractor. For construction activities immediately adjacent to impaired surface waters, the Contractor shall be capable of quantifying sediment or pollutant loading to that surface water when required by State or Federally issued Clean Water Act permits.

3.3.1 Cofferdams, Diversions, and Dewatering Operations

Construction operations for dewatering shall be controlled at all times to maintain compliance with existing State water quality standards and designated uses of the surface water body. The Contractor shall comply with the State of Georgia water quality standards and anti-degradation provisions.

3.3.2 Stream Crossings

Stream crossings shall allow movement of materials or equipment without

violating water pollution control standards of the Federal, State, and local governments.

3.3.3 Wetlands

The Contractor shall not enter, disturb, destroy, or allow discharge of contaminants into any wetlands. The Contractor shall be responsible for the protection of wetlands shown on the drawings in accordance with paragraph ENVIRONMENTAL PERMITS, REVIEWS, AND APPROVALS. Authorization to enter specific wetlands identified shall not relieve the Contractor from any obligation to protect other wetlands within, adjacent to, or in the vicinity of the construction site and associated boundaries.

3.4 AIR RESOURCES

Equipment operation, activities, or processes performed by the Contractor shall be in accordance with all Federal and State air emission and performance laws and standards.

3.4.1 Particulates

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the Federal, State, and local air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs. The Contractor shall comply with all State and local visibility regulations.

3.4.2 Odors

Odors from construction activities shall be controlled at all times. The odors shall not cause a health hazard and shall be in compliance with State regulations and/or local ordinances.

3.4.3 Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize environment damage by noise. The Contractor shall comply with the provisions of the State of Georgia rules.

3.4.4 Burning

Burning shall be prohibited on the Government premises. Burning will not be allowed on the project site unless specified in other sections of the specifications or authorized in writing by the Contracting Officer. The specific time, location, and manner of burning shall be subject to approval.

3.5 CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

Disposal of wastes shall be as directed below, unless otherwise specified in other sections and/or shown on the drawings.

3.5.1 Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling, storage, and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill shall be the minimum acceptable off-site solid waste disposal option. The Contractor shall verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. The Contractor shall comply with Federal, State, and local laws and regulations pertaining to the use of landfill areas.

3.5.2 Chemicals and Chemical Wastes

Chemicals shall be dispensed ensuring no spillage to the ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. This documentation will be periodically reviewed by the Government. Chemical waste shall be collected in corrosion resistant, compatible containers. Collection drums shall be monitored and removed to a staging or storage area when contents are within 6 inches of the top. Wastes shall be classified, managed, stored, and disposed of in accordance with Federal, State, and local laws and regulations.

3.5.3 Contractor Generated Hazardous Wastes/Excess Hazardous Materials

Hazardous wastes are defined in 40 CFR 261, or are as defined by applicable State and local regulations. Hazardous materials are defined in 49 CFR 171 - 178. The Contractor shall, at a minimum, manage and store hazardous waste in compliance with 40 CFR 262 and shall manage and store hazardous waste in accordance with the Installation hazardous waste management plan. The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. The Contractor shall segregate hazardous waste from other materials and wastes, shall protect it from the weather by placing it in a safe covered location, and shall take precautionary measures such as berming or other appropriate measures against accidental spillage. The Contractor shall be responsible for storage, describing, packaging, labeling, marking, and placarding of hazardous waste and hazardous material in accordance with 49 CFR 171 - 178, State, and local laws and regulations. The Contractor shall transport Contractor generated hazardous waste off Government property within 60 days in accordance with the Environmental Protection Agency and the Department of Transportation laws and regulations. The Contractor shall dispose of hazardous waste in compliance with Federal, State and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the Contracting Officer and the Facility Environmental Office. Cleanup and cleanup costs due to spills shall be the Contractor's responsibility. The disposition of Contractor generated hazardous waste and excess hazardous materials are the Contractor's responsibility. The Contractor shall coordinate the disposition of hazardous waste with the Facility's Hazardous Waste Manager and the Contracting Officer.

3.5.4 Fuel and Lubricants

Storage, fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants and oil shall be managed and stored in accordance with all Federal, State, Regional, and local laws and regulations. Used lubricants and used oil to be discarded shall be stored in marked corrosion-resistant containers and recycled or disposed in accordance with 40 CFR 279, State, and local laws and regulations. Storage of fuel on the project site shall be accordance with all Federal, State, and local laws and regulations. Maintain security distance from all buildings per AT/FP Requirements.

3.5.5 Waste Water

Disposal of waste water shall be as specified below.

a. Waste water from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, forms, etc. shall not be allowed to enter water ways or to be discharged prior to being treated to remove pollutants. The Contractor shall dispose of the construction related waste water off-Government property in accordance with all Federal, State, Regional and Local laws and regulations. or by collecting and placing it in a retention pond where suspended material can be settled out and/or the water can evaporate to separate pollutants from the water. The site for the retention pond shall be coordinated and approved with the Contracting Officer. The residue left in the pond prior to completion of the project shall be removed, tested, and disposed off-Government property in accordance with Federal, State, and local laws and regulations.

b. For discharge of ground water, the Contractor shall surface discharge in accordance with all Federal, State, and local laws and regulations.

c. Water generated from the flushing of lines after disinfection or disinfection in conjunction with hydrostatic testing shall be land applied in accordance with all Federal, State, and local laws and regulations for land application.

3.6 RECYCLING AND WASTE MINIMIZATION

The Contractor shall participate in State and local government sponsored recycling programs. The Contractor is further encouraged to minimize solid waste generation throughout the duration of the project.

3.7 NON-HAZARDOUS SOLID WASTE DIVERSION REPORT

The Contractor shall develop, maintain and implement, a C&D Waste Management Plan to achieve the required 50 percent minimum diversion of construction and demolition (C&D) waste by weight, from landfill disposal. The principles of the C&D Plan will be incorporated into and be compliant with the updated installation Integrated Solid Waste Management Plan (ISWMP).

The Contractor shall maintain an inventory of non-hazardous solid waste diversion and disposal of construction and demolition debris. The

Contractor shall submit a report to the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that non-hazardous solid waste has been generated. The following shall be included in the report:

a. Construction and Demolition (C&D) Debris Disposed = _____ in cubic yards or tons, as appropriate.

b. Construction and Demolition (C&D) Debris Recycled = _____ in cubic yards or tons, as appropriate.

c. Total C&D Debris Generated = _____ in cubic yards or tons, as appropriate.

d. Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount) = _____ in cubic yards or tons, as appropriate.

3.8 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. The Contractor shall cease all activities that may result in impact to or the destruction of these resources. The Contractor shall secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

3.9 BIOLOGICAL RESOURCES

The Contractor shall minimize interference with, disturbance to, and damage to fish, wildlife, and plants including their habitat. The Contractor shall be responsible for the protection of threatened and endangered animal and plant species including their habitat in accordance with Federal, State, Regional, and local laws and regulations.

3.10 INTEGRATED PEST MANAGEMENT

In order to minimize impacts to existing fauna and flora, the Contractor, through the Contracting Officer, shall coordinate with the Installation Pest Management Coordinator (IPMC) at the earliest possible time prior to pesticide application. The Contractor shall discuss integrated pest management strategies with the IPMC and receive concurrence from the IPMC PPC through the COR prior to the application of any pesticide associated with these specifications. Installation Project Office Pest Management personnel shall be given the opportunity to be present at all meetings concerning treatment measures for pest or disease control and during application of the pesticide. For termiticide requirements see Section 02360 SOIL TREATMENT FOR SUBTERRANEAN TERMITE CONTROL. The use and management of pesticides are regulated under 40 CFR 152 - 186.

3.10.1 Pesticide Delivery and Storage

Pesticides shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses. Pesticides shall be stored according to manufacturer's instructions and under lock and key when unattended.

3.10.2 Qualifications

For the application of pesticides, the Contractor shall use the services of a subContractor whose principal business is pest control. The subContractor shall be licensed and certified in the state where the work is to be performed.

3.10.3 Pesticide Handling Requirements

The Contractor shall formulate, treat with, and dispose of pesticides and associated containers in accordance with label directions and shall use the clothing and personal protective equipment specified on the labeling for use during all phases of the application. Material Safety Data Sheets (MSDS)shall be available for all pesticide products.

3.10.4 Application

Pesticides shall be applied by a State Certified Pesticide Applicator in accordance with EPA label restrictions and recommendation. The Certified Applicator shall wear clothing and personal protective equipment as specified on the pesticide label. Water used for formulating shall only come from locations designated by the Contracting Officer. The Contractor shall not allow the equipment to overflow. Prior to application of pesticide, all equipment shall be inspected for leaks, clogging, wear, or damage and shall be repaired prior to being used.

3.11 PREVIOUSLY USED EQUIPMENT

The Contractor shall clean all previously used construction equipment prior to bringing it onto the project site. The Contractor shall ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. The Contractor shall consult with the USDA jurisdictional office for additional cleaning requirements.

3.12 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3.13 MILITARY MUNITIONS

In the event the Contractor discovers or uncovers military munitions as defined in 40 CFR 260, the Contractor shall immediately stop work in that area and immediately inform the Contracting Officer.

3.14 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel shall be trained in all phases of environmental protection and pollution control. The Contractor shall conduct environmental protection/pollution control meetings for all Contractor

personnel prior to commencing construction activities. Additional meetings shall be conducted for new personnel and when site conditions change. The training and meeting agenda shall include: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, wetlands, and endangered species and their habitat that are known to be in the area.

3.15 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". The Contractor shall, unless otherwise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed area shall be graded, filled and the entire area seeded unless otherwise indicated.

-- End of Section --

SECTION 01356

STORM WATER POLLUTION PREVENTION MEASURES

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM D 3786	(2001) Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
ASTM D 4355	(2002) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D 4632	(1991; R 2003) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(2004) Determining Apparent Opening Size of a Geotextile
ASTM D 4873	(2002) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT)

GDOT	(2001) Standard Specifications Construction of Transportation Systems
Green Book	(2000) Manual for Erosion and Sedimentation Control in Georgia - Fifth Edition

FORT GORDON DIRECTORATE OF PUBLIC WORKS (DPW)

SWPPP	Fort Gordon Stormwater Pollution Prevention Plan

1.2 GENERAL REQUIREMENTS

Contractor shall implement the storm water pollution prevention measures to prevent sediment from entering streams or water bodies as specified in this Section in conformance with the requirements of the National Pollution Discharge Elimination System (NPDES) permit attached to that Section.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The

following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Mill Certificate or Affidavit

Certificate attesting that the Contractor has met all specified requirements.

1.4 EROSION AND SEDIMENT CONTROLS

The erosion and sediments controls shall be implemented in accordance with the State of Georgia Green Book and the Fort Gordon Storm Water Pollution Prevention Plan (SWPPP). The controls and measures required by the Contractor are described below.

1.4.1 Stabilization Practices

The stabilization practices to be implemented shall include temporary seeding, mulching, geotextiles, erosion control matts, protection of trees, preservation of mature vegetation, etc. On his daily CQC Report, the Contractor shall record the dates when the major grading activities occur, (e.g., clearing and grubbing, excavation, embankment, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS, stabilization practices shall be initiated as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have temporarily or permanently ceased.

1.4.1.1 Unsuitable Conditions

Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases is precluded by unsuitable conditions caused by the weather, stabilization practices shall be initiated as soon as practicable after conditions become suitable.

1.4.1.2 No Activity for Less Than 21 Days

When the total time period in which construction activity is temporarily ceased on a portion of the site is 21 days minimum, stabilization practices do not have to be initiated on that portion of the site until 14 days have elapsed after construction activity temporarily ceased.

1.4.2 Structural Practices

Structural practices shall be implemented to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Structural practices shall be implemented in a timely manner during the construction process to minimize erosion and sediment runoff. Structural practices shall include the following devices. Location and details of installation and construction are shown on the drawings.

1.4.2.1 Silt Fences

The Contractor shall provide silt fences as a temporary structural practice to minimize erosion and sediment runoff. Silt fences shall be properly

installed to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading). Silt fences shall be installed in the locations indicated on the drawings. Final removal of silt fence barriers shall be upon approval by the Contracting Officer.

The Contractor shall provide two types of silt fence in accordance with the requirements of the State of Georgia Green Book. Type "A" silt fence shall be placed at the toe of all dirt stockpile areas and as indicated on the drawings. Type "C" silt fence shall be installed at the perimeter of the disturbed areas and where indicated on the drawings.

1.4.2.2 Straw Bales

The Contractor may provide bales of straw as a temporary structural practice to minimize erosion and sediment runoff. If bales are used, the bales shall be properly placed to effectively retain sediment immediately after completing each phase of work (e.g., clearing and grubbing, excavation, embankment, and grading) in each independent runoff area (e.g., after clearing and grubbing in a area between a ridge and drain, bales shall be placed as work progresses, bales shall be removed/replaced/relocated as needed for work to progress in the drainage area). Areas where straw bales are to be used are shown on the drawings. Final removal of straw bale barriers shall be upon approval by the Contracting Officer. Rows of bales of straw shall be provided as follows:

a. Along the downhill perimeter edge of all areas disturbed.

b. Along the top of the slope or top bank of drainage ditches, channels, swales, etc. that traverse disturbed areas.

c. Along the toe of all cut slopes and fill slopes of the construction areas, except at the toe of the Operations Building excavation.

d. Perpendicular to the flow in the bottom of existing drainage ditches, channels, swales, etc. that traverse disturbed areas or carry runoff from disturbed areas. Rows shall be spaced as shown on the drawings.

e. Perpendicular to the flow in the bottom of new drainage ditches, channels, and swales. Rows shall be spaced as shown on the drawings.

f. At the entrance to culverts that receive runoff from disturbed areas.

1.4.2.3 Diversion Dikes

Diversion dikes shall have a maximum channel slope of 2 percent and shall be adequately compacted to prevent failure. The minimum height measured from the top of the dike to the bottom of the channel shall be 18 inches. The minimum base width shall be 6 feet and the minimum top width shall be 2 feet. The Contractor shall ensure that the diversion dikes are not damaged by construction operations or traffic. Diversion dikes shall be located as shown on the drawings.

PART 2 PRODUCTS

2.1 COMPONENTS FOR SILT FENCES

2.1.1 Filter Fabric

The geotextile shall comply with the requirements from the GDOT - qualified Product List (QPL) 36. Type "A" fences shall use woven filter fabric. If using woven fabric, the fabric may have slit tape yarns in one direction (warp or fill) only. Type "C" fence shall use non-calendered woven fabric constructed with monofilament yarns only. Type "C" fence shall use a woven wire support with the following:

a. Wire fence fabric is at least 32 inches high with at least six horizontal wires.

b. Vertical wires shall have a maximum spacing of 12 inches.

c. The top and bottom wires are at least 10 gauge wire and all others at least 12-1/2 gauge.

The filter fabric shall meet the following requirements:

a. Has strong rot-proof synthetic fibers formed into either a woven or non-woven fabric.

b. Has no treatment or coating that might significantly alter its physical properties after installation.

c. Contains stabilizers and/or inhibitors to make the filaments resistant to deterioration resulting from exposure to sunlight or heat.

d. Makes a pervious sheet of synthetic fibers oriented into a stable network so that the fibers retain their relative position with respect to each other under normal handling, installation, and service conditions.

e. Has finished fabric edges to prevent the outer yarn from pulling away from the fabric.

f. Has no defects or flaws that would significantly affect its physical and/or filtering properties.

g. Meets the following physical or dimensional requirements:

Type Fence	A	B	C
Min. tensile strength, pounds(1)	Warp-120 Fill-100	Warp-120 Fill-100	Warp-260 Fill-180
Elongation (% max.)	40	40	40
Apparent opening size (max. sieve size)	No. 30	No. 30	No. 30
Flow rate, gal/min./ft.^{2}	25	25	70

Ultraviolet stability(2)	80	80	80
Bursting strength, psi	175	175	175
Minimum fabric width	36 in	22 in	36 in

(1) Minimum roll average of five specimens.
(2) Percent of required initial minimum tensile strength.

The filter fabric shall meet the following testing requirements:

Test	Method
Tensile strength	ASTM D 4632
Elongation	ASTM D 4632
Apparent opening size	ASTM D 4751
Flow Rate	GDOT 87
Ultraviolet stability	ASTM D 4632 (after 300 hours weather according to ASTM D 4355)
Bursting strength	ASTM D 3786, Diaphragm Bursting Strength Tester

2.1.2 Silt Fence Stakes and Posts

The Contractor may use either wooden stakes or steel posts for fence construction. The stakes and posts shall meet the following requirements:

Use post sizes and types as determined by the type of fence being installed. Generally, hardwood posts will be limited to ash, hickory, or oak. Other hardwoods may be acceptable if approved by the Office of Materials and Research.

a. Type "A" Fence: Use either wood or steel posts that are at least 4 feet long.

1. If using soft wood, use posts that are at least 3 inches in diameter or nominal 2 x 4 inches and straight enough to provide a fence without noticeable misalignment.

2. If using hardwood, use posts that are 1-1/2 x 1-1/2 inches with a minus tolerance of 1/4 inch providing the cross sectional area is at least 2.25 inches^2.

3. If using steel, use posts that are "U", "T", or "C" shaped with a minimum weight of 1.15 lb/ft, and have projections for fastening the fence to the posts.

b. Type "C" Fence: Use only steel posts that are at least 4 feet. Use "U", "T", or "C" shaped posts with a minimum weight of 1.15 lb/ft. Use posts that have projections for fastening the woven wire and filter

fabric.

c. Fasteners for Wood Posts.

1. Wire Staples: Use staples that are at least 17 gauge, legs at least 1/2 inch long, and a crown at least 3/4 inch wide.

2. Nails: Use nails that are at least 14 gauge, 1 inch long, with button heads of at least 3/4 inch.

2.1.3 Mill Certificate or Affidavit

A mill certificate or affidavit shall be provided attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. The mill certificate or affidavit shall specify the actual Minimum Average Roll Values and shall identify the fabric supplied by roll identification numbers. The Contractor shall submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

2.1.4 Identification Storage and Handling

Filter fabric shall be identified, stored and handled in accordance with ASTM D 4873.

2.2 COMPONENTS FOR STRAW BALES

The straw in the bales shall be stalks from oats, wheat, rye, barley, rice, or from grasses such as byhalia, bermuda, etc., furnished in air dry condition. The bales shall have a standard cross section of 14 by 18 inches. All bales shall be either wire-bound or string-tied. The Contractor may use either wooden stakes or steel posts to secure the straw bales to the ground. Wooden stakes utilized for this purpose, shall have a minimum dimensions of 2 by 2 inches in cross section and shall have a minimum length of 3 feet. Steel posts (standard "U" or "T" section) utilized for securing straw bales, shall have a minimum weight of 1.33 pounds/linear foot and a minimum length of 3 feet.

PART 3 EXECUTION

3.1 INSTALLATION OF SILT FENCES

Silt fences shall extend a minimum of 18 inches above the ground surface and shall not exceed 34 inches above the ground surface. Filter fabric shall be from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be spliced together at a support post, with a minimum 6 inch overlap, and securely sealed. A trench shall be excavated approximately 4 inches wide and 4 inches deep on the upslope side of the location of the silt fence. The 4 by 4 inch trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed upon approval by the Contracting Officer.

3.2 INSTALLATION OF STRAW BALES

Straw bales shall be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent

deterioration of the bindings. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. After the bales are staked and chinked (gaps filled by wedging with straw), the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 inches against the uphill side of the barrier. Loose straw shall be scattered over the area immediately uphill from a straw bale barrier to increase barrier efficiency. Each bale shall be securely anchored by at least two stakes driven through the bale. The first stake or steel post in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or steel pickets shall be driven a minimum 18 inches deep into the ground to securely anchor the bales.

3.3 MAINTENANCE

The Contractor shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. The following procedures shall be followed to maintain the protective measures.

3.3.1 Silt Fence Maintenance

Silt fences shall be inspected in accordance with paragraph INSPECTIONS. Any required repairs shall be made promptly. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. When a silt fence is no longer required, it shall be removed. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall receive erosion control.

3.3.2 Straw Bale Maintenance

Straw bale barriers shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales. Necessary repairs to barriers or replacement of bales shall be accomplished promptly. Sediment deposits shall be removed when deposits reach one-half of the height of the barrier. Bale rows used to retain sediment shall be turned uphill at each end of each row. When a straw bale barrier is no longer required, it shall be removed. The immediate area occupied by the bales and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with the schedule on drawing SIT-C-041.

3.3.3 Diversion Dike Maintenance

Diversion dikes shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged diversion dikes and necessary repairs shall be accomplished promptly. When diversion dikes are no longer required, they shall be shaped to an acceptable grade.

3.4 INSPECTIONS

3.4.1 General

The Contractor shall inspect disturbed areas of the construction site, areas that have not been finally stabilized used for storage of materials exposed to precipitation, stabilization practices, structural practices, other controls, and area where vehicles exit the site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 0.5 inches or more rainfall at the site. Where sites have been finally stabilized, such inspection shall be conducted at least once every month.

3.4.2 Inspections Details

Disturbed areas and areas used for material storage that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan shall be observed to ensure that they are operating correctly. Discharge locations or points shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles exit the site shall be inspected for evidence of offsite sediment tracking.

3.4.3 Inspection Reports

For each inspection conducted, the Contractor shall prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. The report shall be furnished to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.

3.4.4 Monthly Inspection Report and Certification Form for Erosion and Sediment Controls

On the first working day of each month the Contractor shall complete, sign, and submit the original form to the State of Georgia, Office of Pollution Control (OPC).

-- End of Section --

SECTION 01420

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B 564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

ACI INTERNATIONAL (ACI)
P.O. Box 9094
Farmington Hills, MI 48333-9094
Ph: 248-848-3700
Fax: 248-848-3701
E-mail: bkstore@concrete.org
Internet: http://www.aci-int.org

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)
4100 North Fairfax Drive, Suite 200
Arlington, VA 22203
Ph: 703-524-8800
Fax: 703-528-3816
E-mail: ari@ari.org
Internet: http://www.ari.org

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)
30 West University Drive
Arlington Heights, IL 60004-1893
Ph: 847-394-0150
Fax: 847-253-0088
E-mail: amca@amca.org
Internet: http://www.amca.org

ALUMINUM ASSOCIATION (AA)
National Headquarters
1525 Wilson Boulevard, Suite 600
Arlington, VA 22209
Ph: 703-358-2960
Fax: 703-358-2961

Internet: http://www.aluminum.org

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)
1827 Walden Office Square
Suite 550
Schaumburg, IL 60173-4268
Ph: 847-303-5664
Fax: 847-303-5774
E-mail: webmaster@aamanet.org
Internet: http://www.aamanet.org

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: http://www.aashto.org

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)
P.O. Box 12215
Research Triangle Park, NC 27709-2215
Ph: 919-549-8141
Fax: 919-549-8933
E-mail: quantem@aatcc.org
Technical Questions: hammona@aatc.org
Internet: http://www.aatcc.org

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)
2025 M Street, NW, Suite 800
Washington, DC 20036
Ph: 202-367-1155
Fax: 202-367-2155
E-mail: info.abma@smithbucklin.com
Internet: http://www.abma-dc.org

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)
222 West Las Colinas Boulevard, Suite 641
Irving, TX 75039-5423
Ph: 972-506-7216
Fax: 972-506-7682
E-mail: info@concrete-pipe.org
Internet: http://www.concrete-pipe.org

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
1330 Kemper Meadow Drive
Cincinnati, OH 45240
Ph: 513-742-2020
Fax: 513-742-3355
E-mail: mail@acgih.org
Internet: http://www.acgih.org

AMERICAN FOREST & PAPER ASSOCIATION (AF&PA)
American Wood Council
ATTN: Publications Department
1111 Nineteenth Street NW, Suite 800
Washington, DC 20036
Ph: 800-890-7732 or 202-463-2766

Fax: 202-463-2791
Internet: http://www.awc.org/

AMERICAN HARDBOARD ASSOCIATION (AHA)
c/o Composite Panel Association
18922 Premiere Court
Gaithersburg, MD 20879-1574
Ph: 301-670-0604
Fax: 301-840-1252
Internet: http://www.pbmdf.org

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
One East Wacker Drive
Chicago, IL 60601-1802
Ph: 312-670-2400
Fax: 312-670-5403
Publications: 800-644-2400
E-mail: pubs@aisc.org
Internet: http://www.aisc.org

AMERICAN IRON AND STEEL INSTITUTE (AISI)
1140 Connecticut Avenue, NW, Suite 705
Washington, DC 20036
Ph: 202-452-7100
Fax: 202-463-6573
Internet: http://www.steel.org

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1819 L Street, NW, 6th Floor
Washington, DC 20036
Ph: 202-293-8020
Fax: 202-293-9287
E-mail: info@ansi.org
Internet: http://www.ansi.org/

--- ANSI documents beginning with the letter "S" can be ordered from:

Acoustical Society of America (ASA)
2 Huntington Quadrangle, Suite 1NO1
Melville, NY 11747-4502
Ph: 516-576-2360
Fax: 516-576-2377
E-mail: asa@aip.org
Internet: http://asa.aip.org

AMERICAN PETROLEUM INSTITUTE (API)
1220 L Street, NW
Washington, DC 20005-4070
Ph: 202-682-8000
Fax: 202-682-8223
Internet: http://www.api.org

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)
1711 Arlingate Lane
P.O. Box 28518
Columbus, OH 43228-0518
Ph: 800-222-2768; 614-274-6003

Fax: 614-274-6899
E-mail: webmaster@asnt.org
Internet: http://www.asnt.org

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20191-4400
Ph: 703-295-6300 - 800-548-2723
Fax: 703-295-6222
E-mail: marketing@asce.org
Internet: http://www.asce.org

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
1791 Tullie Circle, NE
Atlanta, GA 30329
Ph: 800-527-4723 or 404-636-8400
Fax: 404-321-5478
E-mail: ashrae@ashrae.org
Internet: http://www.ashrae.org

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
901 Canterbury, Suite A
Westlake, OH 44145
Ph: 440-835-3040
Fax: 440-835-3488
E-mail: info@asse-plumbing.org
Internet: http://www.asse-plumbing.org

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 West Quincy Avenue
Denver, CO 80235
Ph: 800-926-7337
Fax: 303-347-0804
Internet: http://www.awwa.org

AMERICAN WELDING SOCIETY (AWS)
550 N.W. LeJeune Road
Miami, FL 33126
Ph: 800-443-9353 - 305-443-9353
Fax: 305-443-7559
E-mail: info@aws.org
Internet: http://www.aws.org

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)
P.O. Box 361784
Birmingham, AL 35236-1784
Ph: 205-733-4077
Fax: 205-733-4075
E-mail: email@awpa.com
Internet: http://www.awpa.com

APA - THE ENGINEERED WOOD ASSOCIATION (APA)
7011 South 19th
Tacoma, WA 98466
Ph: 253-565-6600
Fax: 253-565-7265
E-mail: help@apawood.org
Internet: http://www.apawood.org

ARCHITECTURAL WOODWORK INSTITUTE (AWI)
146179 Westlake Drive, Suite 120
Potomac Falls, VA 20165
Ph: 571-323-3636
Fax: 571-323-3630
Internet: http://www.awinet.org

ASME INTERNATIONAL (ASME)
Three Park Avenue
New York, NY 10016-5990
Ph: 212-591-7722 or 800-843-2763
Fax: 212-591-7674
E-mail: infocentral@asme.org
Internet: http://www.asme.org

ASSOCIATED AIR BALANCE COUNCIL (AABC)
1518 K Street, NW
Washington, DC 20005
Ph: 202-737-0202
Fax: 202-638-4833
E-mail: info@aabc.com
Internet: http://www.aabchq.com

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)
600 North 18th Street
P.O. Box 2641
Birmingham, AL 35291
Ph: 205-257-2530
Fax: 205-257-2540
Internet: http://www.aeic.org

ASSOCIATION OF HOME APPLIANCE MANUFACTURERS (AHAM)
1111 19th Street NW, Suite 402
Washington, DC 20036
Ph: 202-872-5955
Fax: 202-872-9354
E-mail: info@aham.org
Internet: http://www.aham.org

ASSOCIATION OF THE WALL AND CEILING INDUSTRIES - INTERNATIONAL (AWCI)
803 West Broad Street, Suite 600
Falls Church, VA 22046
Ph: 703-534-8300
Fax: 703-534-8307
E-mail: info@awci.org
Internet: http://www.awci.org

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 610-832-9500
Fax: 610-832-9555
E-mail: service@astm.org
Internet: http://www.astm.org

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)
355 Lexington Avenue

17th Floor
New York, NY 10017
Ph: 212-297-2122
Fax: 212-370-9047
E-mail: assocmgmt@aol.com
Internet: http://www.buildershardware.com

CALIFORNIA ENERGY COMMISSION (CEC)
Media and Public Communications Office
1516 Ninth Street, MS-29
Sacramento, CA 95814-5512
Ph: 916-654-4287
Internet: http://www.energy.ca.gov/

CARPET AND RUG INSTITUTE (CRI)
P.O. Box 2048
Dalton, GA 30722-2048
Ph: 800-882-8846 or 706-278-3176
Fax: 706-278-8835
Internet: http://www.carpet-rug.com

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-- End of Section --

SECTION 01451

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM D 3740	(2004) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(2003) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1110-1-12	(1993) Quality Management

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all design and construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The site project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. The site project superintendent in this context shall be the highest level manager responsible for the overall construction activities at the site, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction and construction related activities at the site.

3.2 QUALITY CONTROL PLAN

The Contractor shall furnish for review by the Government, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.2.1 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all design and construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents subcontractors, designers of record, consultants, architect/engineers (AE), fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subContractors, offsite fabricators, suppliers, and purchasing agents subContractors, designers of record, consultants, architect engineers (AE), offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01330 SUBMITTAL PROCEDURES.

e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer shall be used.)

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

3.2.2 Additional Requirements for Design Quality Control (DQC) Plan

The followng additional requirements apply to the Design Quality Control (DQC) plan:

a. The Contractor's QCP Plan shall provide and maintain a Design Quality Control (DQC) Plan as an effective quality control program which will assure that all services required by this design-build contract are performed and provided in a manner that meets professional architectural and engineering quality standards. As a minimum, all documents shall be technically reviewed by competent, independent reviewers identified in the DQC Plan. The same element that produced the product shall not perform the independent technical review (ITR). The Contractor shall correct errors and deficiencies in the design documents prior to submitting them to the Government.

b. The Contractor shall include the design schedule in the master project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific contract period. This should be at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. The schedule shall include review and correction periods associated with each item. This should be a forward planning as well as a project monitoring tool. The schedule reflects calendar days and not dates for each activity. If the schedule is changed, the Contractor shall submit a revised schedule reflecting the change within 7 calendar days. The Contractor shall include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal. These completed checklists shall be submitted at each design phase as part of the project documentation. Example checklists can be found in ER 1110-1-12.

c. The DQC Plan shall be implemented by an Design Quality Control Manager who has the responsibility of being cognizant of and assuring that all documents on the project have been coordinated. This individual shall be a person who has verifiable engineering or architectural design experience and is a registered professional engineer or architect. The Contractor shall notify the Contracting Officer, in writing, of the name of the individual, and the name of an alternate person assigned to the position.

d. The Contracting Officer will notify the Contractor in writing of the

acceptance of the DQC Plan. After acceptance, any changes proposed by the Contractor are subject to the acceptance of the Contracting Officer.

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the constructiondesign and construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Postaward Conference, before start of design or construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 30 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, design activities, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager, a Design Quality Manager, and sufficient number of additional qualified personnel to ensure safety and contract compliance. The Safety and Health Manager shall receive direction and authority from the CQC System Manager and shall serve as a member of the CQC staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer. The Contractor shall provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Complete records of all letters, material submittals, shop drawing submittals, schedules and all other project documentation shall be promptly furnished to the CQC organization by the Contractor. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise

acceptable to the Contracting Officer.

3.4.2 CQC System Manager

The CQC System Manager shall be a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of 5 years construction experience on construction similar to this contract or a construction person with a minimum of 15 years in related work. The CQC System Manager shall be assigned no other duties.

3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specified personnel to assist the CQC System Manager for the following areas: electrical, mechanical, civil, safety, architectural, submittals clerk, Design Quality Control Manager. These individuals shall be directly employed by the prime contractor and may not be employed by a supplier or sub-contractor on this project be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have necessary education and/or experience in accordance with the experience matrix listed herein. These individuals shall have no other duties other than quality control.

EXPERIENCE MATRIX

	AREA	QUALIFICATIONS
a.	Civil	Graduate Civil Engineer with 2 yrs experience in the type of work being performed on this project or a technician with 5 yrs of related experience.
b.	Mechanical	Graduate Mechanical Engineer with 2 yrs experience or a person with 5 yrs of related experience.
c.	Electrical	Graduate Electrical Engineer with 2 yrs experience or a person with 5 yrs of related experience.
d.	Architectural	Graduate Architect with 2 yrs experience or a person with 5 yrs of related experience.
e.	Safety	Graduate Safety Engineer with 2 yrs experience or a person with 10 yrs of safety related experience.
f.	Submittals	Submittal clerk with 1 yrs experience.
g.	Design Quality Control	Registered Architect or Manager Professional Engineer.

3.4.4 Additional Requirement

In addition to the above experience and education requirements the CQC System Manager shall have completed the course entitled "Construction

Quality Management For Contractors".

3.4.5 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 15995A COMMISSIONING OF HVAC SYSTEMS are included in the contract, the submittals required by those sections shall be coordinated with Section 01330 SUBMITTAL PROCEDURES to ensure adequate time is allowed for each type of submittal required.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subContractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of the construction work as follows:

3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

a. A review of each paragraph of applicable specifications, reference codes, and standards. A copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field shall be made available by the Contractor at the preparatory inspection. These copies shall be maintained in the field and available for use by Government personnel until final acceptance of the work.

b. A review of the contract drawings.

c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.

e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

g. A review of the appropriate activity hazard analysis to assure safety requirements are met.

h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

j. Discussion of the initial control phase.

k. The Government shall be notified at least 48 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the

deficient work. The Contractor shall not build upon nor conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing Laboratories

3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge equal to the cost of the check to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials shall be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

For delivery by mail: [_____]

For other deliveries: [_____]

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the SPECIAL CONTRACT REQUIREMENTS Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications, the CQC Manager shall conduct an inspection of the work. A punch list of items which do not conform to the approved drawings and specifications shall be prepared and included in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.9 DOCUMENTATION

a. The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subContractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

1) Contractor/subContractor and their area of responsibility.

2) Operating plant/equipment with hours worked, idle, or down for repair.

3) Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

4) Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase shall be identified (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.

5) Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

6) Submittals and deliverables reviewed, with contract reference, by whom, and action taken.

7) Offsite surveillance activities, including actions taken.

8) Job safety evaluations stating what was checked, results, and instructions or corrective actions.

9) Instructions given/received and conflicts in plans and/or specifications.

10) Contractor's verification statement.

b. These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

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3.10 SAMPLE FORMS

Sample forms enclosed at the end of this section.

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance 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 issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

-- End of Section --

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Site Plan

The Contractor shall prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Any areas which may have to be graveled to prevent the tracking of mud shall also be identified. The Contractor shall also indicate if the use of a supplemental or other staging area is desired.

1.1.2 Identification of Employees

a. The Contractor shall be responsible for furnishing to each employee, and for requiring each employee engaged on the work to display, identification as approved and directed by the Contracting Officer. Prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of any employee, per NSA Security Standards. When required, the Contractor shall obtain and provide fingerprints of persons employed on the project. Contractor and subcontractor personnel shall wear identifying markings on hard hats clearly identifying the company for whom the employee works.

b. All personnel shall have badges and vehicle passes or decals to enter the installation per NSA Security and Fort Gordon Military Police Standards. Badges will be required to be worn at all times while on the installation. Decals will be required to enter the installation or the driver will be required to go to the MP station for a permit which will require driver license, proof of insurance, contract number, and point of contact for company before being allowed to enter.

1.1.2.1 Contractor Employee Information

a. Fort Gordon requires the following information to remain on file throughout the life of this contract. Provide the following information to the Contracting Officer at the Pre-work and/or Pre-Construction meeting.

1) Contract No.
2) Contractor Name
3) Contractor Mailing Address
4) POC for Contractor (Name) and Phone No.
5) POC for Contract (COE or Installation) and Phone No.
6) Installation that contractor needs access; i.e. Hunter or Gordon

b. This requirement applies to construction firms, design AE firms, consultants and studies firms. Prescribed identification shall immediately be delivered to the Contracting Officer for

cancellation upon release of any employee.

c. All personnel must be U.S. Citizens with a minimum of two valid U.S. ID's.

1.1.2.2 Vehicle Registration

Ft. Gordon requires that all vehicles operated on the reservation with the Military Police. All contractor vehicles must be registered. Personnel must submit a memorandum, issued from the prime contractor and Fort Gordon Area Office, with each individual contractor's name listed, the start and completion date of project, drivers license, proof of insurance, state vehicle registration and special power of attorney (if you wish to register a vehicle and your name does not appear on the state vehicle registration) to Building 33720 Darling Hall, during regular business hours. Personnel at the registration station will check the documents and issue a decal. The decal indicating expiration month/year must be displayed on the windshield (top, middle0 of the registered vehicle.

1.1.3 Employee Parking

Contractor employees shall park privately owned vehicles in an area designated by the Contracting Officer per NSA Security Standards. This area will be within reasonable walking distance of the construction site. Contractor employee parking shall not interfere with existing and established parking requirements of the military installation.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Termiticide Application Report; G, RE

*8

Completed Fort Bragg Gordon Termiticide Application Report (no form number) for each structure receiving termiticide treatment.

1.3 AVAILABILITY AND USE OF UTILITY SERVICES

1.3.1 Payment for Utility Services

The Government will make all reasonably required utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

1.3.2 Meters and Temporary Connections

The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain necessary temporary

connections, distribution lines, and meter bases (Government will provide meters) required to measure the amount of each utility used for the purpose of determining charges. The Contractor shall notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established. The Government will provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. The Contractor shall not make the final electrical connection.

1.3.3 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of $50.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed to the Contractor prior to the end of the current fiscal year.

1.3.4 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, the Contractor shall notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meters. The Contractor shall then remove all the temporary distribution lines, meter bases, and associated paraphernalia. The Contractor shall pay all outstanding utility bills before final acceptance of the work by the Government.

1.3.5 Sanitation

The Contractor shall provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

1.3.6 Telephone

The Contractor shall make arrangements and pay all costs for telephone facilities desired.

1.4 AVAILABILITY AND USE OF UTILITY SERVICES (FORT GORDON)

1.4.1 Payment for Utility Services

The Government will make all reasonably required utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to and paid for by the Contractor at the prevailing rates. The rates listed below are current as of September 2002 and are subject to change. The Contractor shall carefully conserve all utilities furnished.

1.4.2 Meters and Temporary Connections

The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain necessary temporary connections, distribution lines, and meters required to measure the amount

of each utility used for the purpose of determining charges. The Contractor shall notify the Contracting Officer's Representative, in writing, no less than 10 working days before the temporary connection is made. The Contracting Officers Representative will then provide the contractor with the name and phone number of the utility provider. The contractor will be responsible for contacting the utility provider and making arrangements for connections and billing. For temporary electrical connections the Government or applicable utility provider will provide the meter (meter base provided by contractor) and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. The Contractor shall not make the final electrical connection. For temporary water and sewer connections the contractor will provide the meter and after inspection/approval by the Contracting Officer's Representative make the final connection at the contractor's expense.

1.4.3 Use of Permanent Building Utility Connections

Utilities consumed by the contractor from permanent building utility connections shall also be metered and paid for by the contractor. When the permanent system is activated the initial meter reading shall be recorded and reported as specified below. On building renovation projects the initial meter reading shall be recorded when the contractor is given possession of the building to perform the work. The Contractor shall pay for utilities consumed through the permanent building connection until the work has been completed or the Government has occupied the facility, which ever occurs first.

1.4.4 Initial Meter Readings

Upon installation of the meter, the initial reading shall be recorded (in the presence of the Contracting Officer's Representative) and forwarded to the point of contact for utility service with a copy to the Contracting Officer's Representative.

1.4.5 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, the Contractor shall notify the Contracting Officer and the applicable utility provider, in writing, 10 working days before termination is desired. The Government or applicable utility provider will take a final meter reading. Electric service will be disconnected by the provider. Water and sewer connections will be disconnected by the contractor, at his expenses and by a method approved by the Contracting Officer's Representative. The Contractor shall then remove all the temporary distribution lines, meters, meter bases, and associated paraphernalia. The Contractor shall pay all outstanding utility bills before final acceptance of the work by the Government.

1.4.6 Requirement for Backflow Prevention on Temporary/Permanent Potable Water Connections

The contractor shall install a backflow prevention device on all connections to the potable water system. The backflow prevention device shall be a reduced pressure or double check type, meeting all the State code requirements for backflow preventers on potable water. If the contractor requests the use of a fire hydrant and receives approval from the Contracting Officer's Representative a backflow prevention device and meter shall be installed prior to each use.

1.4.7 Utilities Charge Rates

Water	$1.61 per 1,000 gallons
Electricity	$0.0861 per KW hour
Sewer	$10.00/month for each connected trailer up to single wide size. The rate for larger trailers will be determined by the utility provider, however; this rate will not exceed $20.00/month per trailer.
Natural Gas	$0.9787/Therm

NOTE: Rates are subject to yearly increases.

1.5 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

1.5.1 Bulletin Board

Immediately upon beginning of work, the Contractor shall provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. The bulletin board shall be located at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of work the bulletin board shall be removed by and remain the property of the Contractor.

1.5.2 Project Signs

The Contractor shall furnish and install a project sign at the location selected by the Contracting Officer and in accordance with NSA Security Standards. The project sign shall be painted on 1/2 inch thick exterior grade plywood. The sign layout shall be in accordance with the graphic format shown in Attachment 1 to Section 00800. The 4-foot by 4-foot right-hand section shall be painted white (Color No. 37875, Fed. Std. 595a) with black (Color No. 37038, Fed. Std. 595a) lettering. The 2-foot by 4-foot left-hand section shall be painted red (Color No. 12199, Fed. Std. 595a) with white lettering. The Contractor shall furnish and install a project sign at the location selected by the Contracting Officer. The project sign shall be painted on 1/2 inch thick exterior grade plywood. The sign layout shall be in accordance with the graphic format shown in Attachment 1 to Section 00800. The Contractor shall furnish and install a project sign at the location selected by the Contracting Officer. The project sign shall be painted on 1/2 inch thick exterior grade plywood. The sign layout shall be in accordance with the graphic format shown in Attachment 1 to Section 00800. The 4' by 4' right-hand section shall be painted white (Color No. 37875, Fed. Std. 595a) with black (Color No. 37038, Fed. Std. 595a) lettering. The 2' by 4' left-hand section shall be painted red (Color No. 12199, Fed. Std. 595a) with white lettering. Eight additional signs of similar construction and finish shall be furnished and installed at locations selected by the Contracting Officer. These signs shall be 36 inches wide, 15 inches high, with red letters 2 inches high on a white background and shall read as follows:

"RESTRICTED AND CONTROLLED ACCESS INSIDE CONSTRUCTION ZONE"

The Contractor shall furnish and erect a project sign in the location as selected by the Contracting Officer. Details of construction shall be as shown on sketches included in Attachment 1 to Section 00800. The sign shall

be constructed of 1/2 inch thick (or metric equivalent), grade A-C, exterior type plywood. The sign shall receive one coat primer paint followed by two coats brown color paint in accordance with Fed. Std. 595a, Color No. 20100 semigloss exterior type enamel. Lettering must be white gloss exterior type enamel (Fed. Std. 595a, Color No. 37875). Windows and door of the Castle and logo background shall be painted white (Fed. Std. 595a, Color No. 37875). The Castle and inner border line shall be brown (Fed. Std. 595a, Color No. 20100). Upon completion of work under this contract, the project sign shall be removed from the job site and shall remain the property of the Contractor. The Engineering and Services Directorate emblem (AFVA 85-3) may be acquired by sending a letter; a completed DD Form 1149, Requisition and Invoice/Shipping Document; or a DA Form 17, Requisition for Publications (Army customers) to:

The Air Force Publishing Distribution Center
2800 Eastern Boulevard
Baltimore, MD 21220-2898

1.6 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction the Contractor shall provide access and temporary relocated roads as necessary to maintain traffic. The Contractor shall maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. The traveling public shall be protected from damage to person and property. The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. The Contractor shall investigate the adequacy of existing roads and the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

1.6.1 Haul Roads

The Contractor will be required to use the haul routes shown on the plans unless otherwise permitted in writing by the Contracting Officer. When haul routes are not designated on the plans, the Contractor must obtain approval of the Contracting Officer of haul routes he intends to use. The Contractor shall maintain the haul routes and shall keep the dust problem under control by wetting the surface as needed. Sweeping and cleaning of pavements will be done as necessary to remove spillage resulting from the hauling operations. After all hauling has been completed, the Contractor shall restore the earth areas used for the haul routes to original condition by final grading, shaping, compacting, and grassing, and shall clean and sweep all paved areas as required. Any pavement damaged as a result of hauling operations under this contract for both the earth and other materials shall be promptly repaired by the Contractor, as approved by the Contracting Officer. The cost of maintenance and repair of the haul routes, as mentioned above, shall be considered as a subsidiary obligation of the Contractor. The axle load of earth hauling equipment operating on paved streets shall not exceed 18,000 pounds.

1.6.2 Barricades

The Contractor shall erect and maintain temporary barricades to limit

public access to hazardous areas. Such barricades shall be required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall be securely placed, clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

1.7 GOVERNMENT FIELD OFFICES

1.7.1 Leased Resident Office

The Contractor shall provide the Government Field Engineer with an office of approximately 11,500 square feet in area (approximately 100 feet x 115 feet)with spaces of approximate size and functional relationships as illustrated (see Appendix S for Resident Engineer Office Requirments drawing). Full utilities and services shall be provided including heating, ventilation, and air conditioning (HVAC); plumbing water and sewer; electric light and power; and communications telephone and data. (Contractor to co-ordinate actual connections of utilities with Fort Gordon Public Works.) The Contractor shall provide high-speed internet service for all workstations as part of the Government's office. All charges for the high speed internet service for the government office shall be borne by the Contractor. Construction of the office, including fire alarm system, shall meet the latest versions of building codes including IBC 2006, NFPA 101 (2003), NEC 2005, IPC 2006.

Custodial service shall be provided by the Contractor a minimum of two times per week.

Additional requirements shall be as follows:

a. HVAC - Office shall be divided into a minimum of four separate thermostatically controlled zones; "User" area, COE Resident Engineer area, COE Administrative and Technical Support area, and Large Conference Room. Air conditioning shall be capable of maintaining the office at 50 percent relative humidity and a room temperature 30 degrees F below the outside air temperature when the outside air temperature is 95 degrees F.

b. Plumbing - Provide hot water heater for hot water service to the Kitchen, Men's Toilet and Women's Toilet. Plumbing fixture requirements by room include: Corridor - two electric water coolers, one of which meets American Disabilities Act (ADA); Kitchen - one stainless steel, double compartment sink; Men's Toilet - two urinals, two lavatories (one meeting ADA), two toilets (one meeting ADA); Women's Toilet - one lavatory meeting ADA, two toilets (one meeting ADA).

c. Electric Lighting and Power - Light fixtures shall be provided in quantity and arrangement to meet minimum lighting levels for functional spaces as defined by Illuminating Engineering Society (IES) Handbook. In addition light fixtures in large conference room shall be controlled by dimming device. Provide minimum one duplex power receptacle adjacent to each LAN connection indicated in Communications paragraph. Additional power requirements are as follows: Large Conference Room - provide power to receptacle in ceiling adjacent to projector mount, to electric projector screen, and to two duplex receptacles in each of the four main walls; Kitchen - provide minimum 4 GFI duplex receptacles on two separate dedicated circuits along counter, a 220V circuit to range,

power to range hood, and duplex receptacle at refrigerator; Men's and Women's Toilets - provide minimum one GFI duplex receptacle at each toilet room; Private Offices, Conference Rooms, and CADD rooms - provide minimum one duplex receptacle each wall in private offices, smaller conference rooms, and CADD rooms.

d. Communications - The Contractor shall provide high-speed internet service for all workstations as part of the Government's office. All charges for the high speed internet service for the government office shall be borne by the Contractor. Provide minimum 42 Cat5 LAN connections and 35 telephone connections all wired through the Tele/Comm Room illustrated. LAN connections shall be provided at each modular workstation, each small conference room, and at each of four main walls in Large Conference Room. Telephone connections shall be provided at each modular workstation. Breakdown of LAN and telephone connections by zone: "User" area - 14 LAN, 12 telephone; COE Resident Engineer area - 4 LAN, 4 telephone; COE Administrative and Technical Support area - 20 LAN, 19 phone; Large Conference Room - 4 LAN.

e. Fixtures and Furnishings - Provide modular workstation for each private office and CADD room and in total quantities by zone as follows: Total number of workstations shall be provided per attached sketch, Appendix S. Modular workstations shall be sized to accommodate a computer workstation, storage space and bookshelf (12 feet of work surface), and a 30-inch by 6 feet long layout table with drawer(s). Additional fixture and furnishing requirements by room type are as follows: Wall finishes shall be painted gypsum board throughout and ceiling finish shall be acoustical tile ceiling throughout.

1) Private Offices, Open Offices, and CADD Rooms - Flooring shall be durable commercial grade, broadloom type tufted carpet with resilient base.

2) Corridors - Flooring shall vinyl composition tile (VCT) with resilient base.

3) Conference Rooms - Flooring shall be durable commercial grade, broadloom type tufted carpet with resilient base. Provide painted wooden chair rail around entire room. Furnishings for conference shall be provided per attached sketch, Appendix S. Conference Room labeled "User" shall be provided with a conference room type table with six chairs. In additional each smaller conference room shall be provided with one 4 feet by 8 feet marker board and the conference room no. 1 shall be provided with two 4 feet by 8 feet marker boards, a ceiling mounted projector mount and an electronic projector screen. Provide conference room type table with six chairs and one 4 feet by 8 feet marker board in both smaller conference rooms. In the larger conference room provide conference room type tables and chairs for 30 people, two 4 feet by 8 feet marker boards, a ceiling mounted projector mount, and an electric projection screen.

4) Equipment Room - Flooring shall be sealed concrete if building is on concrete slab, otherwise VCT with resilient base.

5) Kitchen - Flooring shall be VCT with resilient base. Provide minimum 10 feet of cabinets (upper and lower) with counter, freestanding electric range, electric range hood, full size refrigerator, and microwave oven. Kitchen appliances shall have

matching finish.

6) Men's Toilet - Flooring shall be ceramic tile with ceramic tile base. Provide toilet and urinal partitions for fixtures indicated in plumbing paragraph. Toilet partition at ADA toilet shall meet ADA requirements. Toilet accessories shall be as follows: one double roll toilet tissue dispenser per toilet, one 36 inch and one 42 inch grab bar at ADA toilet, one glass mirror per lavatory (ADA type at ADA lavatory), one heavy duty metal shelf per lavatory, and one combination paper towel dispenser/waste receptacle.

7) Women's Toilet - Flooring shall be ceramic tile with ceramic tile base. Provide toilet partitions for fixtures indicated in plumbing paragraph. Toilet partition at ADA toilet shall meet ADA requirements. Toilet accessories shall be as follows: one double roll toilet tissue dispenser per toilet, one 36 inch and one 42 inch grab bar at ADA toilet, one ADA type glass mirror at lavatory, one heavy duty metal shelf at lavatory, and one combination paper towel dispenser/waste receptacle.

f. Exterior Doors and Windows - Provide a sufficient number of operable windows with insect screens for adequate light and ventilation. At minimum each private office/room shall have one large window and open office areas/conference rooms shall have at least one window per 12 feet of linear wall space. Exterior doors shall have non-removable hinge pins and dead bolts manually operated from the inside and keyed from the outside. Exterior entrances will have covered porch areas. The front entrance shall have double doors and shall be ADA accessible with 10 feet by 15 feet landing in front of the door and ADA ramp to parking surface as required. All other entrances shall have landings of approximately 8 feet by 10 feet.

g. Site Requirements - The Office complex site will be designated by the Resident Engineer prior to award. A 70 foot by 70 foot gravel parking lot (8 inches gravel depth) sufficiently graded to allow easy access and egress for compact sedans. This will include one concrete entranceway made through existing curb and gutter. The entire facility and parking area will be secured with a 6 foot high chain link fence, topped with 3-strand barbed wire. In addition to the vehicle gate, 2 pedestrian gates will be installed. Final site plan and facility locations will approved by the Resident Engineer. This office will be the contractor's property after BOD and removed from the site. The complex will be provided and installed onsite within 60 days of NTP.

1.7.2 Field Engineer's Office

The Contractor shall provide the Government Field Engineer with an office on the project site, approximately 1500 square feet in floor area. Full utilities and services shall be provided including heating, ventilation, and air conditioning (HVAC); plumbing water and sewer; electric light and power; and communications telephone and data. One male and one female toilet rooms with single toilets and lavatories each shall be provided. A hot water heater shall be provided to provide hot water service to both toilet rooms. The office shall have a minimum of two doors, a mail slot in one of the doors or a lockable mail box mounted on the surface of the door, battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. The windows and doors shall be screened and the doors

provided with dead bolt type locking devices or a padlock and heavy-duty hasp bolted to the door. Door hinge pins shall be non-removable. The windows shall be arranged to open and to be securely fastened from the inside. Glass panels in windows shall be protected by bars or heavy mesh screens to prevent easy access to the building through these panels. In warm weather, air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 30 degrees F below the outside temperature when the outside temperature is 95 degrees F shall be furnished. At the completion of the project, the office shall remain the property of the Contractor and shall be removed from the site. Utilities shall be connected and disconnected in accordance with local codes and to the satisfaction of the Contracting Officer.

1.8 CONTRACTOR'S TEMPORARY FACILITIES

1.8.1 Administrative Field Offices

The Contractor shall provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

1.8.2 Storage Area

The Contractor shall construct a temporary 6 foot high chain link fence meeting NSA Security requirements around trailers and materials. The fence shall include plastic strip inserts, colored brown, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the military boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day. Materials shall not be stockpiled outside the fence in preparation for the next day's work. Mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, shall be parked within the fenced area at the end of each work day.

1.8.3 Temporary Project Safety Fencing

As soon as practicable, but not later than 15 days after the date established for commencement of work, the Contractor shall furnish and install temporary project screening fence around the entire work site including all storage areas. Fence shall be chain link fence 8 feet high with an attached bronze color screening material. See Appendix S NSA Construction Security Requirements for additional requirements. The fence shall be maintained by the Contractor during the life of the project and removed at the end of the project. Grass and vegetation along the fnece line shall be edged or neatly trimmed. Temporary safety fencing shall be erected to avoid conflict with the permanent perimeter fence.

1.8.4 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on

the military property.

1.8.5 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

1.8.6 New Building

In the event a new building is constructed for the temporary project field office, it shall be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. It shall be equipped with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. It shall be provided with a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building shall be waterproof, shall be supplied with heater, shall have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Approved sanitary facilities shall be furnished. The windows and doors shall be screened and the doors provided with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins shall be non-removable. The windows shall be arranged to open and to be securely fastened from the inside. Glass panels in windows shall be protected by bars or heavy mesh screens to prevent easy access to the building through these panels. In warm weather, air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 20 degrees F below the outside temperature when the outside temperature is 95 degrees F, shall be furnished. Any new building erected for a temporary field office shall be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work shall become the property of the Contractor and shall be removed from the site. All charges for telephone service for the temporary field office shall be borne by the Contractor, including long distance charges up to a maximum of $75.00 per month.

1.8.7 Security Provisions

Adequate outside security lighting shall be provided at the Contractor's temporary facilities. The Contractor shall be responsible for the security of its own equipment; in addition, the Contractor shall notify the NSA Georgia Security or NSA Georgia Police requesting periodic security checks of the temporary project field office.

1.9 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor shall install a satisfactory means of communication, such as telephone or other suitable devices. The devices shall be made available for use by Government personnel.

1.10 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, the Contractor shall furnish and erect temporary project safety fencing at the work site in accordance with NSA Security Standards. The safety fencing shall be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on maximum 10 foot centers, constructed at the approved location. The safety fencing shall be maintained by the Contractor during the life of the contract and, upon completion and acceptance of the work, shall become the property of the Contractor and shall be removed from the work site.

1.11 PARTNERING

Following contract award, the Government intends to propose a voluntary partnering relationship with the Contractor. This partnering relationship will attempt to draw on strengths of each organization to facilitate communications and minimize delays to achieve a quality product, within budget, and on schedule. Participation in such partnering activities may include attendance at coordination meetings and cooperation in other efforts to promote the partnering relationship. The Government and the Contractor will each bear their own costs for participation in the partnering relationship, with no change in the contract price. Participation will not result in any change in the terms or price of the contract.

1.12 TERMITICIDE APPLICATION REPORT

A Termiticide Application Report (no form number) shall be completed for each structure receiving termiticide treatment. The Contractor shall obtain the form from the Fort Bragg PWBC pest management coordinator through the Contracting Officer. All requested information shall be provided in detail. The location of application shall be clearly designated, e.g., building number, name, or address. If necessary, provide a map showing location of structure with the report.

1.13 INSTALLATION REGULATIONS

The employees of the Contractor will be required to abide by all installation regulations as published by the Commanding Officer and NSA Security Standards. A copy of these regulations can be obtained from the Area/Resident Engineer at the installation. All costs in connection therewith shall be included in the contract price for the work.

1.14 TESTING LABORATORIES

Testing is required to be performed by the Contractor as part of his Quality Control Program to verify contract compliance. This Quality Control Testing is to be conducted by a project or commercial laboratory which has been found adequate and qualified by a Corps of Engineers Division Laboratory Inspection Team.

1.14.1 Approved Testing Laboratories

A composite listing of approved testing laboratories within the Savannah District is available upon request. The Contractor should engage the services of a laboratory contained in the composite list. Contractors may

obtain the list by calling (678) 354-0310. Fax requests can be made to number (678) 354-0330.

1.14.2 Other Laboratory Services

The Contractor may engage the services of a laboratory other than those approved by Corps of Engineers District Laboratory Inspection Team if they comply with the following:

a. The Contractor identifies and proposes the unapproved laboratory a minimum of 90 days prior to the start of testing. This time is necessary to allow for scheduling an inspection by a Corps of Engineers District Laboratory team. The time for Government inspection will not be the basis for an increase in the contract performance period.

b. All costs of Government inspection shall be the responsibility of the Contractor.

c. The Contractor may request Government inspection and approval prior to award by forwarding a written request to:

US Army Engineer District, Savannah
Environmental and Materials Unit
200 North Cobb Parkway
Building 400, Suite 404
Marietta, GA 30062

1.15 "AS-BUILT" RECORD DRAWINGS - CIVIL

1.15.1 Masters

The Contractor shall be responsible for maintaining one set of master prints on the job site, on which he shall keep a careful and neat record of all deviations from the original contract drawings which are made to each phase of construction as the work progresses. The Contractor is responsible for noting all changes and corrections on these record drawing prints promptly as the changes occur, but in no case less often than on a weekly basis. The record drawing prints which are maintained shall indicate all changes and modifications incorporated into the work as well as the following:

1.15.1.1 Subsurface Utility Lines

Actual location of all subsurface utility lines. Type of materials actually installed, major sizes of lines, etc. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered or obscured, the record drawings shall show, by offset dimensions to two permanently fixed surface features, both ends of each run each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensions along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

1.15.1.2 Shop Drawings

Any shop drawings which constitute part of the design shall be included with the record drawings.

1.15.1.3 Manufacturer and Model Number

The manufacturer and model number of all major items of equipment shall be shown on the record drawings.

1.15.1.4 Additives

Upon completion of all construction, the Contractor will delete all references to unawarded additives shown on the contract drawings.

1.15.2 Notated Prints

These notated prints shall be certified as to their correctness by the signature of an authorized representative of the Contractor and turned over to the Resident Contracting Officer not later than 10 days after final acceptance of the work by the Government. Marked-up prints shall be reviewed for approval by the Resident Contracting Officer and returned for corrections as necessary.

1.15.3 Final Revised As-built Drawings

Final revised as-built drawings will be made by the Government by transferring all corrections the Contractor has noted on the set of master prints to the original contract drawings.

1.16 ENVIRONMENTAL EVALUATION FOR SITE CONTAMINATION - CATEGORY II

1.16.1 Site Evaluation

The job site has been evaluated for potential site contamination. The site is perceived as a clean location which has the potential for contamination.

1.16.2 Site Analysis

The Project Site is located adjacent to a former landfill to the east. There are existing methane gas monitoring wells which must be protected and maintained. The site is the former location of a barracks, wash protected and maintained. The site is the former location of a barracks, wash facility and gas station. There are existing underground monitoring wells which must be protected and maintained. The site is also still littered with concrete pads, brick foundations and mounds of debris.

1.16.3 Contractual Responsibilities of All Parties in the Event of Encounter with Contamination

If the Contractor encounters materials or conditions which indicate that there may be contamination on the site, the Contractor shall stop all work on the job site and report the discovery of the contaminants to the Contracting Officer's Representative (COR). The Contracting Officer, will issue a written order to the Contractor to resume work or to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government as provided in FAR 52.212-12 - SUSPENSION OF WORK. The Government will be responsible for making an assessment of the contaminated site if this course of action is determined to be appropriate. After the assessment has been completed, the Government reserves the right to the following courses of action:

a. Direct the Contractor to resume work.

b. Clean up the contaminated site prior to directing the Contractor to resume work. The COR will determine whether the cleanup is to be accomplished by others or the Contractor.

c. Relocate the project site.

d. Terminate the contract for the convenience of the Government as provided in FAR 52.249-1 - TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (SHORT FORM) or FAR 52.249-2 - TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) - ALTERNATE I as applicable.

1.17 CONSTRUCTION SCHEDULE RESTRAINTS

1.17.1 Occupancy

The work to be performed is to be accomplished in facilities which will be unoccupied and vacant during the course of construction. It is the intent of these provisions to provide for maximum coordination between construction activities pursuant to this contract and concurrent ongoing routine activities of base personnel. Interference with and inconvenience to the occupants or routine of the facility shall be held to an absolute minimum.

1.17.2 Protection

Contractor is responsible to provide such covering, shields and barricades as are required to protect building occupants, equipment, stores, supplies, etc., from dust, debris, weather intrusion, water, moisture or other cause of damage resulting from construction.

1.17.3 Phasing and Sequence

1.17.3.1 General

In addition to the submittals required by clause SCHEDULES FOR CONSTRUCTION CONTRACTS (see SECTION 00700, FAR 52.236-15) the Contractor shall submit for approval a summary work schedule setting forth schedule dates for initiation and completion of construction in each work area. No work shall be performed prior to approval of this schedule and all work shall be performed in strict adherence thereto. If departures from this schedule appear to be required or desired, the Contracting Officer shall be promptly notified and his approval will be required prior to implementation of said departure(s).

1.17.3.2 Special Work Restraints

NONE.

1.17.4 Time of Performance

1.17.4.1 Access to Buildings

All work requiring access to building interiors excluding attics, crawl spaces, etc., and all other work shall be performed between 7:30 a.m. and 4 p.m. (normal working hours for base where project is located) excluding official holidays, unless otherwise indicated or approved by the Contracting Officer. Requests to work during other than these normal hours shall be made in writing at least 36 hours in advance. For example, a

request to work on a Saturday shall be submitted no later than Thursday at noon.

1.17.4.2 Work Requiring Outages

Work requiring outages of utilities or building systems will be accomplished after normal working hours and/or on weekends in accordance with prior approved schedule(s).

1.17.5 Outages

Contractor's work requiring outages of utility systems or building systems will require 2 weeks' advance notice and will be subject to the approval of the Contracting Officer. Notice shall include type of outage, date, and time outage will commence and estimated duration of outage. Outages to existing NSA Facilities is not allowed.

1.17.6 Continuity

All tools, labor and materials required to complete any item of work within a given work area or requiring an outage of any building utility or system shall be available at the site prior to commencement thereof. Once work has commenced on an item of work, said work shall be continuously and diligently performed to completion and acceptance. Breaks in work to be negotiated with the Contracting Officers Representative if other then Holidays.

1.18 COLOR BOARDS

Six sets of color boards shall be submitted, in addition to samples required elsewhere. Such submittals shall be made not later than 60 days prior to approval date required to achieve compliance with approved project schedule. Each set of boards shall include samples of colors and finishes of all exterior and interior building surfaces such as walls, toilet partitions, floors and ceilings. The samples will be presented on 8-inch by 10-1/2-inch boards (modules) with a maximum spread of by 31-1/2 inches for foldouts. The modules shall be designed to fit in a standard looseleaf, three-ring binder. If more space is needed, more than one board per set may be submitted. The Contractor shall certify that he has reviewed the color samples in detail and that they are in strict accordance with the contract drawings and specifications, except as may be otherwise explicitly stated. If multiple material and finish (color) schemes are required, samples shall be identified by scheme and coordinated to room names and numbers shown on the architectural floor plans and room finish and color schedule. Submittal of the color boards shall not relieve the Contractor of the responsibility to submit the samples required by technical specifications.

1.19 REQUEST FOR INFORMATION (RFI) SYSTEM

The Government has developed an electronic database, the Request for Information (RFI) System, to track and answer Contractor questions, requests for information and clarifications during construction. The use of the RFI System for all requests (the Contractor's as well as the subcontractors'/suppliers') is a contractual requirement for this project. The Contractor will enter the system over the Internet using a WEB browser such as Internet Explorer 5.0 or newer or Netscape 4.7 or newer and any Internet service provider. The Government will provide the Contractor a user identification and password for the system that will only allow the Contractor to enter and view the requests for this project. The Contractor

will provide the Government the E-mail address for the individual(s) inputting into the system in order that E-mail messages can be sent from the Government to the Contractor indicating a response to the request. The Government will provide instructions in the use of the RFI system. The Contractor must fill in seven fields in the Contractor Data portion of the RFI form, which include Date Required, Priority, Short Description, Problem Description, Recommended Action, Cost, and Time. The Government will be notified through an E-mail message that the Contractor has entered a request into the system. When the Government has answered the request, an E-mail message will be sent informing the Contractor that the answer to the request is in the system. The Contractor will enter the system to retrieve the answer using the same procedure to enter the question. The RFI System assigns a unique number to each request. The Contractor will not be reimbursed separately for the required use of this system. The Contractor shall include any costs associated with the use of this system into their bid.

1.20 CLEANUP

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away. Materials resulting from demolition activities which are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

1.21 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

SECTION 01525

SAFETY AND OCCUPATIONAL HEATLH REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.32	Personal Fall Protection - Safety Requirements for Construction and Demolition Operations
ANSI Z359.1	(1992; R 1999) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components
ANSI/ASSE A10.34	(2001) Protection of the Public on or Adjacent to Construction Sites
ASME B30.3	(1996) Construction Tower Cranes

ASME INTERNATIONAL (ASME)

ASME B30.22	(2000) Articulating Boom Cranes
ASME B30.5	(2004) Mobile and Locomotive Cranes
ASME B30.8	(2004) Floating Cranes and Floating Derricks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2002) Portable Fire Extinguishers
NFPA 241	(2000) Safeguarding Construction,Alteration, and Demolition Operations
NFPA 51B	(2003) Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2005) National Electrical Code
NFPA 70E	(2004) Electrical Safety in the Workplace

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) Safety -- Safety and Health Requirements

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.500	Fall Protection
29 CFR 1926.550	Cranes and Derricks

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

Government acceptance is required for submittals with a "G, A" designation.

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G, A

Activity Hazard Analysis (AHA); G, A

Crane Critical Lift Plan; G, A

Proof of qualification for Crane Operators; G, A

SD-06 Test Reports

Reports

Accident Reports

Accident Reports

Monthly Exposure Reports

Crane Reports

Regulatory Citations and Violations

Submit reports as their incidence occurs, in accordance with the requirements of the paragraph entitled, "Reports."

SD-07 Certificates

Confined Space Entry Permit

Hot work permit

Contractor Safety Self-Evaluation Checklist; G, A

Certificates of Compliance (Crane)

Submit one copy of each permit/certificate attached to each Daily Quality Control Report.

Machinery & Mechanized Equipment Certification Form.

1.3 DEFINITIONS

a. Competent Person for Fall Protection. A person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as their application and use with related equipment, and has the authority to take prompt corrective measures to eliminate the hazards of falling.

b. High Visibility Accident. Any mishap which may generate publicity and/or high visibility.

c. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

d. Operating Envelope. The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers and crane walkers, rigging gear between the hook and the load, the load and the crane's supporting structure (ground, rail, etc.).

e. Qualified Person for Fall Protection. A person with a recognized degree or professional certificate, and with extensive knowledge, training and experience in the field of fall protection; who is capable of performing design, analysis, and evaluation of fall protection systems and equipment.

f. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:

1. Death, regardless of the time between the injury and death, or the length of the illness;

2. Days away from work (any time lost after day of injury/illness onset);

3. Restricted work;

4. Transfer to another job;

5. Medical treatment beyond first aid;

6. Loss of consciousness; or

7. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in 1. through 6. above.

g. "USACE" property and equipment specified in EM 385-1-1 should be interpreted as Government property and equipment.

h. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the six elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; and/or collision, including unplanned contact between the load, crane, and/or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.).

1.4 CONTRACTOR SAFETY SELF-EVALUATION CHECKLIST

Contracting Officer will provide a "Contractor Safety Self-Evaluation checklist" to the Contractor at the pre-construction conference. The checklist will be completed monthly by the Contractor and submitted with each request for payment voucher. An acceptable score of 90 or greater is required. Failure to submit the completed safety self-evaluation checklist or achieve a score of at least 90, will result in a retention of up to 10 percent of the voucher.

1.5 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, work performed shall comply with EM 385-1-1, and applicable federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

1.6 SITE QUALIFICATIONS, DUTIES AND MEETINGS

1.6.1 Personnel Qualifications

1.6.1.1 Site Safety and Health Officer (SSHO)

Site Safety and Health Officer (SSHO) shall be provided at the work site at all times to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The Contractor Quality Control (QC) person can be the SSHO on this project. The SSHO shall meet the following requirements:

Level 6:

A Certified Safety Professional (CSP) and/or Certified Industrial Hygienist (CIH).

A minimum of 10 years safety work of a progressive nature with at least 5 years of experience on similar projects.

30-hour OSHA construction safety class or equivalent within the last 5 years.

An average of at least 24 hours of formal safety training each year for the past 5 years with training for competent person status for at least the following 4 areas of competency: Excavation; Scaffolding; Fall protection; Hazardous energy; Confined space; Health hazard recognition, evaluation and control of chemical, physical and biological agents; Personal protective equipment and clothing to include selection, use and maintenance.

1.6.1.2 Certified Safety Professional (CSP) and/or Certified Industrial hygienist (CIH)

Provide a Certified Safety Professional (CSP) at the work site to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The CSP shall be the safety and occupational health "competent person" as defined by USACE EM 385-1-1. The CSP shall have no other duties than safety and occupational health management, inspections, and/or industrial hygiene.

1.6.1.3 Associate Safety professional (ASP), Certified Safety Trained Supervisor (STS) and/or Construction Health and Safety Technician (CHST)

Provide a Certified Safety Trained Supervisor (STS) and/or Construction Health & Safety Technician (CHST) at the work site to perform safety management, surveillance, inspections, and safety enforcement for the Contractor. The STS and/or CHST shall be the safety and occupational health "competent person" as defined by USACE EM 385-1-1. The STS and/or CHST shall be at the work site at all times whenever work or testing is being performed and shall conduct and document daily safety inspections. The STS and/or CHST shall have no other duties other than safety and occupational health management, inspections, and enforcement on this contract.

1.6.1.4 Competent Person for Confined Space Entry

Provide a competent person for confined space meeting the definition and requirements of EM 385-1-1.

1.6.1.5 Crane Operators

Crane operators shall meet the requirements in EM 385-1-1, Section 16 and Appendix G. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacitates of 50,000 pounds or greater, crane operators shall be designated as qualified by a source that qualifies crane operators (i.e., union, a government agency, or and organization that tests and qualifies crane operators). Proof of current qualification shall be provided.

1.6.2 Personnel Duties

1.6.2.1 Site Safety and Health Officer (SSHO)/Superintendent

a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Safety inspection logs shall be attached to the Contractors' daily quality control report.

b. Conduct mishap investigations and complete required reports.

Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.

c. Maintain applicable safety reference material on the job site.

d. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.

e. Implement and enforce accepted APPS and AHAs.

f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. A list of unresolved safety and health deficiencies shall be posted on the safety bulletin board.

g. Ensure sub-contractor compliance with safety and health requirements.

h. Failure to perform the above duties will result in dismissal of the superintendent and/or SSHO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

1.6.2.2 Certified Safety Professional (CSP),Associate Safety Professional (ASP), Certified Safety Trained Supervisor (STS),and/or Certified Construction Health & Safety Technician (CHST)

a. Perform safety and occupational health management, surveillance, inspections, and safety enforcement for the project.

b. Perform as the safety and occupational health "competent person" as defined by EM 385-1-1.

c. Be on-site at all times whenever work or testing is being performed.

d. Conduct and document safety inspections.

e. Shall have no other duties other than safety and occupational health management, inspections, and enforcement on this contract.

f. If the CSP, ASP, STS, or CHST is appointed as the SSHO all duties of that position shall also be performed.

1.6.3 Meetings

1.6.3.1 Preconstruction Conference

a. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).

b. The Contractor shall discuss the details of the submitted APP to

include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, a schedule for the preparation, submittal, review, and acceptance of AHAs shall be established to preclude project delays.

c. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Work shall not begin until there is an accepted APP.

d. The functions of a Preconstruction conference may take place at the Post-Award Kickoff meeting for Design Build Contracts.

1.6.3.2 Safety Meetings

Shall be conducted and documented as required by EM 385-1-1. Minutes showing contract title, signatures of attendees and a list of topics discussed shall be attached to the Contractors' daily quality control report.

1.7 ACCIDENT PREVENTION PLAN (APP)

a. The Contractor shall use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements in EM 385-1-1, Appendix A, "Minimum Basic Outline for Accident Prevention Plan". Specific requirements for some of the APP elements are described below. The APP shall be job-specific and shall address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Any portions of the Contractor's overall safety and health program referenced in the APP shall be included in the applicable APP element and made site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP shall be signed by the person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer and any designated CSP and/or CIH.

b. Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

c. Once accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter

has been rectified.

d. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and quality control manager. Should any hazard become evident, stop work in the area, secure the area, and develop a plan to remove the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, all necessary action shall be taken to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ANSI/ASSE A10.34,) and the environment.

e. Copies of the accepted plan will be maintained at the Contracting Officer's office and at the job site. The APP shall be continuously reviewed and amended, as necessary, throughout the life of the contract. Unusual or high-hazard activities not identified in the original APP shall be incorporated in the plan as they are discovered.

1.7.1 EM 385-1-1 Contents

In addition to the requirements outlines in Appendix A of EM 385-1-1, the following is required:

a. Names and qualifications (resumes including education, training, experience and certifications) of all site safety and health personnel designated to perform work on this project to include the designated site safety and health officer and other competent and qualified personnel to be used such as CSPs, CIHs, STSs, CHSTs. The duties of each position shall be specified.

b. Qualifications of competent and of qualified persons. As a minimum, competent persons shall be designated and qualifications submitted for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; personal protective equipment and clothing to include selection, use and maintenance.

c. Confined Space Entry Plan. Develop a confined space entry plan in accordance with USACE EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)

d. Crane Critical Lift Plan. Prepare and sign weight handling critical lift plans for lifts over 75 percent of the capacity of the crane or hoist (or lifts over 50 percent of the capacity of a barge mounted mobile crane's hoists) at any radius of lift; lifts involving more than one crane or hoist; lifts of personnel; and lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks. The plan shall be submitted 15 calendar days prior to on-site work and include the requirements of EM 385-1-1, paragraph 16.C.18. and the

following:

1. For lifts of personnel, the plan shall demonstrate compliance with the requirements of 29 CFR 1926.550(g).

2. For barge mounted mobile cranes, barge stability calculations identifying barge list and trim based on anticipated loading; and load charts based on calculated list and trim. The amount of list and trim shall be within the crane manufacturer's requirements.

e. Fall Protection and Prevention (FP&P) Plan. The plan shall be site specific and address all fall hazards in the work place and during different phases of construction. It shall address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 6 feet. A qualified person for fall protection shall prepare and sign the plan. The plan shall include fall protection and prevention systems, equipment and methods employed for every phase of work, responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Fall Protection and Prevention Plan shall be revised every six months for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. The accepted Fall Protection and Prevention Plan shall be kept and maintained at the job site for the duration of the project. The Fall Protection and Prevention Plan shall be included in the Accident Prevention Plan (APP).

f. Asbestos Hazard Abatement Plan. The safety and health aspects of asbestos work, prepared in accordance with Section 13280 ASBESTOS ABATEMENT 13281N ENGINEERING CONTROL OF ASBESTOS CONTAINING MATERIALS.

g. Site Demolition Plan. The safety and health aspects prepared in accordance with Section 02 41 00 DEMOLITION and referenced sources. Include engineering survey as applicable.

h. Excavation Plan. The safety and health aspects prepared in accordance with Section 31 00 00 EARTHWORK.

1.8 ACTIVITY HAZARD ANALYSIS (AHA)

a. The Activity Hazard Analysis (AHA) format shall be in accordance with EM 385-1-1. Submit the AHA for review at least 15 calendar days prior to the start of each phase. Format subsequent AHAs as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

b. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

c. The activity hazard analyses shall be developed using the project schedule as the basis for the activities performed. Any activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier or subcontractor and provided to the prime contractor for submittal to the Contracting Officer.

1.9 DISPLAY OF SAFETY INFORMATION

Within one (1) calendar days after commencement of work, erect a safety bulletin board at the job site. The safety bulletin board shall include information and be maintained as required by EM 385-1-1, section 01.A.06. Additional items required to be posted include:

a. Confined space entry permit.

b. Hot work permit.

1.10 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in the article "References." Maintain applicable equipment manufacturer's manuals.

1.11 EMERGENCY MEDICAL TREATMENT

Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment.

1.12 REPORTS

1.12.1 Accident Reports

a. For recordable injuries and illnesses, and property damage accidents resulting in at least $2,000 in damages, the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the Navy Contractor Significant Incident Report (CSIR) form USACE Accident Report Form 3394 and provide the report to the Contracting Officer within 5 calendar day(s) of the accident. The Contracting Officer will provide copies of any required or special forms.

b. For any weight handling equipment accident (including rigging gear accidents) the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the WHE Accident Report (Crane and Rigging Gear) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Crane operations shall not proceed until cause is determined and corrective actions have been implemented to the satisfaction of the contracting officer. The Contracting Officer will provide a blank copy of the accident report form.

1.12.2 Accident Notification

Notify the Contracting Officer as soon as practical, but not later than four hours, after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than $2,000, or any weight handling equipment accident. Information shall include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted.

1.12.3 Monthly Exposure Reports

Monthly exposure reporting to the Contracting Officer is required to be attached to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. The Contracting Officer will provide copies of any special forms.

1.12.4 Crane Reports

Submit crane inspection reports required in accordance with EM 385-1-1, Appendix H and as specified herein with Daily Reports of Inspections.

1.12.5 Certificate of Compliance

The Contractor shall provide a Certificate of Compliance for each crane entering an activity under this contract (see Contracting Officer for a blank certificate). Certificate shall state that the crane and rigging gear meet applicable OSHA regulations (with the Contractor citing which OSHA regulations are applicable, e.g., cranes used in construction, demolition, or maintenance shall comply with 29 CFR 1926 and EM 385-1-1 section 16 and Appendix H. Certify on the Certificate of Compliance that the crane operator(s) is qualified and trained in the operation of the crane to be used. For cranes at DOD activities in foreign countries, the Contractor shall certify that the crane and rigging gear conform to the appropriate host country safety standards. The Contractor shall also certify that all of its crane operators working on the DOD activity have been trained in the proper use of all safety devices (e.g., anti-two block devices). These certifications shall be posted on the crane.

1.13 HOT WORK

a. Prior to performing "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices, a written permit shall be requested from the Fire Division. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. The Contractor will provide at least two 20 pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch shall be trained in accordance with NFPA 51B and remain on-site for a minimum of 30 minutes after completion of the task or as specified on the hot work permit.

b. When starting work in the facility, Contractors shall require their personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire Division phone number. ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED TO THE RESPONSIBLE FIRE DIVISION IMMEDIATELY.

PART 2 PRODUCTS

2.1 CONFINED SPACE SIGNAGE

The Contractor shall provide permanent signs integral to or securely attached to access covers for new permit-required confined spaces. Signs wording: "DANGER--PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER -" in bold letters a minimum of 1 inch in height and constructed to be clearly legible

with all paint removed. The signal word "DANGER" shall be red and readable from 5 feet.

2.2 FALL PROTECTION ANCHORAGE

Fall protection anchorage, conforming to ANSI Z359.1, installed under the supervision of a qualified person in fall protection, shall be left in place for continued customer use and so identified by signage stating the capacity of the anchorage (strength and number of persons who may be tied-off to it at any one time).

PART 3 EXECUTION

3.1 CONSTRUCTION AND/OR OTHER WORK

The Contractor shall comply with USACE EM 385-1-1, NFPA 241, the APP, the AHA, Federal and/or State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard shall prevail.

3.1.1 Hazardous Material Use

Each hazardous material must receive approval prior to being brought onto the job site or prior to any other use in connection with this contract. Allow a minimum of 10 working days for processing of the request for use of a hazardous material.

3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with USACE EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocynates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials.

3.1.3 Unforeseen Hazardous Material

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos. If additional material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

3.2 PRE-OUTAGE COORDINATION MEETING

Contractors are required to apply for utility outages at least 15 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary

sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, the Contractor shall attend a pre-outage coordination meeting with the Contracting Officer and the Installation Representative to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist. No outages at existing NSA Facilities are allowed.

3.3 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

The Contractor shall establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. The program shall include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures.

3.3.1 Training

The Contractor shall institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, the Contractor shall provide training for each employee who might be exposed to fall hazards. A competent person for fall protection shall provide the training. Training requirements shall be in accordance with USACE EM 385-1-1, section 21.A.16.

3.3.2 Fall Protection Equipment and Systems

The Contractor shall enforce use of the fall protection equipment and systems designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is exposed to a fall hazard. Employees shall be protected from fall hazards as specified in EM 385-1-1, section 21. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, paragraphs 05.H. and 05.I. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems are required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500, Subpart M, EM 385-1-1 and ANSI A10.32.

3.3.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ANSI Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabiners shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 6 feet. The total fall distance and any

swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

3.3.3 Fall Protection for Roofing Work

Fall protection controls shall be implemented based on the type of roof being constructed and work being performed. The roof area to be accessed shall be evaluated for its structural integrity including weight-bearing capabilities for the projected loading.

3.3.3.1 Low Sloped Roofs

a. For work within 6 feet of an edge, on low-slope roofs, personnel shall be protected from falling by use of personal fall arrest systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and is not authorized.

b. For work greater than 6 feet from an edge, warning lines shall be erected and installed in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

3.3.3.2 Steep-Sloped Roofs

Work on steep-sloped roofs requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also includes residential or housing type construction.

3.3.4 Existing Anchorage

Existing anchorages, to be used for attachment of personal fall arrest equipment, shall be certified (or re-certified) by a qualified person for fall protection in accordance with ANSI Z359.1. Exiting horizontal lifeline anchorages shall be certified (or re-certified) by a registered professional engineer with experience in designing horizontal lifeline systems.

3.3.5 Horizontal Lifelines

Horizontal lifelines shall be designed, installed, certified and used under the supervision of a qualified person for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

3.3.6 Guardrails and Safety Nets

Guardrails and safety nets shall be designed, installed and used in accordance with EM 385-1-1 and 29 CFR 1926, Subpart M.

3.3.7 Rescue and Evacuation Procedures

When personal fall arrest systems are used, the contractor must ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. A Rescue and Evacuation Plan shall be prepared by the contractor and include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. The Rescue and Evacuation Plan shall be included in the Activity Hazard Analysis (AHA)

for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident Prevention Plan (APP).

3.4 SHIPYARD REQUIREMENTS

All personnel who enter the Controlled Industrial Area (CIA) shall wear mandatory personal protective equipment (PPE) at all times. All personnel shall also comply with PPE postings of shops both inside and outside the CIA. PPE shall be governed in all other areas by the nature of the work the employee is performing. They will also use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks. Mandatory PPE includes:

a. Hard Hat

b. Safety Glasses

c. Safety Toed Shoes

3.5 SCAFFOLDING

Employees shall be provided with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Access to scaffold platforms greater than 20 feet in height shall be accessed by use of a scaffold stair system. Vertical ladders commonly provided by scaffold system manufacturers shall not be used for accessing scaffold platforms greater than 20 feet in height. The use of an adequate gate is required. Contractor shall ensure that employees are qualified to perform scaffold erection and dismantling. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. Special care shall be given to ensure scaffold systems are not overloaded. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material is prohibited. The first tie-in shall be at the height equal to four times the width of the smallest dimension of the scaffold base. Work platforms shall be placed on mud sills. Scaffold or work platform erectors shall have fall protection during the erection and dismantling of scaffolding or work platforms that are more than 6 feet. Delineate fall protection requirements when working above six feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

3.5.1 Stilts

The use of stilts for gaining additional height in construction, renovation, repair or maintenance work is prohibited.

3.6 EQUIPMENT

3.6.1 Material Handling Equipment

a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.

b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.

c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

3.6.2 Weight Handling Equipment

a. Cranes and derricks shall be equipped as specified in EM 385-1-1, section 16.

b. The Contractor shall notify the Contracting Officer 15 days in advance of any cranes entering the activity so that necessary quality assurance spot checks can be coordinated. Prior to cranes entering federal activities, a Crane Access Permit must be obtained from the Contracting Officer. A copy of the permitting process will be provided at the Preconstruction Conference. Contractor's operator shall remain with the crane during the spot check.

c. The Contractor shall comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Erection shall be performed under the supervision of a designated person (as defined in ASME B30.5). All testing shall be performed in accordance with the manufacturer's recommended procedures.

d. The Contractor shall comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.

e. Under no circumstance shall a Contractor make a lift at or above 90% of the cranes rated capacity in any configuration.

f. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and shall follow the requirements of EM 385-1-1 section 11 and ASME B30.5 or ASME B30.22 as applicable.

g. Crane suspended personnel work platforms (baskets) shall not be used unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Personnel shall not be lifted with a line hoist or friction crane.

h. Portable fire extinguishers shall be inspected, maintained, and recharged as specified in NFPA 10, Standard for Portable Fire Extinguishers.

i. All employees shall be kept clear of loads about to be lifted and of suspended loads.

j. The Contractor shall use cribbing when performing lifts on outriggers.

k. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

l. A physical barricade must be positioned to prevent personnel from

entering the counterweight swing (tail swing) area of the crane.

m. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.

n. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.

o. Certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

p. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. Prior to conducting lifting operations the contractor shall set a maximum wind speed at which a crane can be safely operated based on the equipment being used, the load being lifted, experience of operators and riggers, and hazards on the work site. This maximum wind speed determination shall be included as part of the activity hazard analysis plan for that operation.

3.6.3 Equipment and Mechanized Equipment

a. Proof of qualifications for operator shall be kept on the project site for review.

b. Manufacture specifications or owner's manual for the equipment shall be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or EM 385-1-1. Such additional safety precautions or requirements shall be incorporated into the AHAs.

c. A Machinery & Mechanized Equipment Certification Form shall be submitted for acceptance by the Contracting Officer prior to being placed into use. A copy of the certification form will be provided during the Pre-construction Conference.

3.7 EXCAVATIONS

The competent person shall perform soil classification in accordance with 29 CFR 1926.

3.7.1 Utility Locations

Prior to digging, the appropriate digging permit must be obtained. All underground utilities in the work area must be positively identified by a private utility locating service in addition to any station locating service and coordinated with the station utility department. Any markings made during the utility investigation must be maintained throughout the contract.

3.7.2 Utility Location Verification

The Contractor must physically verify underground utility locations by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system. Digging within 2 feet of a known utility must not be performed by

means of mechanical equipment; hand digging shall be used. If construction is parallel to an existing utility the utility shall be exposed by hand digging every 100 feet if parallel within 5 feet of the excavation.

3.7.3 Shoring Systems

Trench and shoring systems must be identified in the accepted safety plan and AHA. Manufacture tabulated data and specifications or registered engineer tabulated data for shoring or benching systems shall be readily available on-site for review. Job-made shoring or shielding shall have the registered professional engineer stamp, specifications, and tabulated data. Extreme care must be used when excavating near direct burial electric underground cables.

3.7.4 Trenching Machinery

Trenching machines with digging chain drives shall be operated only when the spotters/laborers are in plain view of the operator. Operator and spotters/laborers shall be provided training on the hazards of the digging chain drives with emphasis on the distance that needs to be maintained when the digging chain is operating. Documentation of the training shall be kept on file at the project site.

3.8 UTILITIES WITHIN CONCRETE SLABS

Utilities located within concrete slabs or pier structures, bridges, and the like, are extremely difficult to identify due to the reinforcing steel used in the construction of these structures. Whenever contract work involves concrete chipping, saw cutting, or core drilling, the existing utility location must be coordinated with station utility departments in addition to a private locating service. Outages to isolate utility systems shall be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the contractor from meeting this requirement.

3.9 ELECTRICAL

3.9.1 Conduct of Electrical Work

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Positive cable identification must be made prior to submitting any outage request for electrical systems. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. In addition, provide

electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA.

3.9.2 Portable Extension Cords

Portable extension cords shall be sized in accordance with manufacturer ratings for the tool to be powered and protected from damage. All damaged extension cords shall be immediately removed from service. Portable extension cords shall meet the requirements of NFPA 70.

3.10 WORK IN CONFINED SPACES

The Contractor shall comply with the requirements in Section 06.I of USACE EM 385-1-1, OSHA 29 CFR 1910.146 and OSHA 29 CFR 1926.21(b)(6). Any potential for a hazard in the confined space requires a permit system to be used.

3.10.1 Entry Procedures

a. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 06.I.06 of USACE EM 385-1-1 for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.

b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.

c. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

-- End of Section --

SECTION 01572

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

PART 1 GENERAL

1.1 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction and use of facilities. As part of the implementation of that policy the Contractor shall: (1) practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction and demolition waste from landfills and incinerators and to facilitate their recycling or reuse.

1.2 REFERENCE

1.2.1 DAIM-ZA Memorandum dated Feb 06, 2006

"Sustainable Management of Waste in Military Construction, Renovation, And Demolition Activities" Including ENCLOSURE.

1.3 MANAGEMENT

The Contractor shall take a pro-active, responsible role in the management of construction and demolition waste and require all subContractors, vendors, and suppliers to participate in the effort. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates. The Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recycling shall accrue to the Contractor. Firms and facilities used for recycling, reuse, and disposal shall be appropriately permitted for the intended use to the extent required by federal, state, and local regulations.

1.4 PLAN

A waste management plan shall be submitted within 15 days after notice to proceed and prior to initiating any site preparation work. The plan shall include the following:

a. Name of individuals on the Contractor's staff responsible for waste prevention and management.

b. Actions that will be taken to reduce solid waste generation.

c. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas and equipment to be used for processing, sorting, and

temporary storage of wastes.

d. Characterization, including estimated types and quantities, of the waste to be generated.

e. Name of landfill and/or incinerator to be used and the estimated costs for use, assuming that there would be no salvage or recycling on the project.

f. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used materials such as materials exchange networks and Habitat for Humanity.

g. List of specific waste materials that will be salvaged for resale, salvaged and reused, or recycled. Recycling facilities that will be used shall be identified.

h. Identification of materials that cannot be recycled/reused with an explanation or justification.

i. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue generated by sale of the materials and the incineration and/or landfill cost avoidance.

1.5 RECORDS

Records shall be maintained to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. The records shall be made available to the Contracting Officer during construction, and a copy of the records shall be delivered to the Contracting Officer upon completion of the construction.

1.6 COLLECTION

The necessary containers, bins and storage areas to facilitate effective waste management shall be provided and shall be clearly and appropriately identified. Recyclable materials shall be handled to prevent contamination of materials from incompatible products and materials and separated by one of the following methods:

1.6.1 Source Separated Method

Waste products and materials that are recyclable shall be separated from trash and sorted into appropriately marked separate containers and then transported to the respective recycling facility for further processing.

1.6.2 Co-Mingled Method

Waste products and recyclable materials shall be placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed.

1.6.3 Other Methods

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

1.7 DISPOSAL

Except as otherwise specified in other sections of the specifications, disposal shall be in accordance with the following:

1.7.1 Reuse

First consideration shall be given to salvage for reuse since little or no re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Sale or donation of waste suitable for reuse shall be considered. Salvaged materials, other than those specified in other sections to be salvaged and reinstalled, shall not be used in this project.

1.7.2 Recycle

Waste materials not suitable for reuse, but having value as being recyclable, shall be made available for recycling whenever economically feasible.

1.7.3 Waste

Materials with no practical use or economic benefit shall be disposed at a landfill or incinerator.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

SECTION 01670

RECYCLED / RECOVERED MATERIALS

PART 1 GENERAL

1.1 REFERENCES

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

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.2 OBJECTIVES

Government procurement policy is to acquire, in a cost effective manner, items containing the highest percentage of recycled and recovered materials practicable consistent with maintaining a satisfactory level of competition without adversely affecting performance requirements or exposing suppliers' employees to undue hazards from the recovered materials. The Environmental Protection Agency (EPA) has designated certain items which must contain a specified percent range of recovered or recycled materials. EPA designated products specified in this contract comply with the stated policy and with the EPA guidelines. The Contractor shall make all reasonable efforts to use recycled and recovered materials in providing the EPA designated products and in otherwise utilizing recycled and recovered materials in the execution of the work.

1.3 EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

Various sections of the specifications contain requirements for materials that have been designated by EPA as being products which are or can be made with recovered or recycled materials. These items, when incorporated into the work under this contract, shall contain at least the specified percentage of recycled or recovered materials unless adequate justification (non-availability) for non-use is provided. When a designated item is specified as an option to a non-designated item, the designated item requirements apply only if the designated item is used in the work.

1.4 EPA PROPOSED ITEMS INCORPORATED IN THE WORK

Products other than those designated by EPA are still being researched and are being considered for future Comprehensive Procurement Guideline (CPG) designation. It is recommended that these items, when incorporated in the work under this contract, contain the highest practicable percentage of recycled or recovered materials, provided specified requirements are also met.

1.5 EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK

There are many products listed in 40 CFR 247 which have been designated or proposed by EPA to include recycled or recovered materials that may be used by the Contractor in performing the work but will not be incorporated into the work. These products include office products, temporary traffic control products, and pallets. It is recommended that these non-construction products, when used in the conduct of the work, contain the highest practicable percentage of recycled or recovered materials and that these products be recycled when no longer needed.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

SECTION 01780

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

As-Built Drawings

Drawings showing final as-built conditions of the project. The final CADD as-built drawings shall consist of one set of electronic CADD drawing files in the specified format, one set of mylar drawings, 2 sets of blue-line prints of the mylars, and one set of the approved working as-built drawings.

SD-03 Product Data

As-Built Record of Equipment and Materials

Two copies of the record listing the as-built materials and equipment incorporated into the construction of the project.

Warranty Management Plan

One set sets of the warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. The Contractor shall furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

Warranty Tags

Two record copies of the warranty tags showing the layout and design.

Final Cleaning

Two copies of the listing of completed final clean-up items.

1.2 PROJECT RECORD DOCUMENTS

1.2.1 As-Built Drawings

This paragraph covers as-built drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working as-built drawings" and "final as-built drawings" refer to contract

drawings which are revised to be used for final as-built drawings.

1.2.1.1 Government Furnished Materials

One set of electronic CADD files in the specified software and format revised to reflect all bid amendments will be provided by the Government at the preconstruction conference for projects requiring CADD file as-built drawings.

1.2.1.2 Working As-Built and Final As-Built Drawings

The Contractor shall revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. These working as-built marked drawings shall be kept current on a weekly basis and at least one set shall be available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. Final as-built drawings shall be prepared after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked prints and final as-built drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working and final as-built drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the as-built drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. The working and final as-built drawings shall show, but shall not be limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

b. The location and dimensions of any changes within the building structure.

c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Changes or modifications which result from the final inspection.

g. Where contract drawings or specifications present options, only the option selected for construction shall be shown on the final as-built prints.

h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, the Contractor shall furnish a contour map of the final borrow pit/spoil area elevations.

i. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

j. Modifications (change order price shall include the Contractor's cost to change working and final as-built drawings to reflect modifications) and compliance with the following procedures:

1. Directions in the modification for posting descriptive changes shall be followed.

2. A Modification Circle shall be placed at the location of each deletion.

3. For new details or sections which are added to a drawing, a Modification Circle shall be placed by the detail or section title.

4. For minor changes, a Modification Circle shall be placed by the area changed on the drawing (each location).

5. For major changes to a drawing, a Modification Circle shall be placed by the title of the affected plan, section, or detail at each location.

6. For changes to schedules or drawings, a Modification Circle shall be placed either by the schedule heading or by the change in the schedule.

7. The Modification Circle size shall be 1/2 inch diameter unless the area where the circle is to be placed is crowded. Smaller size circle shall be used for crowded areas.

1.2.1.3 Drawing Preparation

The as-built drawings shall be modified as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints shall be neat, legible and accurate. These drawings are part of the permanent records of this project and shall be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at no expense to the Government.

1.2.1.4 Computer Aided Design and Drafting (CADD) Drawings

Only personnel proficient in the preparation of CADD drawings shall be employed to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings shall be

equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols shall be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, they shall be prepared using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final as-built drawings shall be identical to that used on the contract drawings. Additions and corrections to the contract drawings shall be accomplished using CADD files. The Contractor will be furnished "as-designed" drawings in Microstation format compatible with a Windows XP operating system. The electronic files will be supplied on compact disc, read-only memory (CD-ROM). The Contractor shall be responsible for providing all program files and hardware necessary to prepare final as-built drawings. The Contracting Officer will review final as-built drawings for accuracy and the Contractor shall make required corrections, changes, additions, and deletions.

a. CADD colors shall be the "base" colors of red, green, and blue. Color code for changes shall be as follows:

1. Deletions (red) - Deleted graphic items (lines) shall be colored red with red lettering in notes and leaders.

2. Additions (Green) - Added items shall be drawn in green with green lettering in notes and leaders.

3. Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes shall be in blue.

b. The Contract Drawing files shall be renamed in a manner related to the contract number (i.e., 98-C-10.DGN) as instructed in the Pre-Construction conference. Marked-up changes shall be made only to those renamed files. All changes shall be made on the layer/level as the original item. There shall be no deletions of existing lines; existing lines shall be over struck in red. Additions shall be in green with line weights the same as the drawing. Special notes shall be in blue on layer #63.

c. When final revisions have been completed, the cover sheet drawing shall show the wording "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in letters at least 3/16 inch high. All other contract drawings shall be marked either "AS-Built" drawing denoting no revisions on the sheet or "Revised As-Built" denoting one or more revisions. Original contract drawings shall be dated in the revision block.

d. 20 days for contracts $5 million and above after Government approval of all of the working as-built drawings for a phase of work, the Contractor shall prepare the final CADD as-built drawings for that phase of work and submit two sets of blue-lined prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days for contracts $5 million and above the Contractor shall revise the CADD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days for contracts $5 million and above of substantial completion of all phases of work, the Contractor shall submit the final as-built drawing package for the entire project. The

submittal shall consist of one set of electronic files on compact disc, read-only memory (CD-ROM), one set of mylars, two sets of blue-line prints and one set of the approved working as-built drawings. They shall be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CADD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final as-built drawing files and marked prints as specified shall be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final as-built drawings shall be accomplished before final payment is made to the Contractor.

1.2.1.5 Manually Prepared Drawings

Only personnel proficient in the preparation of manually prepared drawings shall be employed to modify the original contract drawing or prepare additional new drawings. Additions and corrections to the contract drawings shall be neat, clean and legible, shall be done to the same level of detail, and shall match the adjacent existing line work, and lettering being annotated in type, density, size and style. Drafting work shall be done using the same medium (pencil, plastic lead or ink) that was employed on the original contract drawings and with graphite lead on paper base material. The Contracting Officer will review as-built drawings for accuracy and conformance to the above specified drafting standards. Corrections, changes, additions, and deletions required shall meet these standards. The title block to be used for any new as-built drawings shall be similar to that used on the original drawings.

a. When final revisions have been completed, each drawing shall be lettered or stamped with the words "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in letters at least 5 mm 3/16 inch high. Original contract drawings shall be marked either "As-Built" drawings denoting no revisions on the sheet or "Revised As-Built" denoting one or more revisions All original contract drawings shall be dated in the revision block.

b. Within 20 days for contracts $5 million and above after Government approval of all of the working as-built drawings for a phase of work, the Contractor shall prepare the final as-built drawings for that phase of work and submit two sets of blue-line prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days for contracts $5 million and above the Contractor shall revise the drawings accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days for contracts $5 million and above of substantial completion of all phases of work, the Contractor shall submit the final as-built drawing package for the entire project. The submittal shall consist of the completed final as-built drawings, two blue-line prints of these drawings and the return of the approved marked as-built prints. The drawings shall be complete in all details. Paper prints and reproducible drawings will become the property of the Government upon final approval. Failure to submit final as-built drawings and marked prints, as required herein, will be cause for withholding any payment due the Contractor under this

contract. Approval and acceptance of final as-built drawings shall be accomplished before final payment is made to the Contractor.

1.2.1.6 Payment

No separate payment will be made for as-built drawings required under this contract, and all costs accrued in connection with such drawings shall be considered a subsidiary obligation of the Contractor.

1.2.2 As-Built Record of Equipment and Materials

The Contractor shall furnish one copy of preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 2 days after final inspection with Government comments. Two sets of final record of equipment and materials shall be submitted 10 days after final inspection. The designations shall be keyed to the related area depicted on the contract drawings. The record shall list the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA

Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used

1.2.3 Final Approved Shop Drawings

The Contractor shall furnish final approved project shop drawings 30days after transfer of the completed facility.

1.2.4 Construction Contract Specifications

The Contractor shall furnish final as-built construction contract specifications, including modifications thereto, 30 days after transfer of the completed facility.

1.2.5 Real Property Equipment

The Contractor shall furnish a list of installed equipment furnished under this contract. The list shall include all information usually listed on manufacturer's name plate. The "EQUIPMENT-IN-PLACE LIST" shall include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. A draft list shall be furnished at time of transfer. The final list shall be furnished 30 days after transfer of the completed facility.

1.3 WARRANTY MANAGEMENT

1.3.1 Warranty Management Plan

The Contractor shall develop a warranty management plan which shall contain information relevant to the clause Warranty of Construction in Georgia. At least 30 days before the planned pre-warranty conference, the Contractor shall submit the warranty management plan for Government approval. The

warranty management plan shall include all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan shall be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase shall be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Approved information shall be assembled in a binder and shall be turned over to the Government upon acceptance of the work. The construction warranty period shall begin on the date of project acceptance and shall continue for the full product warranty period. A joint 4 month and 9 month warranty inspection shall be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Information contained in the warranty management plan shall include, but shall not be limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subContractors, manufacturers or suppliers involved.

b. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.

c. A list for each warranted equipment, item, feature of construction or system indicating:

1. Name of item.

2. Model and serial numbers.

3. Location where installed.

4. Name and phone numbers of manufacturers or suppliers.

5. Names, addresses and telephone numbers of sources of spare parts.

6. Warranties and terms of warranty. This shall include one-year overall warranty of construction. Items which have extended warranties shall be indicated with separate warranty expiration dates.

7. Cross-reference to warranty certificates as applicable.

8. Starting point and duration of warranty period.

9. Summary of maintenance procedures required to continue the warranty in force.

10. Cross-reference to specific pertinent Operation and Maintenance manuals.

11. Organization, names and phone numbers of persons to call for

warranty service.

12. Typical response time and repair time expected for various warranted equipment.

d. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

e. Procedure and status of tagging of all equipment covered by extended warranties.

f. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.3.2 Performance Bond

The Contractor's Performance Bond shall remain effective throughout the construction period.

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.3.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor shall furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, shall be continuously available, and shall be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.3.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. The Contractor shall submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframes specified, the Government will perform the work and backcharge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Air Conditioning Systems

1. Recreational support.
2. Air conditioning leak in part of building, if causing damage.
3. Air conditioning system not cooling properly.

Code 1-Doors

1. Overhead doors not operational, causing a security, fire, or safety problem.
2. Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

Code 3-Doors

1. Overhead doors not operational.
2. Interior/exterior personnel doors or hardware not functioning properly.

Code 1-Electrical

1. Power failure (entire area or any building operational after 1600 hours).
2. Security lights.
3. Smoke detectors.

Code 2-Electrical

1. Power failure (no power to a room or part of building).
2. Receptacle and lights (in a room or part of building).

Code 3-Electrical

Street lights.

Code 1-Gas

1. Leaks and breaks.
2. No gas to family housing unit or cantonment area.

Code 1-Heat

1. Area power failure affecting heat.
2. Heater in unit not working.

Code 2-Kitchen Equipment

1. Dishwasher not operating properly.
2. All other equipment hampering preparation of a meal.

Code 2-Plumbing

1. Flush valves not operating properly.
2. Fixture drain, supply line to commode, or any water pipe leaking.
3. Commode leaking at base.

Code 3-Plumbing

1. Leaky faucets.

Code 3-Interior

1. Floors damaged.
2. Paint chipping or peeling.
3. Casework.

Code 1-Roof Leaks

Temporary repairs will be made where major damage to property is occurring.

Code 2-Roof Leaks

Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2-Water (Exterior)

No water to facility.

Code 2-Water (Hot)

No hot water in portion of building listed.

Code 3-All other work not listed above.

Code 1-SCADA and EMCS

1.3.5 Warranty Tags

At the time of installation, each warranted item shall be tagged with a durable, oil and water resistant tag approved by the Contracting Officer. Each tag shall be attached with a copper wire and shall be sprayed with a silicone waterproof coating. The date of acceptance and the QC signature shall remain blank until project is accepted for beneficial occupancy. The tag shall show the following information:

a. Type of product/material_____.

b. Model number_____.

c. Serial number_____.

d. Contract number_____.

e. Warranty period_____from_____to_____.

f. Inspector's signature_____.

g. Construction Contractor_____.
Address_____.
Telephone number_____.

h. Warranty contact_____.
Address_____.
Telephone number_____.

i. Warranty response time priority code_____.

j. WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

1.4 MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING

Prior to final inspection and transfer of the completed facility; all reports, statements, certificates, and completed checklists for testing, adjusting, balancing, and commissioning of mechanical systems shall be submitted to and approved by the Contracting Officer as specified in applicable technical specification sections.

1.5 OPERATION AND MAINTENANCE MANUALS

Operation manuals and maintenance manuals shall be submitted as specified. Operation manuals and maintenance manuals provided in a common volume shall be clearly differentiated and shall be separately indexed.

1.6 FINAL CLEANING

The premises shall be left broom clean. Stains, foreign substances, and temporary labels shall be removed from surfaces. Carpet and soft surfaces shall be vacuumed. Equipment and fixtures shall be cleaned to a sanitary condition. Filters of operating equipment shall be replaced. Debris shall be removed from roofs, drainage systems, gutters, and downspouts. Paved areas shall be swept and landscaped areas shall be raked clean. The site shall have waste, surplus materials, and rubbish removed. The project area shall have temporary structures, barricades, project signs, and construction facilities removed. A list of completed clean-up items shall

be submitted on the day of final inspection.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

SECTION 01781

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01330 SUBMITTAL PROCEDURES.

1.1.1 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.1.2 Package Content

Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission.

1.1.3 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

1.2 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.2.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation:

1.2.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

1.2.1.2 Operator Prestart

Include procedures required to set up and prepare each system for use.

1.2.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown

operating procedures including the control sequence for each procedure.

1.2.1.4 Normal Operations

Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

1.2.1.5 Emergency Operations

Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.2.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

1.2.1.7 Environmental Conditions

Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.2.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair.

1.2.2.1 Lubrication Data

Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":

a. A table showing recommended lubricants for specific temperature ranges and applications.

b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.

c. A Lubrication Schedule showing service interval frequency.

1.2.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

1.2.3 Corrective Maintenance (Repair)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs.

1.2.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.2.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.2.3.3 Maintenance and Repair Procedures

Include instructions and alist of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.2.3.4 Removal and Replacement Instructions

Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.2.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.2.4 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

1.2.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.2.6 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.

1.2.6.1 Warranty Information

List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

1.2.6.2 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.2.6.3 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.2.6.4 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.3 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.3.1 Data Package 1

a. Safety precautions

b. Maintenance and repair procedures

c. Warranty information

d. Contractor information

e. Spare parts and supply list

1.3.2 Data Package 2

a. Safety precautions

b. Normal operations

c. Environmental conditions

d. Lubrication data

e. Preventive maintenance plan and schedule

f. Maintenance and repair procedures

g. Removal and replacement instructions

h. Spare parts and supply list

i. Parts identification

j. Warranty information

k. Contractor information

1.3.3 Data Package 3

a. Safety precautions

b. Normal operations

c. Emergency operations

d. Environmental conditions

e. Lubrication data

f. Preventive maintenance plan and schedule

g. Troubleshooting guides and diagnostic techniques

h. Wiring diagrams and control diagrams

i. Maintenance and repair procedures

j. Removal and replacement instructions

k. Spare parts and supply list

l. Parts identification

m. Warranty information

n. Testing equipment and special tool information

o. Contractor information

1.3.4 Data Package 4

a. Safety precautions

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Lubrication data

i. Preventive maintenance plan and schedule

j. Troubleshooting guides and diagnostic techniques

k. Wiring diagrams and control diagrams

l. Maintenance and repair procedures

m. Removal and replacement instructions

n. Spare parts and supply list

o. Corrective maintenance man-hours

p. Parts identification

q. Warranty information

r. Personnel training requirements

s. Testing equipment and special tool information

t. Contractor information

1.3.5 Data Package 5

a. Safety precautions

b. Operator prestart

c. Start-up, shutdown, and post-shutdown procedures

d. Normal operations

e. Environmental conditions

f. Preventive maintenance plan and schedule

g. Troubleshooting guides and diagnostic techniques

h. Wiring and control diagrams

i. Maintenance and repair procedures

j. Spare parts and supply list

k. Testing equipments and special tools

l. Warranty information

m. Contractor information

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

SECTION 01810

GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE	(2005) Guideline 0-2005, The Commissioning Process

U.S. ARMY CORPS OF ENGINEERS (USACE)

SPiRiT	(2002) Sustainable Project Rating Tool (SPiRiT), Version 1.4.1

1.2 COMMISSIONING OVERVIEW

1.2.1 Commissioning Overview

Objectives - Commissioning will verify and ensure that building elements and systems are designed, installed and calibrated to operate as intended. We will meet the following requirements and implement all of the following best practice commissioning procedures.

a. Engage a commissioning authority.

b. Develop a design intent and basis of design documentation.

c. Include commissioning requirements in the construction documents.

d. Conduct a focused review of the design prior to the construction documents phase.

e. Conduct a focused review of the construction documents when close to completion.

f. Develop and utilize a commissioning plan.

g. Conduct a selective review of contractor submittals of commissioned equipment.

h. Verify installation, functional performance, training and documentation.

i. Develop a system and energy management manual.

j. Complete a final commissioning report.

k. Have a contract in place for a near warranty end or post occupancy

review.

1.2.2 Design Phase

a. Document design intent, basis of design & owner's operational needs as the Project Intent Document.

b. Develop commissioning specifications.

c. Conduct independent design reviews of commissioned systems ability to be constructed, function, and maintained.

d. Develop Commissioning Plan to be utilized through the Construction Process.

1.2.3 Construction Phase

a. Conduct a Pre-Construction Meeting and Controls System Integration Meeting.

b. Review selected contractor submittals.

c. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.

d. Develop site visit and commissioning meeting reports.

e. Identify and Track Commissioning Process Issues.

f. Verify that O&M documentation left on site is complete.

1.2.4 Turnover Phase

a. Verify and document proper performance of equipment and systems.

b. Verify that the Owner's operating personnel are adequately trained.

1.2.5 Operations Phase

a. Prepare Final Commissioning Report.

b. Verify Seasonal Testing.

c. Verify Warranty Review.

1.3 ABBREVIATIONS AND DEFINITIONS

a. A/E Architect and design engineer

b. CxA Commissioning Authority - Independent commissioning Agent

c. CC Controls Contractor

d. CM Construction Manager

e. CO Contractor Officer (Owner)

f. Cx Commissioning

g. CxPlan Commissioning Plan document

h. CxM Commissioning Manager - General Contractors onsite representative and coordinator

i. EC Electrical Contractor

j. FPT Functional Performance Test

k. GC General Contractor

l. MC Mechanical Contractor

m. PC Pre-functional Checklist

n. Subs Subcontractors delivering commissioned systems

o. TAB Test Adjust Balance Contractor

1.4 COMMISSIONING TEAM ROLES AND RESPONSIBILITIES

1.4.1 Members of the Commissioning Team

a. Commissioning Authority (CxA.)

b. Designated representative of the owner.

c. Commissioning Manager (CxM).

d. Architect and design engineers (particularly the mechanical, fire protection and electrical engineer).

e. Mechanical Contractor (MC), TAB representative, Controls Contractor.

f. Electrical Contractor (EC).

g. Fire Protection Contractor.

h. Other installing subcontractors or suppliers of commissioned equipment.

1.4.2 Commissioning Authority

a. The CxA's responsibilities are the same regardless of who the CxA works for.

b. Write the Commissioning Plan for the Construction Phase of the work incorporating the criteria and objectives outlined in this commissioning specification and information obtained in the design phase of the project otherwise known as Design Intent.

c. Review and provide comments on the 60% Construction Documents, 100% Construction Documents prior to submission to the owner for the commissioned systems outlined in 3.2.

d. Assist in developing and compiling the design intent document in the final commissioning report.

e. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications with all necessary parties, frequently updated timelines and schedules.

f. Coordinate the commissioning work and, with the CM and GC, ensure that commissioning activities are being scheduled into the master schedule.

g. Plan and conduct a commissioning scoping meeting and other commissioning meetings.

h. Review and approve the normal Contractor submittals applicable to system being commissioned as noted in Section 3.2 for compliance with commissioning needs, concurrent with the A/E review timeframe.

i. Request and review additional information required to perform commissioning tasks, including contractor start-up, equipment checkout procedures, and O&M materials.

j. Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity ahs been obtained, in writing, to be able to write detailed testing procedures.

k. Review and approve pre-functional tests and checklists.

l. Review and approve functional performance tests.

m. Develop a start-up and initial systems checkout plan with Subs.

n. Perform site visits, once a month starting 1-1/2 years prior to the project completion date and once a week starting 6 months from the project completion date, to observe component and system installations. Also attend selected planning and job site meetings to obtain information on construction progress. Provide site visits reports indicating activities performed and observed at the jobsite.

o. Participate in the resolution of system deficiencies identified during commissioning.

p. Witness all or part of the HVAC and Fire Protection Underground piping test and flushing procedures, sufficient to be confident that proper procedures were followed.

q. Approve pre-functional tests and checklist completion by reviewing pre-functional checklist reports and by selected site observations and spot checking.

r. Approve systems startup by reviewing start-up reports and by selected site observations.

s. Review TAB execution plan.

t. Coordinate, witness and approve functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.

u. Maintain a master deficiency and resolution log and a separate testing record. Provide the CM or GC with written progress reports and test results with recommended actions.

v. Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.

w. Oversee and approve the training of the Owner's operating personnel.

x. Review and approve the preparation of the O&M manuals.

y. Provide a final commissioning report. See 3.7 below.

z. Coordinate and supervise required seasonal or deferred testing and deficiency corrections. Attend and provide comments during a near-warranty end or post occupancy review.

1.4.3 Architect

a. Develop the project intent document for the systems to be commissioned and deliver to the CxA for inclusion in the commissioning final report. The project intent document includes traditional programming information, owner's goals, performance criteria and records of decisions and trade-offs made during design and construction. The document is intended for the owner, design team, construction team, operation and maintenance staff and future renovation teams.

b. Attend the commissioning scoping meeting.

c. Coordinate resolution of system deficiencies identified during commissioning activities.

1.4.4 Engineers/Designers of Commissioned Equipment

a. Attend commissioning scoping meeting and other selected commissioning team meetings.

b. Provide any design narrative and sequences documentation requested by the CxA. The designers shall assist (along with contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

c. Participate in the resolution of system deficiencies identified during commissioning.

d. Verify and approve the subcontractor's red-line drawings of commissioned systems.

1.4.5 General Contractor

a. Facilitate the coordination of the commissioning work by the CxA and ensure that commissioning activities are being scheduled in the master schedule.

b. Furnish a copy of all construction documents, addenda, and approved submittals and shop drawings related to commissioned equipment to the CxA.

c. A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CxA to facilitate the Cx process.

d. Coordinate the training of owner personnel.

e. Prepare O&M manuals.

1.4.6 Subcontractors of Commissioned Equipment

a. A representative shall attend a commissioning scoping meeting and all other necessary meetings scheduled by the CxA to facilitate the Cx process.

b. Provide all requested submittal data for equipment, including detailed start-up procedures, O&M manuals, and specific responsibilities of the owner to keep warranties in force.

c. Provide start up for all equipment.

d. Write and submit pre-functional test and equipment checklist to CxA for review and approval.

e. Write and submit functional test to CxA for review and approval.

f. Provide necessary tools and manpower to complete the functional performance testing of the commissioned equipment as a complete system.

g. For equipment with specified training provide necessary materials and manpower to train the owner's representatives on proper operating requirements, preventative maintenance, and special tools needed and spare parts inventory suggestions. Discuss relevant health and safety issues and concerns. Discuss common troubleshooting problems and solutions. Discuss any peculiarities of equipment installation or operation.

h. Be proactive in seeing that commissioning processes are executed and that the CxA has the scheduling information needed to efficiently execute the commissioning process in accordance with ASHRAE.

PART 2 COMMISSIONING DELIVERABLE

2.1 COMMISSIONING PLAN

Final Draft by CxA Due 30 days after Commissioning Specification is released as a Construction Document.

2.2 60 PERCENT CONSTRUCTION DOCUMENT DESIGN REVIEW

2.3 100 PERCENT CONSTRUCTION DOCUMENT DESIGN REVIEW

Comments by CxA due prior to document submission to the owner.

2.4 CONSTRUCTION DOCUMENTS REVIEW

comments by CxA due 45 days after release.

2.5 PROJECT SCHEDULE REVIEW

Comments by CxA to establish approximate time frames for commissioning activities due 90 days after Project Schedule Release.

2.6 PROJECT SUBMITTALS REVIEW

Submittals as noted in Section 3.2 are to be reviewed concurrently with the A/E of record with comments by the CxA due 14 days after receipt of submittal.

2.7 COMMISSIONING SCOPING MEETING

The CxA is to conduct a Commissioning Scoping Meeting at the 1/3 point of the project schedule.

2.8 SYSTEM AND EQUIPMENT INSTALLATION CHECKOUT

Subcontractors to provide normal Contractor equipment checkout and equipment manufacturer startup procedures due at the mid point of the project schedule for approval and comments by the CxA.

2.9 PRE-FUNCTIONAL CHECKLIST

The subcontractors are to write and distribute pre-functional checklist 30 days after approval of subcontractors equipment checkout forms.

2.10 FUNCTIONAL PERFORMANCE TESTS

The subcontractors are to write and distribute functional performance tests 30 days after the approval of the Controls Submittal. The CxA will approve and provide comments to the functional performance tests.

2.11 CONTROLS INTEGRATION MEETING

The CxA is to conduct a Controls Integration Meeting 30 days after the approval of the Controls Submittal.

2.12 STARTUP AND TESTING SCHEDULING MEETING

The CxA is to conduct a meeting with the subcontractors and general contractor to integrate the startup and testing of the systems into the project schedule.

2.13 PROJECT INTENT DOCUMENT

The A/E of record to provide the project intent document at the 2/3 point of the project schedule.

2.14 SEQUENCE OF OPERATION DOCUMENTATION

The engineer of record to provide sequence of operation documentation clarifying the operation and control of commissioned equipment in the submittal review comments.

PART 3 COMMISSIONING EXECUTION

3.1 COMMISSIONING PLAN

a. The Commissioning Plan is to include all aspects as outlined in the Commissioning Specification and SPiRiT Prerequisite 3.R1 Fundamental Building System Commissioning and SPiRiT Prerequisite 3.R3 Additional Commissioning, along with any other items deemed necessary to ensure complete and functional systems and include the following items:

b. Commissioning Process Description - This section provides a detailed description of the tasks to be accomplished during the commissioning process. The information is tailored for the GRSOC, focusing specifically on what must be accomplished during the design, construction, turnover, and operation phases of the project.

c. Roles and Responsibilities - The roles and responsibilities of each commissioning team member are clearly defined in this section. The goal of this section is to have each individual understand what he or she must do and how he or she fit into the entire process.

d. Communication Structures - Proper communication is critical for the success of any project. The communication paths to be used by the commissioning team members are outlined in this section.

e. Contact Information - In order to facilitate communication throughout this commissioned project, this section, as developed through the course of the project will organize the contact information and protocols for the commissioning team members.

f. Commissioned Systems and Equipment - The systems and equipment to be commissioned include those that are in Section 3.5 and outlined in the commissioning agent contract.

g. Commissioning Process Schedule - There are specific sequences of events that must occur during the commissioning process. These events are outlined and detailed in this section.

h. Appendices: Part of the Final Report as noted in Sections 3.6.2 - 3.6.11

3.2 DOCUMENT REVIEW

3.2.1 Commission Authority

The commissioning authority is to review 60% CD, 100% CD (prior to owner submission), CD & Submittals noted in Section 3.2.

3.2.2 Fire Protection System

a. Fire Pumps

b. Fire Protection System

3.2.3 Plumbing Systems

a. Cleaning/Flushing

b. Thermometers and gauges

c. Trap Primers

d. Backflow Preventers

e. Water Heaters

f. Vibration Isolation

3.2.4 Heating, Ventilation, and Air-Conditioning (HVAC)

a. Thermometers and Gauges

b. Vibration Isolation

c. Chemical Water Treatment Systems

d. Rooftop Units

e. Air Tereminal Unit System/VAV Units (under floor system)

f. Humidifiers

g. Duct Silencers

h. Fire and Smoke/Fire Dampers

i. Variable Speed Drives

j. Air Distribution System

k. Exhaust Air Systems

3.2.5 Automatic Temperature Control System

a. Component FPT and Calibration

b. Controls, Air Supply

c. Air Terminal Units

d. Sequence of Controls of 100% OSA AHU, Exhaust air fans, Air terminal units, cabinet unit heaters, steam humidifiers, water heaters, heating coils/radiant panels, graphic displays, trend logs, status review screens (checks & alarming), network communication head end.

3.2.6 Electrical Systems

a. Electrical Primary Voltage System

b. Switchgear

c. Panels

d. Generators

e. Lighting Controls

f. Emergency Power System - Lighting

3.2.7 Fire Alarm, Life Safety, and Security Systems

a. Emergency Lighting Systems

b. Access Control and Alarm Monitoring, Security

c. Fire Alarm

d. Uninterruptible Power Supply

3.2.8 Building Envelope

a. Enevlope Walls

b. Envelope Windows

c. Envelope Doors

d. Envelope Roofing

3.2.9 Test, Adjust, and Balance Reports

3.2.10 Warranty Documentation

3.3 EQUIPMENT FIELD REVIEW

3.3.1 Equipment and Systems

All equipment and systems noted in Section 3.2 are subject to field review of generally accepted installation practices.

3.4 EQUIPMENT AND SYSTEMS INSTALLATION CHECKLIST

a. Installation checklist for equipment & systems noted in Section 3.4 are to be written and performed by the installing subcontractor.

b. The commissioning authority is to approve the completion of the installation checklist by witnessing the installation during regular project visits.

c. Systems

1. Fire Protection
2. Chemical Water Treatment, HVAC
3. Air Distribution Systems
4. Exhaust Air Systems
5. Controls, Air Supply
6. Electrical Primary Voltage System
7. Lighting Controls
8. Emergency Lighting System
9. Access Control and Alarm Monitoring, Security
10. Envelope Walls
11. Envelope Roofing
12. Uninterruptible Power Supply

d. Equipment

1. Trap Primers

2. Water Heaters
3. Thermometers and gauges, HVAC
4. Rooftop units
5. Air terminal units
6. Humidifiers
7. Variable speed drives
8. Air distribution systems
9. Controls, air supply, air terminal units, AHUs, Exhaust air fans, cabinet unit heaters, steam humidifiers, water heaters, heating coils/radiant panels
10. Switchgear
11. Emergency power system - Lighting
12. Uninterruptible Power Supply

3.5 FUNCTIONAL PERFORMANCE TEST

Functional Performance Tests for the systems noted in this section are to be written and performed by the installing subcontractor. Subcontractors are to provide all manpower and equipment to test the functionality of all system integration points.

a. Commissioning Authority to review, approve, and witness functional performance tests.

b. Fire Protection Systems

1. Fire Pumps
2. Standpipes

c. Heating Ventilation and Air Conditioning (HVAC) with Controls

All equipment interfacing with the controls front end is subject to a Functional Performance Test including but not limited to RTUs, AHUs, Terminal Units, Steam Humidifiers, Exhaust Fans, Cabinet Unit Heaters, radiant coils/panels etc.

d. Electrical

1. Electrical primary voltage system
2. Switchgear
3. Panels
4. Lighting controls
5. Uninterruptible power supply

e. Fire Alarm, Life Safety, and Security Systems

1. Emergency Lighting System
2. Access control and alarm monitoring, security
3. Fire alarm
4. Generator

f. Building Envelope

1. Envelope walls
2. Envelope windows
3. Envelope doors
4. Envelope roofing

3.6 COMMISSIONING SURVEILLANCE ACTIVITIES

a. CxA to document all site visits in a daily and record any discrepancies.

b. CxA to document each discrepancy and track the issue to completion.

c. CxA to lead commissioning meetings through the project duration.

d. CxA to review As-built documentation during site visits.

e. CxA to surveillance training activities.

3.7 COMMISSIONING FINAL REPORT TO BE COMPILED BY THE CXA

a. Executive Summary with Project Summary

b. Project Intent

c. Commissioning Specifications - As-built

d. Construction Checklist - Systems and Equipment

e. Site Visits, Commissioning Meetings, and Discrepancy Log

f. Training Schedule and Reports

g. Functional Performance Testing Reports

h. Warranty Review

i. Commissioning Process Schedule

j. Commissioning Plan - As-built

k. Testing, Adjusting, and Balancing (TAB) Report

-- End of Section --

SECTION 02220

SITE DEMOLITION

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.6	(1990; R 1998) Safety Requirements for Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) Safety -- Safety and Health Requirements

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61-SUBPART M	National Emission Standard for Asbestos

1.2 GENERAL REQUIREMENTS

Do not begin demolition until authorization is received from the Contracting Officer. The work of this section is to be performed in a manner that maximizes salvage and recycling of materials. The work includes demolition and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Site Superintendent. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Demolition Plan; G
Notifications; G

Proposed demolition and removal procedures for approval before work is started.

1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with federal, state, and local hauling and disposal regulations. In

addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ANSI A10.6.

1.4.1 Notifications

1.4.1.1 General Requirements

Furnish timely notification of demolition projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61-SUBPART M. Notify the State's environmental protection agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61-SUBPART M.

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Sweep pavements as often as necessary to control the spread of debris.

1.6 PROTECTION

1.6.1 Items to Remain in Place

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required.

1.6.2 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction.

1.6.3 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations.

1.6.4 Protection of Personnel

Before, during and after the demolition work the Contractor shall continuously evaluate the condition of the structures being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.7 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.8 REQUIRED DATA

Prepare a Demolition Plan. Include in the plan procedures for careful removal and disposition of materials to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Identify components and materials to be salvaged for reuse or recycling. Coordinate with Waste Management Plan. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by Contracting Officer prior to work beginning.

1.9 ENVIRONMENTAL PROTECTION

Comply with the Environmental Protection Agency requirements specified.

1.10 USE OF EXPLOSIVES

Use of explosives will not be permitted.

PART 2 PRODUCTS

2.1 FILL MATERIAL

Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill basements, voids, depressions or excavations resulting from demolition or deconstruction of structures.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Materials shall be designated for reuse on site whenever possible.

3.1.1 Structures

Remove existing structures indicated to be removed in their entirety, including foundations. Remove sidewalks, curbs, gutters and street light bases as indicated.

3.1.2 Utilities and Related Equipment

3.1.2.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made.

3.1.2.2 Disconnecting Existing Utilities

Remove existing utilities, as indicated or uncovered by work and terminate as indicated on the drawings. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area.

3.1.3 Chain Link Fencing

Remove chain link fencing, gates and other related items as indicated on the drawings.

3.1.4 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs as indicated. Provide neat sawcuts at limits of pavement removal.

3.1.5 Items With Unique/Regulated Disposal Requirements

Remove and dispose of items with unique or regulated disposal requirements in the manner dictated by law or in the most environmentally responsible manner.

3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition work in areas occupied by structures to be demolished until all demolition in the area has been completed and debris removed. Fill and compact all holes created by demolition activities in accordance with Section 31 00 00 EARTHWORK.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property.

3.4 CLEANUP

Remove debris and rubbish. Remove and transport the in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.5 DISPOSAL OF REMOVED MATERIALS

3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations at the location identified in the Demolition Plan.

3.5.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property.

3.5.3 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

-- End of Section --

SECTION 02231

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-04 Samples

Tree wound paint

Submit samples in cans with manufacturer's label.

1.2 DELIVERY, STORAGE, AND HANDLING

Deliver materials to, store at the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS

2.1 TREE WOUND PAINT

Bituminous based paint of standard manufacture specially formulated for tree wounds.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Trees, Shrubs, and Existing Facilities

Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require. Vegetation in areas designated as future parking may be retained or removed as directed by the Contracting Officer.

3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered

within the area of operations, the Contractor shall notify the Contracting Officer in ample time to minimize interruption of the service.

3.2 CLEARING

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint.

3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.4 PRUNING

Trim trees designated to be left standing within the cleared areas of dead branches 1 1/2 inches or more in diameter; and trim branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1-1/2 inches in diameter with an approved tree wound paint.

3.5 GRUBBING

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. All stumps inside the project limits shall be grubbed. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.6 DISPOSAL OF MATERIALS

3.6.1 Saleable Timber

3.6.2 Nonsaleable Materials

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations shall be disposed of outside the limits of Government-controlled land at the Contractor's responsibility.

-- End of Section --

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 224	(2001) Correction for Coarse Particles in the Soil Compaction Test
AASHTO T 99	(2001; R 2004) Moisture-Density Relations of Soils Using a 2.5-kg (5.5 lb) Rammer and a 305-mm (12-in) Drop

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C600	(2005) Installation of Ductile-Iron Water Mains and Their Appurtenances

ASTM INTERNATIONAL (ASTM)

ASTM C 136	(2005) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 33	(2003) Concrete Aggregates
ASTM D 1140	(2000) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2487	(2000) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(2004) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(2004) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 422	(1963; R 2002) Particle-Size Analysis of Soils
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 698	(2000ae1) Laboratory Compaction

Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT)

GDOT (2001) Standard Specifications Construction of Transportation Systems

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, and SP-SC. Satisfactory materials for grading comprise stones less than 8 inches, except for fill material for pavements which comprise stones less than 3 inches in any dimension.

1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

1.2.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 698 abbreviated as a percent of laboratory maximum density. Since ASTM D 698 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 99 and corrected with AASHTO T 224. To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in AASHTO T 99.

1.2.5 Topsoil

Material suitable for topsoils obtained from excavations is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

1.2.6 Unstable Material

Unstable material are too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.2.7 Select Granular Material

1.2.7.1 General Requirements

Select granular material consist of materials classified as GW, GP, SW, SP, by ASTM D 2487 where indicated.

1.2.8 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks 2 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, free the initial backfill material of stones larger than 1/2 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Shoring

Submit 15 days prior to starting work.

SD-03 Product Data

Utilization of Excavated Materials

Procedure and location for disposal of unused satisfactory material. Advance notice on the opening of excavation or borrow areas.

SD-06 Test Reports

Testing
Fill Material
Within 24 hours of conclusion of physical tests, 5 copies of test results, including calibration curves and results of calibration tests. Results of testing at the borrow site.

SD-07 Certificates

Testing

Qualifications of the Corps validated commercial testing laboratory or the Contractor's validated testing facilities.

1.4 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all

excavation will be designated as unclassified excavation.

PART 2 PRODUCTS

2.1 BURIED WARNING AND IDENTIFICATION TAPE

Provide metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes

Red:	Electric
Yellow:	Gas, Oil; Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Water Systems
Green:	Sewer Systems

2.1.1 Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.003 inch and a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.1.2 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.004 inch, and a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.2 MATERIAL FOR RIP-RAP

Provide bedding material, filter fabric, and rock conforming to GDOT State Standard for construction indicated.

2.3 CAPILLARY WATER BARRIER

Provide capillary water barrier of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab as noted on the drawings without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Conform to ASTM C 33, 1-1/2 inch and no more than 2 percent by weight passing the No. 4 size sieve or coarse aggregate Size 57, 67, or 77.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where shown on the drawings, strip topsoil. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inch in diameter, and other materials that would interfere with planting and maintenance operations. Stockpile in locations indicated any surplus of topsoil from excavations and gradings.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.2.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on the drawings. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a minimum 4 feet from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Do not disturb the bottom of the excavation when concrete or masonry is to be placed in an excavated area. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Grade the construction area to provide

positive surface water runoff away from the construction activity or provide temporary ditches, berms, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.4 Trench Excavation Requirements

Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation manual. Shore trench walls in accordance with OSHA regulations. Excavate trench walls which are cut back to at least the angle of repose of the soil. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inch inside diameter, and do not exceed 36 inch plus pipe outside diameter for sizes larger than 24 inch inside diameter. Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures by the Contractor. The Contractor is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Government.

3.2.4.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. Remove stones of 2 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.2.4.2 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.2.4.3 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. When concrete or masonry is to be placed in an excavated area, take special care not to disturb the bottom of the excavation.

3.2.4.4 Jacking, Boring, and Tunneling

Unless otherwise indicated, provide excavation by open cut except that sections of a trench may be jacked, bored, or tunneled if the pipe, cable, or duct can be safely and properly installed and backfill can be properly

compacted in such sections.

3.2.5 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. Excavation made with power-driven equipment is not permitted within two feet of known utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.2.6 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Testing Agency prior to concrete placement. Backfill and compact over excavations and changes in grade to 98 percent of maximum density.

3.3 SELECTION OF BORROW MATERIAL

Select borrow material to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Obtain borrow material from within the limits of the project excavations.

3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

The Contractor is responsible for notifying the Testing Agency sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, excavate borrow pits and other excavation areas providing adequate drainage. Transport overburden and other spoil material to designated spoil areas or otherwise dispose of as directed. Provide neatly trimmed and drained borrow pits after the excavation is completed. Ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.5 SHORING

3.5.1 General Requirements

Submit a Shoring and Sheeting plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheeting as excavations are backfilled, in a manner to prevent caving.

3.6 GRADING AREAS

Place and grade stockpiles of satisfactory and unsatisfactory and wasted materials. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and

fitness of the stockpiled material.

3.7 GROUND SURFACE PREPARATION

3.7.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Testing Agency, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 6 inch before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 6 inch, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inch and compact it as specified for the adjacent fill.

3.7.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

3.8 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Government-controlled land before disposal of waste material thereon. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.9 BURIED TAPE AND DETECTION WIRE

3.9.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 12 inch below finished grade; under pavements and slabs, bury tape 6 inch below top of subgrade.

3.10 BACKFILLING AND COMPACTION

Place backfill adjacent to any and all types of structures, and compact to at least 98 percent laboratory maximum density. Prepare ground surface on which backfill is to be placed as specified in paragraph GROUND SURFACE PREPARATION. Provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.10.1 Trench Backfill

Backfill trenches to the grade shown. Do not backfill the trench until all specified tests are performed.

3.10.1.1 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 6 inch loose thickness.

3.10.1.2 Bedding and Initial Backfill

Provide bedding of the type and thickness shown. Place initial backfill material and compact it with approved tampers to a height of at least one foot above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Compact backfill to top of pipe to 95 percent of maximum density. Provide plastic piping with bedding to spring line of pipe. Provide materials as follows:

a. Clean, coarse-grained sand gradation SW or SP by ASTM D 2487 for bedding.

3.10.1.3 Final Backfill

Fill the remainder of the trench, except for special materials for roadways, with satisfactory material. Place backfill material and compact as follows:

a. Roadways: Place backfill up to the required elevation as specified and compact to 98 percent maximum density.

b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Deposit backfill in layers of a maximum of 12 inch loose thickness, and compact it to 92 percent maximum density. Do not compact by water flooding or jetting. Apply this requirement to all other areas not specifically designated above.

3.10.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed, place backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.11 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.11.1 Water Lines

Excavate trenches to a depth that provides a minimum cover of 3 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.11.2 Electrical Distribution System

Provide a minimum cover of 24 inch from the finished grade to direct burial cable and conduit or duct line, unless otherwise indicated.

3.11.3 Rip-Rap Construction

Construct rip-rap on bedding material and on filter fabric in accordance with GDOT in the areas indicated. Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 0.1 foot.

3.11.3.1 Bedding Placement

Spread filter fabric bedding material uniformly to a thickness of at least 3 inches on prepared subgrade as indicated. Compaction of bedding is not required. Finish bedding to present even surface free from mounds and windrows.

3.11.3.2 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above.

3.12 EMBANKMENTS

3.12.1 General Fills

Construct general fills in grassed areas from satisfactory materials free of organic or frozen material. Place the material in successive horizontal layers of loose material not more than 12 inches in depth. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, plow, disk, or otherwise brake up each layer; moisten or aerate as necessary; thoroughly mix; and compact to at least 92 percent laboratory maximum density. Compaction requirements for fills forming subgrade for pavements shall be 98 percent of maximum density.

3.13 SUBGRADE PREPARATION

3.13.1 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. After rolling, do not show deviations

for the surface of the subgrade for roadways greater than 1/2 inch. Do not vary the elevation of the finish subgrade more than 0.05 foot from the established grade and cross section.

3.13.2 Compaction

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Compact each layer of the embankment to at least the laboratory maximum density provided below.

3.13.2.1 Subgrade for Structures

Compact subgrade for structures to at least 98 percent laboratory maximum density.

3.13.2.2 Subgrade for Pavements

Compact subgrade for pavements to at least 98 percentage laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, thoroughly blend, reshape, and compact the top 12 inch of subgrade.

3.13.2.3 Subgrade for Shoulders

Compact subgrade for shoulders to at least 92 percentage laboratory maximum density for the depth below the surface of shoulder shown.

3.14 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.14.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do no disturb the finished subgrade by traffic or other operation. The Contractor is responsible for protecting and maintaining the finsihed subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.14.2 Grading Around Structures

Construct areas within 5 feet outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until

final inspection has been completed and the work has been accepted.

3.15 PLACING TOPSOIL

On areas to receive topsoil, prepare the compacted subgrade soil to a 2 inch depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of 4 inch and grade to the elevations and slopes shown. Do not spread topsoil when frozen or excessively wet or dry. Obtain material required for topsoil in excess of that produced by excavation within the grading limits.

3.16 TESTING

Perform testing by a Corp. validated commercial testing laboratory or the Contractor's validated testing facility. Determine field in-place density in accordance with ASTM D 1556 and ASTM D 2922. When ASTM D 2922 is used, check the calibration curves and adjust using only the sand cone method as described in ASTM D 1556. ASTM D 2922 results in a wet unit weight of soil to determine the moisture content of the soil when using this method ASTM D 3017. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D 3017; check the calibration of both the density and moisture gauges at the beginning of a job on each different type of material encountered. When test results indicate that compaction is not as specified, remove the material, replace and recompact to meet specification requirements. Perform tests on recompacted areas to determine conformance with specification requirements. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.16.1 In-Place Densities

In-place density tests shall be performed in the material and at the minimum frequency specified below:

MATERIAL TYPE	LOCATION OF MATERIAL	MINIMUM TEST FREQUENCY
Fill, embankment and backfill	Beneath structures to 5-foot building line	One test per lift per each increment, or fraction, of 10,000 square feet
Fill, embankment and backfill	Beneath paved areas	One test per lift per each increment, or fraction, of 20,000 square feet
Fill, embankment and backfill	All other areas	One test per lift per each increment, or fraction, of 45,000 square feet
Subgrade	Under building slabs	One test per each

MATERIAL TYPE	LOCATION OF MATERIAL	MINIMUM TEST FREQUENCY
		increment, or fraction, of 20,000 square feet
Subgrade	Under paved areas, excluding roads	One test per each increment, or fraction, of 8,000 square feet
Subgrade	Roads	One test per each increment, or fraction, of 400 linear feet
Backfill	Utility trenches beneath roads and paved areas	One test per each increment, or fraction, of 150 linear feet per foot of depth
Backfill	Utility trenches beneath grassed areas	One test per each increment, or fraction, of 150 linear feet per 2 feet or depth of backfill
Fill, embankment and backfill	Areas compacted by hand operated compaction equipment, other than utility trenches	One test per each increment, or fraction, of 250 square feet, or for each 100 linear feet of long narrow (less than 2 feet wide) fills 100 feet or more in length

3.16.2 Moisture Contents

In the stockpile, excavation, or borrow areas, perform a minimum of two tests per day per type of material or source of material being placed during stable weather conditions. During unstable weather, perform tests as dictated by local conditions and approved by the Contracting Officer.

3.16.3 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. Nine representative tests of materials classified as satisfactory materials.

3.16.4 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.17 DISPOSITION OF SURPLUS MATERIAL

Waste surplus material or other soil material not required or suitable for filling or backfilling to locations designated onsite., and brush, refuse, stumps, roots, and NED/timber wasted in Government disposal area.

-- End of Section --

SECTION 02360

SOIL TREATMENT FOR SUBTERRANEAN TERMITE CONTROL

PART 1 GENERAL

1.1 REFERENCES

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

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

7 USC Section 136	Federal Insecticide, Fungicide, and Rodenticide Act

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Termiticide Application Plan; G

Termiticide application plan with proposed sequence of treatment work with dates and times. The termiticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area/volume treated, amount applied; and the name and state license number of the state certified applicator shall be included.

Termiticides

Manufacturer's label and Material Safety Data Sheet (MSDS) for termiticides proposed for use.

Foundation Exterior

Written verification that other site work will not disturb the treatment.

Verification of Measurement

Written verification that the volume of termiticide used meets the application rate.

Application Equipment

A listing of equipment to be used.

Warranty

Copy of Contractor's warrany.

SD-04 Samples

Termiticides

Submit on request samples of the pesticides used in this work or the Contracting Officer may draw, at any time and without prior notice, from stocks at the job site. Should analysis, performed by the Government, indicate such samples to contain less than the amount of active ingredient specified on the label, work performed with such products shall be repeated, with pesticides conforming to this specification, at no additional cost to the Government.

SD-06 Test Reports

Equipment Calibration and Tank Measurement

Certification of calibration tests conducted on the equipment used in the termiticide application.

Soil Moisture

Soil moisture test result.

Quality Assurance

Pest Management Report and copies of daily records signed by an officer of the Contractor.

SD-07 Certificates

Qualifications

Qualifications and state license number of the termiticide applicator.

1.3 QUALIFICATIONS

For the application of pesticides, the Contractor shall use the services of a subcontractor whose principal business is pest control. The subcontractor shall be licensed and certified in the state where the work is to be performed. Termiticide applicators shall also be certified in the U.S. Environmental Protection Agency (EPA) pesticide applicator category which includes structural pest control.

1.4 SAFETY REQUIREMENTS

Formulate, treat, and dispose of termiticides and their containers in accordance with label directions. Draw water for formulating only from sites designated by the Contracting Officer, and fit the filling hose with a backflow preventer meeting local plumbing codes or standards. The filling operation shall be under the direct and continuous observation of a contractor's representative to prevent overflow. Secure pesticides and related materials under lock and key when unattended. Ensure that proper protective clothing and equipment are worn and used during all phases of termiticide application. Dispose of used pesticide containers off Government property.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Termiticide material shall be delivered to the site in the original unopened containers bearing legible labels indicating the EPA registration number and manufacturer's registered uses. All other materials to be used on site for the purpose of termite control shall be delivered in new or otherwise good condition as supplied by the manufacturer or formulator.

1.5.2 Storage

Materials shall be stored in designated areas and in accordance with manufacturer's labels. Termiticides and related materials shall be kept under lock and key when unattended.

1.5.3 Handling

Termiticides shall be handled in accordance with manufacturer's labels. Manufacturer's warnings and precautions shall be observed. Materials shall be handled preventing contamination by dirt, water, and organic material. Protect termiticides from sunlight as recommended by the manufacturer.

1.6 INSPECTION

Termiticides shall be inspected upon arrival at the job site for conformity to type and quality in accordance with paragraph TERMITICIDES. Each label shall bear evidence of registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended or under appropriate regulations of the host county. Other materials shall be inspected for conformance with specified requirements. Unacceptable materials shall be removed from the job site.

1.7 WARRANTY

The Contractor shall provide a 5-year written warranty against infestations or reinfestations by subterranean termites of the buildings constructed under this contract. Warranty shall include annual inspections of the buildings. If live subterranean termite infestation or subterranean termite damage is discovered during the warranty period, and the soil and building conditions have not been altered in the interim, the Contractor shall:

a. Retreat the soil and perform other treatment as may be necessary for elimination of subterranean termite infestation;

b. Repair damage caused by termite infestation; and

c. Reinspect the building approximately 180 days after the retreatment.

1.8 QUALITY ASSURANCE

The Contractor shall comply with 7 USC Section 136 for requirements on contractor's licensing, certification, and record keeping. The Contractor shall maintain daily records using Pest Management Maintenance Record, DD Form 1532-1 and submit copies of records when requested by the Contracting Officer. These forms may be obtained from the main web site:

http://www.dtic.mil/whs/directives/infomgt/forms/ddforms1500-1999.htm

Upon completion of this work, submit Pest Management Report. DD Form 1532 identifying target pest, type of operation, brand name and manufacturer of pesticide, formulation, concentration or rate of application used.

PART 2 PRODUCTS

2.1 TERMITICIDES

Termiticides shall be currently registered by the EPA or approved for such use by the appropriate agency of the host county. Non-repellant termiticide shall be selected for maximum effectiveness and duration after application. The selected termiticide shall be suitable for the soil and climatic conditions at the project site.

PART 3 EXECUTION

3.1 TECHNICAL REPRESENTATIVE

The certified installation pest management coordinator shall be the technical representative, shall be present at all meetings concerning treatment measures for subterranean termites, and may be present during treatment application. The command Pest Control Coordinator shall be contacted prior to starting work.

3.2 SITE PREPARATION

Work related to final grades, landscape plantings, foundations, or any other alterations to finished construction which might alter the condition of treated soils, shall be coordinated with this specification.

3.2.1 Ground Preparation

Food sources shall be eliminated by removing debris from clearing and grubbing and post construction wood scraps such as ground stakes, form boards, and scrap lumber from the site, before termiticide application begins.

3.2.2 Verification

Before work starts, the Contractor shall verify that final grades are as indicated and smooth grading has been completed. Soil particles shall be finely graded with particles no larger than 1 inch and compacted to eliminate soil movement to the greatest degree.

3.2.3 Foundation Exterior

The Contractor shall provide written verification that final grading and landscape planting operations will not disturb treatment of the soil on the exterior sides of foundation walls, grade beams, and similar structures.

3.3 SITE CONDITIONS

The following conditions shall determine the time of application.

3.3.1 Soil Moisture

Soils to be treated shall be tested immediately before application. Soil moisture content shall be tested to a minimum depth of 3 inches. The soil moisture shall be as recommended by the termiticide manufacturer. The termiticide will not be applied when soil moisture exceeds manufacturer's recommendations because termiticides do not adhere to the soil particles in saturated soils.

3.3.2 Runoff and Wind Drift

Termiticide shall not be applied during or immediately following heavy rains. Applications shall not be performed when conditions may cause runoff or create an environmental hazard. Applications shall not be performed when average wind speed exceeds 10 miles per hour. The termiticide shall not be allowed to enter water systems, aquifers, or endanger humans or animals.

3.3.2.1 Vapor Barriers and Waterproof Membranes

Termiticide shall be applied prior to placement of a vapor barrier or waterproof membrane.

3.4 TERMITICIDE TREATMENT

The Contractor shall submit a Termiticide Application Plan for approval before starting the specified treatment.

3.4.1 Equipment Calibration and Tank Measurement

Immediately prior to commencement of termiticide application, calibration tests shall be conducted on the application equipment to be used and the application tank shall be measured to determine the volume and contents. These tests shall confirm that the application equipment is operating within the manufacturer's specifications and will meet the specified requirements. The Contractor shall provide written certification of the equipment calibration test results within 1 week of testing.

3.4.2 Mixing and Application

Formulating, mixing, and application shall be performed in the presence of the Contracting Officer or the technical representative. A closed system is recommended as it prevents the termiticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying termiticides shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

3.4.3 Treatment Method

For areas to be treated, the Contractor shall establish complete and unbroken vertical and/or horizontal soil poison barriers between the soil and all portions of the intended structure which may allow termite access to wood and wood related products.

3.4.3.1 Surface Application

Surface application shall be used for establishing horizontal barriers. Surface applicants shall be applied as a coarse spray and provide uniform distribution over the soil surface. Termiticide shall penetrate a minimum of 1 inch into the soil, or as recommended by the manufacturer.

3.4.3.2 Rodding and Trenching

Rodding and trenching shall be used for establishing vertical soil barriers. Trenching shall be to the depth of the foundation footing. Width of trench shall be as recommended by the manufacturer, or as indicated. Rodding or other approved method may be implemented for saturating the base of the trench with termiticide. Immediately after termiticide has reached maximum penetration as recommended by the manufacturer, backfilling of the trench shall commence. Backfilling shall be in 6 inch rises or layers. Each rise shall be treated with termiticide.

3.4.4 Sampling

The Contracting Officer may draw from stocks at the job site, at any time and without prior notice, samples of the termiticides used to determine if the amount of active ingredient specified on the label is being applied.

3.5 VERIFICATION OF MEASUREMENT

Once termiticide application has been completed, tank contents shall be measured to determine the remaining volume. The total volume measurement of used contents for the application shall equal the established application rate for the project site conditions. The Contractor shall provide written verification of the measurements.

3.6 CLEAN UP, DISPOSAL, AND PROTECTION

Once application has been completed, the Contractor shall proceed with clean up and protection of the site without delay.

3.6.1 Clean Up

The site shall be cleaned of all material associated with the treatment measures, according to label instructions, and as indicated. Excess and waste material shall be removed and disposed off site.

3.6.2 Disposal of Termiticide

The Contractor shall dispose of residual termiticides and containers off Government property, and in accordance with label instructions and EPA criteria.

3.6.3 Protection of Treated Area

Immediately after the application, the area shall be protected from other use by erecting barricades and providing signage as required or directed.

3.7 CONDITIONS FOR SATISFACTORY TREATMENT

3.7.1 Equipment Calibrations and Measurements

Where results from the equipment calibration and tank measurements tests

are unsatisfactory, re-treatment will be required.

3.7.2 Testing

Should an analysis, performed by a third party, indicate that the samples of the applied termiticide contain less than the amount of active ingredient specified on the label, and/or if soils are treated to a depth less than specified or approved, re-treatment will be required.

3.7.3 Disturbance of Treated Soils

Soil and fill material disturbed after treatment shall be re-treated before placement of slabs or other covering structures.

3.7.4 Termites Found Within the Warranty Period

If live subterranean termite infestation or termite damage is discovered during the warranty period, the Contractor shall re-treat the site.

3.8 RE-TREATMENT

Where re-treatment is required, the Contractor shall comply with the requirements specified in paragraph WARRANTY.

-- End of Section --

SECTION 02372

FLUID APPLIED GEOMEMBRANE

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM A 742	(2003) Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe
ASTM D 143	(1994; R 2007) Small Clear Specimens of Timber
ASTM D 146	(2004) Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing
ASTM D 257	(1999; R 2005) D-C Resistance or Conductance of Insulating Materials
ASTM D 412	(1998a; R 2002e1) Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 413	(1998; R 2002e1) Rubber Property - Adhesion to Flexible Substrate
ASTM D 543	(2006) Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 751	(2006) Coated Fabrics
ASTM D 822	(2001; R 2006) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D 1343	(1995; R 2006) Viscosity of Cellulose Derivatives by Ball-Drop Method
ASTM D 1434	(1982; R 2003) Determining Gas Permeability Characteristics of Plastic Film and Sheeting
ASTM D 1693	(2005) Environmental Stress-Cracking of Ethylene Plastics
ASTM D 2434	(1968; R 2006) Permeability of Granular Soils (Constant Head)
ASTM D 4068	(2001) Chlorinated Polyethylene Sheeting

	for Concealed Water-Containment Membrane
ASTM D 4833	(2000e1) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 5321	(2002) Determing the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
ASTM D 6392	(1999) Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
ASTM E 108	(2005) Fire Tests of Roof Coverings
ASTM E 96	(2005) Water Vapor Transmission of Materials
ASTM E 154	(1999) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

UNDERWRITERS LABORATORIES (UL)

UL 790	(2004) UL Standard for Safety for Standard Test Methods for Fire Tests of Roof Coverings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Tests, Inspections, and Verifications; G

Installer's QC manual, a minimum of 7 days prior to installation.

Qualifications; G

Installer's, QC inspector's, and QC laboratory's qualification statements including resumes of key personnel involved in the project a minimum of 7 days prior to geomembrane placement.

SD-04 Samples

Samples

Geomembrane QA and QC samples.

SD-06 Test Reports

Materials; G

Surface Preparation; G

Certification from the QC inspector and installer of the acceptability of the surface on which the geomembrane is to be placed, immediately prior to geomembrane placement.

Non-Destructive Field Seam Continuity Testing; G

QC inspector certified test results on field seams.

Tests; G

Certified QC test results.

1.3 QUALIFICATIONS

1.3.1 Installer

Waterproofing contractor/applicator shall be trained and approved by gas vapor barrier/waterproof membrane manufacturer. A pre-installation conference shall be held prior to application of gas vapor barrier/waterproof membrane geocomposite gas drainage layer and protective geotextile to assure proper substrate and installation conditions, to include contractor and applicator.

1.3.2 QC Inspector

The QC inspector is the person or corporation hired by the Contractor or Owner, who is responsible for monitoring and documenting activities related to the QC of the geomembrane from manufacturing through installation. The QC inspector shall have provided QC inspection during installation of the proposed geomembrane material.

1.4 DELIVERY, STORAGE AND HANDLING

1.4.1 Delivery

The QC inspector shall be present during delivery and unloading of the geosynthetics and fluid applied membrane. Each geosynthetic roll/panel or liquid membrane shall be labeled with the manufacturer's name, product identification number, roll/panel number, and roll dimensions. Deliver liquid membrane materials to site in original unbroken packages bearing manufacturer's label showing brand, weight, volume, and batch number.

1.4.2 Storage

Temporary storage at the project site shall be on a level surface, free of sharp objects where water cannot accumulate. The geosysthetic shall be protected from puncture, abrasion, excessive heat or cold, material degradation, or other damaging circumstances. Storage shall not result in crushing the core of roll goods or flattening of the rolls. Palleted materials shall be stored on level surfaces and shall not be stacked on top of one another. Ultraviolet sensitive materials shall be covered with a sacrificial opaque and waterproof covering or placed in a temporary shelter. Damaged geosysthetics shall be removed from the site and replaced with geosysthetics that meets the specified requirements. Store materials at site in strict compliance with manufacturer's instructions. Do not allow materials to freeze in containers.

1.4.3 Handling

Rolls/panels or fluid-applied membrane containers shall not be dragged, lifted by one end, or dropped. A pipe or solid bar, of sufficient strength to support the full weight of a roll without significant bending, shall be used for all handling activities. The diameter of the pipe or solid bar shall be small enough to be easily inserted through the core of the roll. Chains shall be used to link the ends of the pipe or bar to the ends of a spreader bar. The spreader bar shall be wide enough to prevent the chains from rubbing against the ends of the roll. Alternatively, a stinger bar protruding from the end of a forklift or other equipment may be used. The stinger bar shall be at least three-fourths the length of the core and also must be capable of supporting the full weight of the roll without significant bending. If recommended by the manufacturer, a sling handling method utilizing appropriate loading straps may be used.

1.5 WEATHER LIMITATIONS

Perform work only when existing and forecasted weather conditions are within the liquid membrane manufacturer's recommendations for the material and product used. Ambient temperature shall be within liquid membrane manufacturer's specifications. If winter conditions apply, space heaters and necessary cover (i.e. visqueen) shall be used to bring the ambient temperature to at least +45 degrees F until the protection course and structural slab rebar or a mudslab protection courrse has been placed.

1.6 EQUIPMENT

Equipment used in performance of the work shall be in accordance with the liquid membrane manufacturer's recommendations and shall be maintained in satisfactory working condition.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Liquid Applied Membrane

The liquid applied membrane shall be in accordance with Table 1.

2.1.2 Geomembrane Supporting Geotextile

The geomembrane supporting geotextile shall be a non-woven heat-bonded geotextile in accordance with the requirements of the liquid applied membrane manufacturer.

TABLE 1
. FLUID APPLIED MEMBRANE

WATERPROOFING	TEST METHOD	VALUE
Soil Burial	ASTM E 154	Passed
Water Penetration Rate	ASTM D 2434	<7.75 x 10-9 sec
Water Vapor Permeability	ASTM E 96	0.24 perms
Water Vapor Transmission	ASTM E 96	0.10 grains/h-ft^2
GAS VAPOR MEMBRANE	**TEST METHOD**	**VALUE**
Hydrogen Sulfide Gas Permeability	ASTM D 1343	None Detected
Benzene, Toluene, Ethylene, Zylene, Gasoline, Hexane, Perchloroethylene	ASTM D 543, ASTM D 412, ASTM D 1434 (tested at 20,000 ppm)	Passed-gas permeability & weight change
Sodium Sulfate (2% water solution)	ASTM D 543, ASTM D 412, ASTM D 143	Passed-gas permeability & weight change
Acid Exposure (10% H2S04 for 90 days)	ASTM D 543	Less than 1% weight change
Radon Permeability	Tested by US Dept of Energy	Zero Permeability to Radon (222Rn)
Bonded Seam Strength Tests	ASTM D 6392	Passed
Micro Organism Resistance (Soil Burial) average weight change, average tensile strength change, average tensile stress change, average elongation change, bonded seams, methane permeability	ASTM D 4068	Passed
Methane Permeability	ASTM D 1434	Passed
Oil Resistance Test average weight change, average tensile strength change, average, tensile stress change, average elongation change, bonded seams, methane permeability	ASTM D 543	Passed
Heat Aging average tensile strength change, average tensile stress change, average elongation change, bonded seams	ASTM D 4068	Passed

Dead Load Seam Strength	City of Los Angeles	Passed
Environmental Stress-Cracking	ASTM D 1693	Passed
PCE Diffusion Coefficient	Tested at 6,000 mg/m^3	2.74x10-14 m^2/sec
TCE Diffusion Coefficient	Tested at 20,000 mg/m^3	8.04x10-14 m^2/sec
GENERAL INFORMATION	TEST METHOD	VALUE
Coefficient of Friction-with geotextile both sides	ASTM D 5321	0.72
Cold Bend Test	ASTM D 146	Passed. No cracking at 25 F
Freeze-Thaw Resistance (100 Cycles)	ASTM A 742	Meets criteria. No spalling or disbondment
Accelerated Weathering & Ultraviolet Exposure	ASTM D 822	No adverse effect after 500 hours
Hydrostatic Head Resistance	ASTM D 751	Tested to 138 feet or 60 psi
Elongation	ASTM D 412	1,332 percent reinforcement, 90 percent recovery
Elongation-with 8 oz. non-woven geotextile both sides	ASTM D 751	100 percent (same as geotextile tested separately)
Tensile Strength	ASTM D 412	58 psi Reinforcement
Tensile Strength-8oz. non-woven-geotextile both sides	ASTM D 751	196 psi (same as geotextile tested separately)
Tensile Bond Strength to Concrete	ASTM D 413	2,556 lbs/ft^2 uplift force
Puncture Resistance-8 oz. non-woven geotextile both sides	ASTM D 4833	286 lbs. (travel of probe = 0.756 inches)(same as geotextile tested separately)
Flame Spread	ASTM E 108	Class A with top coat (comparable to UL 790)

Electric Volume Resistivity	ASTM D 257	1.91 x 1010 ohms

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Provide 24 inch minimum clearance out from surfaces to receive the gas vapor barrier/waterproofing membrane. The application surface shall be prepared and provided to the applicator in accordance with the manufacturer's specifications listed below:

3.1.1 Concrete/Shotcrete/Masonry

Concrete surfaces shall be light broom finish or smoother, free of any dirt, debris, loose material, release agents, or curing compounds. Fill all voids more than 1/4 inch deep and 1/4 inch wide. Masonry joints, cold joints, and form joints shall be struck smooth. All penetrations shall be prepared in accordance with the manufacturer's specifications. Provide a 3/4 inch minimum cant of gas vapor barrier/waterproofing membrane, or other suitable material, as approved by the manufacturer, at all horizontal to vertical transitions and other inside corners of 120 degreees or less. Allow to cure overnight before the application of gas vapor barrier/waterproofing membrane. All form ties holes must be completely grouted from the inside to outside of wall with non-shrink grout, as approved by the engineer. All cracks or cold joints greater than 1/16 inch must be completely grouted with non-shrink grout, as approved by the engineer. Install Hardcast reinforcing tape over all cold joints, cracks, and form tie holes (after holes and cracks are grouted).

3.1.2 Geocomposite Gas Drainage Net

The geocomposite drainage net shall be laid to the required lines and grades. The net shall be covered with the base geotextile. All base geotextile seams shall be overlapped and sprayed per the liquid membrane manufacturer's recommendation (see Section 3.5.1 and 3.3.1) to prevent fluid applied membrane from entering drainage net.

3.1.3 Soil

The subgrade shall be moisture conditioned and compacted to a minimum relative compaction of 90 percent, or as specified by the civil/geotechnical engineer. The finished surface shall be smooth, uniform, free of debris and standing water. Aggregate subbase surfaces shall be rolled flat, free from any protruding sharp edges. All penetrations shall be prepared in accordance with the manufacturer's specifications. All form stakes that penetrate the membrane shall be of rebar, which shall be bent over and left in the slab. Trenches shall be cut oversize to accommodate gas vapor barrier/waterproof membrane and protection course with perpendicular to sloped sides and maximum obtainable compaction. Adjoining grade shall be finish graded and compacted. Excavated walls shall be vertical or sloped back, free of roots, and protruding rocks. Specific subgrade preparation shall be designed by a qualified civil or geotechnical engineer. If organic materials with potential for growth (ie seeds or grasses) exist with the subbase, spray apply soil sterilant at the sterilant manufacturer's recommended rate.

3.2 INSTALLATION ON CONCRETE/SHOTCRETE/MASONRY

3.2.1 Surface Preparation

Provide a 3/4 inch minimum cant of gas vapor barrier/waterproofing membrane, or other suitable material as approved by the manufacturer, at all horizontal to vertical transitions and other inside corners of 120 degrees or less. Allow to cure overnight before the application of gas vapor barrier/waterproofing membrane.

3.2.2 Startup Testing

Delineate a test area on site with a minimum dimension of 10 feet by 10 feet. Apply gas vapor barrier/waterproofing membrane to a thickness of 80 mils and let it cure for 24 hours. Observe for blisters. if minor or no blistering occurs, proceed to the next step. If significant blistering does occur, apply a thin (10 mil) tack coat of gas vapor barrier/waterproofing membrane "A" side without catalyst to the entire concrete surface and allow to cure before proceeding.

3.2.3 Application

Spray apply gas vapor barrier/waterproofimg membrane to an 80 mil minimum dry thickness. Increase thickness to 100 dry mils if shotcrete is to be applied directly to membrane. If a second coat is required, remove any standing water from the membrane before proceeding with the second application. Do not penetrate membrane. Keep membrane free of dirt and debris and traffic until a protective cover is in place. After membrane has cured and checked for proper thickness and flaws, install protection material pursuant to manufacturer's instructions.

Spray on non-horizontal surfaces should begin at the bottom and work towards the top. This method allows the product to adhere to the surface before hitting catalyst runoff.

Due to the nature of concrete as a substrate, it is normal for some blistering to occur. This is caused by either concrete's tendency to off-gas or water that is temporarily trapped between the concrete and the membrane. With time and the applied pressure of backfill or over-slab, blisters will absorb into the concrete without detriment to the membrane. A small number of blister heads should be sampled and checked for proper membrane thickness. If the samples have the required membrane thickness (80 mils minimum), then the remaining blisters should not be punctured or cut. If the samples have less than the minimum 80 mils, then the area can either be re-sprayed to obtain the proper thickness, or the blisters can be cut out and the area resprayed or patched with gas vapor barrier/waterproofing membrane trowel grade.

3.3 INSTALLATION ON SOIL SURFACES AND MUDSLABS

3.3.1 Geotextile Base

Roll out gas vapor barrier/waterproofing membrane base fabric geotextile on subgrade with the heat-rolled side facing up. Overlap seams a minimum of 6 inches. Lay geotextile tight at all inside corners. Spray gas vapor barrier/waterproofing membrane within the seam overlap to a thickness of 80 mils minimum. Line trenches with geotextile extending at least 6 inches onto adjoining subgrade if slab and footings are to be sprayed separately. Overlap seams a miminum of 6 inches. Lay geotextile tight at all inside

corners. Gas vapor barrier/waterproofing membrane within the seam overlap to a thickness of 80 mils minimum.

3.3.2 Application

Spray apply gas vapor barrier/waterproofing membrane onto geotextile to an 80 mil minimum dry thickness. Increase thickness to 100 dry mils if shotcrete is to be applied directly to membrane. If a second coat is required, remove any standing water from the membrane before proceeding the the second application. Do not penetrate membrane. Keep membrane free of dirt, debris, and traffic until a protective cover is in place. It is the responsibility of the General Contractor to insure that the membrane and the protection system are not penetrated. After membrane has cured and checked for proper thickness and flaws, install protection material pursuant to the manufacturer's instructions.

3.4 SEALING AROUND PENETRATIONS

3.4.1 Base Geotextile

For applications requiring gas vapor barrier/waterproofing membrane base fabric geotextile, roll out geotextile on subgrade with the heat-rolled side facing up, overlapping seams a minimum of 6 inches. Cut the geotextile around penetrations so that it lays flat on the subgrade. Lay geotextile tight at all inside corners. Spray gas vapor barrier/waterproofing membrane within the seam overlap to a thickness of 80 mils minimum.

3.4.2 Surface Preparation

Clean all penetrations. All metal penetrations shall be sanded clean with emery cloth. At the base of penetration, install a minimum 3/4 inch thick membrane cant of gas vapor barrier/waterproofing membrane, or other suitable material as approved by the manufacturer. Extend the membrane at an 80 mil thickness 3 inches around the base of penetration and up the penetration a minimum of 3 inches. Allow to cure overnight before the application of gas vapor barrier/waterproofing membrane (see manufacturer's standard detail).

3.4.3 Application

Spray apply gas vapor barrier/waterproofing membrane to an 80 mils minimum dry thickness around the penetration, completely encapsulating the collar assembly and to a height of 1-1/2 inches minimum above the membrane, as described in Paragraph Surface Preparation above. Spray apply gas vapor barrier/waterproofing membrane to surrounding areas, as specified for the particular application. Allow gas vapor barrier/waterproofing membrane to cure completely before proceeding. Wrap penetration with polypropylene cable tie at a point 2 inches above the base of the penetration. Tighten the cable tie firmly so as to squeeze the cured membrane collar.

3.5 FIELD QUALITY CONTROL

Field quality control is a very important part of all gas vapor barrier/waterproofing membrane applications. Applicators should check their own work for coverage, thickness, and all around good workmanship before calling for inspections. Applicators and inspectors should check membrane for holes, shadow shrinkage, and any other membrane damage when reviewing the membrane. When thickness or integrity is in question the

membrane should be tested in the proper manner, as described below. However, oversammpling defeats the intent of inspections. When thickness or integrity is in question the membrane should be tested in the proper manner, as described below. However, oversampling defeats the intent of inspections. Inspectors should always use visual and tactile measurement to guide them. areas suspected of being too thin to the touch should be measured with the gauges to determine the exact thickness. With practice and by comparing tactile measurements with those of the gauges, fingers become very acurate tools.

3.5.1 Concrete/Shotcrete/Masonry and Other Hard Surfaces

Membrane may be checked for proper thickness with a blunt-nose depth gauge. Record the minimum reading. Mark the test area for repair, if necessary. If necessary, test areas are to be patched over with gas vapor barrier/waterproofing membrane to an 80 mils minimum dry thickness, extending a minimum of 1 inch beyond the test perimeter. Due to the nature of concrete as a substrate, it is normal for some blistering to occur. This is caused by either concrete's tendency to off-gas or by water temporarily trapped between the concrete and the membrane. With time and the applied pressure of backfill or over-slab, blisters will absorb into the concrete without detriment to the membrane. a small number of blister heads should be sampled and checked for proper membrane thickness. If the samples have the required membrane thickness (80 mils minimum), then the remaining blisters should not be punctured or cut. If the samples have less than the minimum 80 mils, then the area can either be resprayed to obtain the proper thickness, or the blisters can be cut out and the area resprayed or patched with gas vapor barrier/waterproofing membrane trowel grade.

3.5.2 On Dirt and Other Soft Substrates

Samples may be cut from the membrane and geotextile sandwich at a rate of one sample per 500 square feet. Samples shall be a minimum of 2 square inches. Measure the thickness with a mil-reading caliper. Deduct the plain geotextile thickness to determing the thickness of gas vapor barrier/waterproofing membrane. Mark the test area for repair. Voids left by sampling are to be patched with geotextile overlapping the void by a minimum of 2 inches. Apply a thin tack coat of gas vapor barrier/waterproofing membrane under the geotextile patch. Then spray or trowel apply gas vapor barier/waterproofing membrane to an 80 mils minimum dry thickness, extending at least 3 inches beyond geotextile patch.

3.6 VISUAL INSPECTION AND EVALUATION

Immediately prior to covering, the geomembrane, seams, and non-seam areas shall be visually inspected by the QC inspector for defects, holes, or damage due to weather conditions or construction activities. A snake test will be performed for areas of membrane placed over soil surfaces per the manufacturer's recommendations. All leaks detected shall be sealed.

-- End of Section --

SECTION 02510

WATER DISTRIBUTION

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.5.2.1M	(1981; R 1995) Metric Round Head Short Square Neck Bolts

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(2004) Hypochlorites
AWWA B301	(2004) Liquid Chlorine
AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105	(2005) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	(2003) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1999) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151	(2002) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C153	(2000) Ductile-Iron Compact Fittings for Water Service
AWWA C500	(2002; A C500a-95) Metal-Seated Gate Valves for Water Supply Service
AWWA C502	(2005) Dry-Barrel Fire Hydrants
AWWA C503	(2005) Wet-Barrel Fire Hydrants
AWWA C509	(2001) Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(2005) Installation of Ductile-Iron Water Mains and Their Appurtenances

AWWA C606	(2004) Grooved and Shouldered Joints
AWWA C651	(2005; Errata 2005) Disinfecting Water Mains
AWWA C700	(2002) Cold-Water Meters - Displacement Type, Bronze Main Case
AWWA C701	(2002) Cold-Water Meters - Turbine Type, for Customer Service
AWWA C707	(2005) Encoder-Type Remote-Registration Systems for Cold-Water Meters
AWWA C800	(2005) Underground Service Line Valves and Fittings

ASME INTERNATIONAL (ASME)

ASME B18.2.2	(1987; R 2005) Square and Hex Nuts
ASME B18.5.2.2M	(1982; R 2000) Metric Round Head Square Neck Bolts

ASTM INTERNATIONAL (ASTM)

ASTM A 307	(2004) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 47	(2004) Ferritic Malleable Iron Castings
ASTM A 536	(1984; R 2004) Ductile Iron Castings
ASTM A 563	(2004a) Carbon and Alloy Steel Nuts
ASTM B 61	(2002) Steam or Valve Bronze Castings
ASTM B 62	(2002) Composition Bronze or Ounce Metal Castings
ASTM C 94	(1994) Ready-Mixed Concrete
ASTM D 1785	(2005) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(2005) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2774	(2004) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1996; R 2002) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM F 402	(1993; R 1999) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves

UNDERWRITERS LABORATORIES (UL)

UL 246	(1993; Rev thru Dec 1998) Hydrants for Fire-Protection Service
UL 262	(2004) Gate Valves for Fire-Protection Service
UL 789	(2004) Indicator Posts for Fire-Protection Service

1.2 DESIGN REQUIREMENTS

1.2.1 Water Distribution Mains

Provide water distribution mains as indicated of ductile-iron. Provide water main accessories, gate valves as specified and where indicated.

1.2.2 Water Service Lines

Provide water service lines as indicated from water distribution main to building service at a point approximately 5 feet from building. Water service lines shall be polyvinyl chloride (PVC) plastic pipe. Provide water service line appurtenances as specified and where indicated. Submit design calculations of water piping.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Piping Materials

Water distribution main piping, fittings, joints, valves, and coupling

Water service line piping, fittings, joints, valves, and coupling

Hydrants

Indicator posts

Corporation stops

Polyethylene tube or sheet material

Valve boxes

Submit manufacturer's standard drawings or catalog cuts, except submit both drawings and cuts for push-on joints. Include information concerning gaskets with submittal for joints and couplings.

SD-06 Test Reports

Bacteriological Disinfection; G.

Test results from commercial laboratory verifying disinfection

SD-07 Certificates

Water distribution main piping, fittings, joints, valves, and coupling

Water service line piping, fittings, joints, valves, and coupling

Lining

Fire hydrants

Displacement Type Meters

SD-08 Manufacturer's Instructions

Delivery, storage, and handling

Installation procedures for water piping

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and hydrants free of dirt and debris.

1.4.2 Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place any other material or pipe inside a pipe or fitting after the coating has been applied. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Store rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

1.4.2.1 Miscellaneous Plastic Pipe and Fittings

Handle Polyvinyl Chloride (PVC) pipe and fittings in accordance with the manufacturer's recommendations. Store plastic piping and jointing materials that are not to be installed immediately under cover out of direct sunlight.

PART 2 PRODUCTS

2.1 WATER DISTRIBUTION MAIN MATERIALS

2.1.1 Piping Materials

2.1.1.1 Ductile-Iron Piping

a. Pipe and Fittings: Pipe, except flanged pipe, AWWA C151, Pressure Class 350. Flanged pipe, AWWA C115. Fittings, AWWA C110 or AWWA C153; fittings with push-on restrained joint ends conforming to the same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved, for push-on joint. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the specified joints. Pipe and fittings shall have cement-mortar lining, AWWA C104, standard thickness.

b. Joints and Jointing Material:

(1) Joints: Joints for pipe and fittings shall be push-on restrained joints or mechanical joints. Provide mechanical joints where indicated. Provide flanged joints where indicated. Provide mechanically coupled type joints using a sleeve-type mechanical coupling where indicated. Provide grooved type joints where indicated. Provide insulating joints where indicated. Joints made with sleeve-type mechanical coupling may be used in lieu of push-on joint, subject to the limitations specified in paragraph entitled "Sleeve-Type Mechanical Couplings." Grooved type joints may be used in lieu of flanged joint or push-on joint, except where joint is buried.

(2) Push-On Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly, AWWA C111.

(3) Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets, AWWA C111.

(4) Flanged Joints: Bolts, nuts, and gaskets for flanged connections as recommended in the Appendix to AWWA C115.

(5) Insulating Joints: Designed to effectively prevent metal-to-metal contact at the joint between adjacent sections of piping. Joint shall be of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers. Gasket shall be of the dielectric type, full face, and in other respects as recommended in the Appendix to AWWA C115. Bolts and nuts, as recommended in the Appendix to AWWA C115.

(6) Sleeve-Type Mechanical Coupled Joints: As specified in paragraph entitled "Sleeve-Type Mechanical Couplings."

(7) Grooved Type Joints: Grooved and shouldered pipe ends and couplings, AWWA C606. Joint dimension shall be as specified in AWWA C606 for rigid joints.

2.1.2 Valves, Hydrants, and Other Water Main Accessories

2.1.2.1 Gate Valves on Buried Piping

AWWA C500, AWWA C509, or UL 262. Unless otherwise specified, valves conforming to: (1) AWWA C500 shall be nonrising stem type with double-disc gates and mechanical-joint ends or push-on joint ends as appropriate for the adjoining pipe, (2) AWWA C509 shall be nonrising stem type with mechanical-joint ends or resilient-seated gate valves 3 to 12 inches in size, and (3) UL 262 shall be inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 175 psi, and shall have mechanical-joint ends or push-on joint ends as appropriate for the pipe to which it is joined. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have 0-ring stem seals . Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. In lieu of mechanical-joint ends and push-on joint ends, valves may have special ends for connection to sleeve-type mechanical coupling. Valve ends and gaskets for connection to sleeve-type mechanical coupling shall conform to the applicable requirements specified respectively for the joint or coupling. Where a post indicator is shown, the valve shall have an indicator post flange; indicator post flange for AWWA C500 valve shall conform to the applicable requirements of UL 262. Valves shall be of one manufacturer.

2.1.2.2 Gate Valves in Valve Pit(s) and Aboveground Location

AWWA C500, AWWA C509, or UL 262. Unless otherwise specified, valves conforming to: (1) AWWA C500 shall be outside-screw-and-yoke rising-stem type with double-disc gates and flanged ends, (2) AWWA C509 shall be outside-screw-and-yoke rising-stem type with flanged ends, and (3) UL 262 shall be outside-screw-and-yoke type, shall have double-disc or split-wedge type gate and flanged ends, and shall be designed for a hydraulic working pressure of 175 psi. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. In lieu of flanged ends, valves may have grooved ends suitable for grooved type joints, as specified in paragraph entitled "Ductile-Iron Piping." Valves shall be of one manufacturer.

2.1.2.3 Vacuum and Air Relief Valves

Vacuum and air relief valves shall be of the size shown and shall be of a type that will release air and prevent the formation of a vacuum. The valves shall automatically release air when the lines are being filled with water and shall admit air into the line when water is being withdrawn in excess of the inflow. Valves shall be iron body with bronze trim and stainless steel float.

2.1.2.4 Fire Hydrants

Dry-barrel type . Paint hydrants with at least one coat of primer and two coats of yellow enamel paint, except use red enamel paint for tops of hydrants in non-potable water systems. Stencil hydrant number and main

size on the hydrant barrel using black stencil paint.

a. Dry-Barrel Type Fire Hydrants: Dry-barrel type hydrants, AWWA C502 or UL 246, "Base Valve" design, shall have 6 inch inlet, 5 1/4 inch valve opening, one 4 1/2 inch pumper connection, and two 2 1/2 inch hose connections. Inlet shall have mechanical-joint or push-on joint end ; end shall conform to the applicable requirements as specified for the joint. Size and shape of operating nut, cap nuts, and threads on hose and pumper connections shall be as specified in AWWA C502 or AWWA C503 or UL 246 . Hydrants indicated as "traffic type," shall have frangible sections as mentioned in AWWA C502 breakable features as mentioned in AWWA C503. The traffic type hydrant shall have special couplings joining upper and lower sections of hydrant barrel and upper and lower sections of hydrant stem and shall be designed to have the special couplings break from a force not less than that which would be imposed by a moving vehicle; hydrant shall operate properly under normal conditions.

2.1.2.5 Indicator Posts

UL 789. Provide for gate valves where indicated. Indicator posts shall be equipped with "System Sensor" Model P1BV2 or approved equal.

2.1.2.6 Valve Boxes

Provide a valve box for each gate valve on buried piping , except where indicator post is shown. Valve boxes shall be of cast iron of a size suitable for the valve on which it is to be used and shall be adjustable. Cast-iron boxes shall have a minimum cover and wall thickness of 3/16 inch. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5-1/4 inches. Cast-iron box shall have a heavy coat of bituminous paint.

2.1.2.7 Valve Pits

Valve pits shall be constructed at locations indicated or as required above and in accordance with the details shown.

2.1.2.8 Turbine Type Meters

Turbine type meters shall conform to AWWA C701 Class I. The main casing shall be bronze with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be an encoder type remote register designed in accordance with AWWA C707. Meters shall comply with the accuracy and capacity requirements of AWWA C701.

2.1.2.9 Meter Vaults

Large meters shall be installed in reinforced concrete vaults manufactured in accordance with Section 03411 PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION. Large meters shall be installed in reinforced concrete vaults in accordance with the details shown on the drawings.

2.1.2.10 Sleeve-Type Mechanical Couplings

Couplings shall be designed to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling shall consist of one middle ring flared or beveled at each end to provide a gasket seat; two follower rings; two resilient tapered rubber gaskets; and bolts and nuts to draw the follower rings toward each other to compress the gaskets. The middle ring and the follower rings shall be true circular sections free from irregularities, flat spots, and surface defects; the design shall provide for confinement and compression of the gaskets. For ductile iron, the middle ring shall be of cast-iron or steel; and the follower rings shall be of malleable or ductile iron. Malleable and ductile iron shall, conform to ASTM A 47 and ASTM A 536, respectively. Steel shall have a strength not less than that of the pipe. Gaskets shall be designed for resistance to set after installation and shall meet the applicable requirements specified for gaskets for mechanical joint in AWWA C111. Bolts shall be track-head type, ASTM A 307, Grade A, with nuts, ASTM A 563, Grade A; or round-head square-neck type bolts, ANSI B18.5.2.1M and ASME B18.5.2.2M with hex nuts, ASME B18.2.2. Bolts shall be 5/8 inch in diameter; minimum number of bolts for each coupling shall be 8 inch for 6 inch pipe. Bolt holes in follower rings shall be of a shape to hold fast the necks of the bolts used. Mechanically coupled joints using a sleeve-type mechanical coupling shall not be used as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint. Mechanical couplings shall provide a tight flexible joint under all reasonable conditions, such as pipe movements caused by expansion, contraction, and traffic vibrations. Couplings shall be of strength not less than the adjoining pipeline and shall not be buried.

2.1.2.11 Warning Tape

Provide warning tape as specified in Section 02300 EARTHWORK.

2.2 WATER SERVICE LINE MATERIALS

2.2.1 Piping Materials

2.2.1.1 Plastic Piping

Plastic pipe and fittings shall bear the seal of the National Sanitation Foundation (NSF) for potable water service. Plastic pipe and fittings shall be supplied from the same manufacturer.

a. Polyvinyl Chloride (PVC) Plastic Piping with Solvent Cement Joints:

Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure.

2.2.1.2 Insulating Joints

Joints between pipe of dissimilar metals shall have a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.2.2 Water Service Line Appurtenances

2.2.2.1 Corporation Stops

Ground key type; bronze, ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops, AWWA C800.

2.2.2.2 Curb or Service Stops

Ground key, round way, inverted key type; made of bronze, ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be as appropriate for connection to the service piping. Arrow shall be cast into body of the curb or service stop indicating direction of flow.

2.2.2.3 Service Clamps

Service clamps used for repairing damaged PVC shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

2.2.2.4 Dielectric Fittings

Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

2.2.2.5 Gate Valves 3 Inch Size and Larger on Buried Piping

Gate valves 3 inch size and larger on buried piping AWWA C500 or UL 262 and of one manufacturer. Valves, AWWA C500, nonrising stem type with double-disc gates. Valves, UL 262, inside-screw type with operating nut, split wedge or double disc type gate, and designed for a hydraulic working pressure of 175 psi. Materials for UL 262 valves conforming to the reference standards specified in AWWA C500. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have 0-ring stem seals and shall be bolted and constructed so as to permit easy removal of parts for repair. Valves shall have ends suitable for joining to the pipe used; push-on joint ends or mechanical-joint ends for joining to ductile-iron pipe or push-on joint ends or mechanical-joint ends for joining to PVC plastic water main pipe; gaskets and pipe ends, AWWA C111.

2.2.2.6 Gate Valves Smaller than 3 Inch in Size on Buried Piping

Gate valves smaller than 3 inch size on Buried Piping MSS SP-80, Class 150, solid wedge, nonrising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve.

2.2.2.7 Gate Valve 3 Inch Size and Larger

Gate valves 3 inch size and larger in valve pits , AWWA C500 or UL 262 and of one make. Valves conforming to: (1) AWWA C500 shall be outside-screw-and-yoke rising-stem type with flanged ends and double-disc gates and (2) UL 262 shall be outside-screw-and-yoke type, shall be

designed for a hydraulic working pressure of 175 psi, and shall have flanged ends and double-disc or split-wedge type gate. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair.

2.2.2.8 Gate Valves Smaller Than 3 Inch Size in Valve Pits

MSS SP-80, Class 150, solid wedge, inside screw, rising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve and a handwheel operator.

2.2.2.9 Curb Boxes

Provide a curb box for each curb or service stop. Curb boxes shall be of cast iron of a size suitable for the stop on which it is to be used. Provide a round head. Cast the word "WATER" on the lid. Each box shall have a heavy coat of bituminous paint.

2.2.2.10 Valve Boxes

Provide a valve box for each gate valve on buried piping. Valve boxes shall be of cast iron of a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Cast-iron box shall have a heavy coat of bituminous paint.

2.2.2.11 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 150 psi. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 50 foot-pound.

2.2.2.12 Displacement Type Meters

Displacement type meters shall conform to AWWA C700. Registers shall be straight-reading and shall read in U.S. gallon. All meters shall be frost-protection design. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be an encoder type remote register designed in accordance with AWWA C707 and compatible with Fort Gordon Department of Public Works Standards. Meters shall comply with the accuracy and capacity requirements of AWWA C700.

2.2.2.13 Meter Boxes

Meter boxes shall be of cast iron. The boxes shall be of sufficient size to completely enclose the meter and shutoff valve or service stop. Meter boxes set in paved areas subject to vehicular traffic shall be cast iron and cast iron meter reader lid. Boxes set in sidewalks, not subject to vehicular traffic, shall be cast iron with cast iron meter reader lids.

Box height shall extend from invert of the meter to final grade at the meter location. The lid shall have the word "WATER" cast in it.

2.2.2.14 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to all pipeline installation except where specific exception is made in the "Special Requirements..." paragraphs.

3.1.1.1 Location of Water Lines

Terminate the work covered by this section at a point approximately 5 feet from the building . Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer horizontally than 10 feet from any sewer line. Where water lines cross under gravity sewer lines, encase sewer line fully in concrete for a distance of at least 10 feet on each side of the crossing, unless sewer line is made of pressure pipe with rubber-gasketed joints and no joint is located within 3 feet horizontally of the crossing. Lay water lines which cross sewer force mains at least 2 feet above these sewer lines; when joints in the sewer line are closer than 3 feet horizontally from the water line, encase these joints in concrete. Do not lay water lines in the same trench with gas lines fuel lines or electric wiring.

Where water piping is required to be installed within 3 feet of existing structures, the water pipe shall be sleeved as required in Paragraph "Casting Pipe". The Contractor shall install the water pipe and sleeve ensuring that there will be no damage to the structures and no settlement or movement of foundations or footings.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 02300 EARTHWORK.

3.1.1.3 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or any other water line material into trenches. Cut pipe in a neat workmanlike manner accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at proper

elevation and grade. Secure firm, uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Depth of cover over top of pipe shall not be less than 3 feet.

3.1.1.4 Installation of Warning Tape

Install a continuous length of warning tape for the full length of each run of pipe per Section 02300 EARTHWORK. Place wire as indicated on the drawings.

3.1.1.5 Connections to Existing Water Lines

Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line. Make connections to existing lines: 1) under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped or 2) cut tees into lines as indicated on drawings. Coordinate work with Contractor's Quality Control Representative. .

3.1.1.6 Penetrations

Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

3.1.1.7 Flanged Pipe

Flanged pipe shall only be installed above ground or with the flanges in valve pits.

3.1.2 Special Requirements for Installation of Water Mains

3.1.2.1 Installation of Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

a. Jointing: Make push-on restrained joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly. Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of Appendix A to AWWA C111. Make flanged joints with the gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not

allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer. Make grooved type joints with the couplings previously specified for this type joint connecting pipe with the grooved ends specified for this type joint; assemble in accordance with the recommendations of the coupling manufacturer. Groove pipe in the field only with approved groove cutting equipment designed especially for the purpose and produced by a manufacturer of grooved joint couplings; secure approval for field-cut grooves before assembling the joint. Make insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves shall be full size for the bolt holes. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

b. Allowable Deflection: The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

c. Pipe Anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage at fire hydrants as indicated. Thrust blocks shall be in accordance with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks shall be as indicated. Use concrete, ASTM C 94, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

d. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet material, using Class A polyethylene film, in accordance with AWWA C105. Tape polyethylene tube or sheet every 2 feet.

3.1.2.2 Installation of Valves and Hydrants

a. Installation of Valves: Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves, AWWA C509, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509. Make and assemble joints to gate valves as specified for making and assembling the same type joints between pipe and fittings.

b. Installation of Hydrants: Install hydrants in accordance with AWWA C600 for hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same

type joints between pipe and fittings. Install hydrants with the 4 1/2 inch connections facing the adjacent paved surface. If there are two paved adjacent surfaces, contact the Contractor's Quality Control Representative for further instructions.

3.1.3 Installation of Water Service Piping

3.1.3.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line at the points indicated; such water service lines shall be closed with plugs or caps.

3.1.3.2 Service Line Connections to Water Mains

Connect service lines 3 inch and smaller to the main by a corporation stop and gooseneck and install a service stop below the frostline. Connect service lines 2 inch size to the main with a rigid connection or a corporation stop and gooseneck and install a gate valve on service line below the frostline. Connect service lines 3 inch and larger size to the main with a rigid connection and install a gate valve on service line below the frostline. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps.

3.1.4 Special Requirements for Installation of Water Service Piping

3.1.4.1 Installation of Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the applicable requirements of ASTM D 2774 , unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F 402.

a. Jointing: Make solvent-cemented joints for PVC plastic piping using the solvent cement previously specified for this material; assemble joints in accordance with ASTM D 2855. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

b. Plastic Pipe Connections to Appurtenances: Connect plastic pipe service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

3.1.4.2 Location of Meters

Meters and meter boxes Vaults shall be installed at the locations shown on the drawings. The meters shall be centered in the boxes to allow for reading and ease of removal or maintenance.

3.1.5 Disinfection

Prior to disinfection, obtain Contractor's Quality Control Representative approval of the proposed method for disposal of waste water from disinfection procedures. Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24

hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying nonpotable water is not required.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

Prior to hydrostatic testing, obtain Contractor's Quality Control Representative approval of the proposed method for disposal of waste water from hydrostatic testing. The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing , except that water and electric power needed for field tests will be furnished as set forth in Section 01500 TEMPORARY CONSTRUCTION FACILITIES. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.

3.2.2 Testing Procedure

Test water mains and water service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test ductile-iron water mains and water service lines in accordance with the requirements of AWWA C600 for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical-joints or push-on joints shall not exceed the amounts given in AWWA C600; no leakage will be allowed at joints made by any other method. Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at plastic pipe joints.

3.2.3 Special Testing Requirements

For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 200 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

3.3 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

SECTION 02531

SANITARY SEWERS

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM C 150	(2005) Portland Cement
ASTM C 270	(2005a) Mortar for Unit Masonry
ASTM C 33	(2003) Concrete Aggregates
ASTM C 443	(2005) Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 478	(2003a) Precast Reinforced Concrete Manhole Sections
ASTM C 923	(2002) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C 94	(1994) Ready-Mixed Concrete
ASTM C 972	(2000) Compression-Recovery of Tape Sealant
ASTM D 2321	(2005) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2412	(2002) Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D 3034	(2004a) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a; R 2003) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 4101	(2005a) Polypropylene Injection and Extrusion Materials
ASTM D 412	(1998a; R 2002e1) Vulcanized Rubber and

	Thermoplastic Elastomers - Tension
ASTM D 624	(2000e2) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005	(Basic) Frames.Covers, Gratings, Steps, Sump and Catch Basin, Manhole

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.27	Fixed Ladders

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6	(1998) Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

1.2 SYSTEM DESCRIPTION

1.2.1 Sanitary Sewer Gravity Pipeline

Provide mains and laterals lines as indicated of polyvinyl chloride (PVC) plastic pipe. Provide building connections 6 inch lines of polyvinyl chloride (PVC) plastic pipe. Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 5 feet outside of building walls.

1.3 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Backfilling shall be accomplished after inspection by the Contractor's Quality Control Representative. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Existing Conditions

Drawings of existing conditions, as specified.

SD-02 Shop Drawings

Drawings

Installation and As-Built drawings, as specified.

Precast concrete manhole
Metal items
Frames, covers, and gratings

Details, as specified.

SD-03 Product Data

Pipeline materials

Submit manufacturer's standard drawings or catalog cuts.

SD-06 Test Reports

Reports

Test and inspection reports, as specified.

SD-07 Certificates

Portland Cement

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.5.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Carry, do not drag, pipe to trench.

1.6 DRAWINGS

a. Submit Installation Drawings showing complete detail, both plan and side view details with proper layout and elevations.

b. Submit As-Built Drawings for the complete sanitary sewer system showing complete detail with all dimensions, both above and below grade, including invert elevation.

c. Sign and seal As-Built Drawings by a Professional Surveyor and Mapper. Include the following statement: "All potable water lines crossed by sanitary hazard mains are in accordance with the permitted utility separation requirements."

1.7 EXISTING CONDITIONS

Submit drawings of existing conditions, after a thorough inspection of the area by the Contractor in the presence of the Contractor's Quality Control Representative. Details shall include the environmental conditions of the site and adjacent areas. Submit copies of the records for verification before starting work.

1.8 INSTALLER QUALIFICATIONS

Install specified materials by a licensed underground utility Contractor licensed for such work in the state where the work is to be performed. Installing Contractor's License shall be current and be state certified or state registered.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 PVC Plastic Gravity Sewer Piping

2.1.1.1 PVC Plastic Gravity Pipe and Fittings

ASTM D 3034, SDR 35, with ends suitable for elastomeric gasket joints.

2.1.1.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D 3212.

2.2 CONCRETE MATERIALS

2.2.1 Cement Mortar

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.2.2 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking. Where aggregates are alkali reactive, as determined by Appendix XI of ASTM C 33, a cement containing less than 0.60 percent alkalies shall be used.

2.2.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Precast Concrete Manholes

Precast concrete manhole risers, base sections, and tops shall conform to ASTM C 478. Base and first riser shall be monolithic.

2.3.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C 443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C 923.

2.3.3 External Preformed Rubber Joint Seals

An external preformed rubber joint seal shall be an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" shall be tested for leakage in the same manner as pipelines as described in paragraph entitled "Leakage Tests." The seal shall be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Proplene Di Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall consist of a top and bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be a non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections shall cover up to two more adjusting rings. Properties and values are listed in the following tables:

Properties, Test Methods and Minimum Values for
Rubber used in Preformed Joint Seals

Physical Properties	Test Methods	EPDM	Neoprene	Butyl mastic
Tensile, psi	ASTM D 412	1840	2195	-
Elogation percent	ASTM D 412	553	295	350
Tear Resistance, ppi	ASTM D 624 (Die B)	280	160	-

Properties, Test Methods and Minimum Values for
Rubber used in Preformed Joint Seals

Physical Properties	Test Methods	EPDM	Neoprene	Butyl mastic
Rebound, percent, 5 minutes	ASTM C 972 (mod.)	-	-	11
Rebound, percent, 2 hours	ASTM C 972	-	-	12

2.3.4 Metal Items

2.3.4.1 Frames, Covers, and Gratings for Manholes

FS A-A-60005, cast iron; figure numbers shall be as follows:

a. Traffic manhole: Provide in paved areas.

Frame: Figure 1, Size 22A
Cover: Figure 8, Size 22A
Steps: Figure 19

b. Non-traffic manhole:

Frame: Figure 4, Size 22
Cover: Figure 12, Size 22
Steps: Figure 19

Frames and covers shall be cast iron or ductile iron. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.3.4.2 Manhole Steps

Zinc-coated steel conforming to 29 CFR 1910.27. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D 4101, copolymer polypropylene. Rubber shall conform to ASTM C 443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less than 4 feet deep.

2.3.4.3 Manhole Ladders

A steel ladder shall be provided where the depth of a manhole exceeds 12 feet. The ladder shall not be less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers shall be a minimum 3/8 inch thick and 2 inches wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123/A 123M.

2.4 REPORTS

Submit Test Reports. Compaction and density test shall be in accordance with Section 02300 EARTHWORK. Submit Inspection Reports for daily activities during the installation of the sanitary system. Information in the report shall be detailed enough to describe location of work and amount of pipe laid in place, measured in linear feet.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 5 feet from the building. Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 10 feet to a water main or service line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 10 feet on each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 02300 EARTHWORK.

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose. Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

3.1.1.4 Connections to Existing Lines

Obtain approval from the Contractor's Quality Control Representative before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

3.1.2 Special Requirements

3.1.2.1 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D 2321 for assembly of joints.

Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.3 Manhole Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the requirements specified under paragraph entitled "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

3.1.4 Miscellaneous Construction and Installation

3.1.4.1 Connecting to Existing Manholes

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.1.5 Installations of Wye Branches

Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contractor's Quality Control Representative will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in Section 01500 TEMPORARY CONSTRUCTION FACILITIES. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Tests for Nonpressure Lines

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line. When pressure piping is used in a nonpressure line for nonpressure use, test this piping as specified for nonpressure pipe.

3.2.2.1 Leakage Tests

Test lines for leakage by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

a. Low-pressure air tests: Perform tests as follows:

(5) PVC plastic pipelines: Test in accordance with UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

3.2.2.2 Deflection Testing

Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads determined in accordance with ASTM D 2412. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device.

a. Pull-through device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided the device meets the applicable requirements specified in this paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections shall

conform to the following:

(1) A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.

(2) Homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface Brinell hardness of not less than 150.

(3) Center bored and through-bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of not less than 70,000 psi, with eyes or loops at each end for attaching pulling cables.

(4) Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

b. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and shall be accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved prior to use.

c. Pull-through device procedure: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.

d. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe which has excessive deflection and completely retest in same manner and under same conditions.

3.2.3 Field Tests for Concrete

Field testing requirements are covered in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

-- End of Section --

SECTION 02532

FORCE MAINS; SEWER

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D	(2002; Errata 2005) Specification for Pipeline Valves

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C203	(2002; A C203a-99) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C210	(2003; R 2004) Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C500	(2002; A C500a-95) Metal-Seated Gate Valves for Water Supply Service
AWWA C508	(2001) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
AWWA C900	(1997) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

ASTM INTERNATIONAL (ASTM)

ASTM C 478	(2003a) Precast Reinforced Concrete Manhole Sections
ASTM D 3139	(1998; R 2005) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3308	(2001) PTFE Resin Skived Tape

ASTM F 477 (2002e1) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-78 (1998) Cast Iron Plug Valves, Flanged and Threaded Ends

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pipe Materials and Fittings; G

SD-06 Test Reports

Hydrostatic Tests.

Copies of test results.

1.3 DELIVERY AND STORAGE

Pipe, fittings and accessories, and pipe coatings shall not be damaged during delivery, handling, and storage.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

Piping for force mains 4 inches in diameter and larger shall be PVC plastic. Piping 8 inches in diameter and larger may also be reinforced plastic mortar pressure (RPMP) pipe. Piping 4 inches in diameter and larger inside pump stations shall be ductile iron pipe with bolted flange joints. Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 PVC Pipe

a. PVC Pipe and Fittings 4 inches Diameter and Larger: AWWA C900, Class 150, with push-on joints.

2.2 JOINTS

2.2.1 PVC Piping

a. Push-On Joint Fittings: ASTM D 3139, with ASTM F 477gaskets.

2.3 VALVES

2.3.1 Gate Valves

Gate valves 3 inches and larger shall comply with AWWA C500. Valves for buried service shall be non-rising stem (NRS), 2 inch square nut operated with joints applicable to the pipe or installation. Buried valves shall be furnished with extension stems comprising socket, extension stem and operating nut, and shall be of an appropriate length to bring operating nut to within 6 inches of grade. One 4 foot "T" handle valve wrench shall be furnished for each quantity of 6 buried valves. Gate valves that are exposed or installed inside shall be outside screw and yoke (OS&Y), handwheel operated with flange ends unless otherwise indicated. Gate valve operating nuts and handwheels shall have an arrow and the word "OPEN" cast in raised letters to indicate the direction of opening.

2.3.2 Check Valves

Check valves shall permit free flow of sewage forward and provide a positive check against backflow. Check valves shall be designed for a minimum working pressure of 150 psi. The body shall be iron. The manufacturer's name, initials, or trademark and also the size of the valve, working pressure, and direction of flow shall be directly cast on the body.

a. Ball Check Valves shall be iron body, shall have flanged ends, and shall be the non-slam type. Flanges shall be the 125 pound type complying with ASME B16.1. Ball shall be stainless steel unless otherwise specified.

b. Swing Check Valves shall comply with AWWA C508 and shall be iron body, bronze mounted, and shall have flanged ends. Flanges shall be the 125 pound type complying with ASME B16.1.

2.3.3 Plug Valves

Cast iron valves shall comply with MSS SP-78. Steel plug valves shall comply with API Spec 6D.

2.3.4 Air Release Valves

Air release valves shall be designed to permit release of air from an empty pipe during filling and shall be capable of discharging accumulated air in the line while the line is in operation and under pressure. Valves shall be attached by means of threaded pipe connections. Valves shall be vented to the atmosphere.

a. Manual Air Release Valves: Manual air release valves shall consist of a 3 inch gate valve and 3 inch ductile iron pipe and fittings. The valve shall be installed with its line of flow in the horizontal position.

b. Automatic Air Vacuum Release Valve: Automatic air vacuum release valves shall be of the compound lever type capable of withstanding operating pressures of 150 psi. The valves shall have a 1/2 inch outlet. The body and cover of the valve shall be of iron with a stainless steel float. All internal parts shall be stainless steel or bronze. The valve shall be specifically adapted for use with sewage. Each valve shall be complete with hose and blow-off valves to permit backflushing without dismantling the valve.

2.4 VALVE BOXES

Valve boxes shall be cast iron. Cast iron boxes shall be the extension type with slide type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. The box length shall be adaptable, without full extension, to the depth of cover over the pipe at the valve locations. The word "SEWER" shall be cast in the cover.

2.5 VALVE VAULTS

Valve vaults shall be precast concrete units manufactured in accordance with Section 03411 PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION and conforming to ASTM C 478.

2.6 MISCELLANEOUS MATERIALS

Miscellaneous materials shall comply with the following requirements:

2.6.1 Pipe Coatings and Linings

a. Steel, interior: AWWA C203 or AWWA C210.

b. Steel, exterior, buried: AWWA C203.

c. Steel, exterior, exposed: AWWA C210.

2.6.2 Joint Lubricants

Joint lubricants shall be as recommended by the pipe manufacturer.

2.6.3 Bolts, Nuts and Glands

AWWA C111.

2.6.4 Joint Compound

A stiff mixture of graphite and oil or inert filler and oil.

2.6.5 Joint Tape

ASTM D 3308.

2.6.6 Bond Wire

Bond wire type RHW or USE, Size 1/0 AWG, neoprene jacketed copper conductor shaped to stand clear of the joint.

PART 3 EXECUTION

3.1 INSTALLATION

Pipe, pipe fittings, and appurtenances shall be installed at the locations indicated. Excavation, trenching, and backfilling shall be as specified in Section 02300 EARTHWORK.

3.1.1 Adjacent Facilities

Installation of force mains and inverted siphons near adjacent facilities

shall be as specified in Section 02531 SANITARY SEWERS.

3.1.2 Cutting

Pipe shall be cut in a neat manner with mechanical cutters. Wheel cutters shall be used where practicable. Sharp and rough edges shall be ground smooth and loose material removed from the pipe before laying.

3.1.3 Laying

Except where otherwise authorized, pipe shall be laid with bells facing the direction of laying. Before lowering and while suspended, the pipe shall be inspected for defects. Defective material shall be rejected. Pipe shall be laid in compliance with the following:

d. Polyvinyl Chloride: Manufacturer's instructions.

3.1.4 Jointing

3.1.4.1 Joints for PVC Pipe

a. Push-on joints: The ends of pipe for push-on joints shall be beveled to facilitate assembly. Pipe shall be marked to indicate when the pipe is fully seated. The gasket shall be lubricated to prevent displacement. The gasket shall remain in proper position in the bell or coupling while the joint is made.

3.1.5 Installation of Valves

Prior to installation, valves shall be cleaned of all foreign matter and inspected for damage. Valves shall be fully opened and closed to ensure that all parts are properly operating. Valves shall be installed with the stem in the vertical position. Valves shall be installed in valve vaults as indicated.

3.1.6 Installation of Valve Boxes

Valve boxes shall be installed over each outside gate valve, unless otherwise indicated. Valve boxes shall be centered over the valve. Fill shall be carefully tamped around each valve box to a distance of 4 feet on all sides or to undisturbed trench face, if less than 4 feet.

3.1.7 Installation of Valve Vaults

Valve vaults shall be installed as indicated.

3.1.8 Thrust Restraint

Plugs, caps, tees and bends deflecting 11-1/4 degrees or more, either vertically or horizontally, shall be provided with thrust restraint. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be thrust blocks.

3.1.8.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than

2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.2 HYDROSTATIC TESTS

The pipeline shall be subjected to both a pressure test and a leakage test. The method proposed for disposal of waste water from hydrostatic tests shall be approved by the Contractor's Quality Control Representative. Testing shall be the responsibility of the Contractor. The test must be witnessed by the Contractor's Quality Control Representative. The Contractor's Quality Control Representative shall be notified at least 7 days in advance of equipment tests. The final test report shall be delivered to the Contractor's Quality Control Representative within 15 days of the test.

3.2.1 Pressure Test

After the pipe has been installed, joints completed, thrust blocks have been in place for at least five days, and the trench has been partially backfilled, leaving the joints exposed for examination, the pipe shall be filled with water to expel all air. The pipeline shall be subjected to a test pressure of 100 psi or 150 percent of the working pressure, whichever is greater, for a period of at least one hour. Each valve shall be opened and closed several times during the test. The exposed pipe, joints, fitting, and valves shall be examined for leaks. Visible leaks shall be stopped or the defective pipe, fitting, joints, or valve shall be replaced.

3.2.2 Leakage Test

The leakage test may be conducted subsequent to or concurrently with the pressure test. The amount of water permitted as leakage for the line shall be placed in a sealed container attached to the supply side of the test pump. No other source of supply will be permitted to be applied to the pump or line under test. The water shall be pumped into the line by the test pump as required to maintain the specified test pressure as described for pressure test for a 2 hour period. Exhaustion of the supply or the inability to maintain the required pressure will be considered test failure. Allowable leakage shall be determined by the following I-P formula:

L = NDP/K Where:

L = Allowable leakage in gallons per hour.

N = Number of joints in length of pipeline tested.

D = Nominal diameter of the pipe in inches.

P = Square root of the test pressure in psig.

K = 7400 for pipe materials.

At the conclusion of the test, the amount of water remaining in the

container shall be measured and the results recorded in the test report.

3.2.3 Retesting

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted until the results of the tests are within specified allowances, without additional cost to the Government.

-- End of Section --

SECTION 02555

EXTERIOR FUEL DISTRIBUTION

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN PETROLEUM INSTITUTE (API)

API BULL 2209	(1978) Pipe Plugging Practices
API Spec 6D	(2002; Errata 2005) Specification for Pipeline Valves
API Std 609	(1997) Butterfly Valves: Double Flanged, Lug-and-Wafer Type

ASME INTERNATIONAL (ASME)

ASME B16.11	(2005) Forged Fittings, Socket-Welding and Threaded
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.34	(2004) Valves Flanged, Threaded, and Welding End
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions
ASME B16.5	(2003) Pipe Flanges and Flanged Fittings
ASME B16.9	(2003) Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.3	(2004) Process Piping

ASTM INTERNATIONAL (ASTM)

ASTM A 193/A 193M	(2005) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(2005) Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service or Both
ASTM A 36/A 36M	(2005) Carbon Structural Steel
ASTM A 53/A 53M	(2004a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM D 229	(2001) Rigid Sheet and Plate Materials

Used for Electrical Insulation

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(2002) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(2002) Pipe Hangers and Supports - Selection and Application

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2003; R 2004) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2003) Flammable and Combustible Liquids Code
NFPA 70	(2005) National Electrical Code

1.2 SYSTEM DESCRIPTION

Provide new exterior fuel distribution system complete and ready for operation. System shall include aboveground piping, buried piping, and related work.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pipe

Valves

Strainers

Pipe hangers and supports

Gages

Fuel meters

Fuel pumps

Including actual diameter of impeller being furnished and manufacturer's certified pump test curves showing the characteristics over the entire operating range.

SD-07 Certificates

Certification of welder's qualifications

SD-10 Operation and Maintenance Data

Fuel pumps, Data Package 2; G

Fuel meters, Data Package 2; G

Submit in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

1.4 QUALITY ASSURANCE

1.4.1 Certification of Welder's Qualifications

Submit prior to site welding. Certifications shall not be more than one year old.

PART 2 PRODUCTS

2.1 FUEL PIPE

2.1.1 Steel Fuel Pipe Aboveground Use

ASTM A 53/A 53M Type E (electric-resistance welded, Grade A or B) or Type S (seamless, Grade A or B), black steel. Provide weight class standard for welding end connections. Provide weight class extra strong for threaded end connections.

2.1.2 Underground Fuel Pipe

Piping routinely carrying fuel underground shall be fiberglass for unloading, loading, and filtration purposes. Piping utilized underground for fuel supply from main storage tanks to emergency generator base tanks, including overflow return piping, shall be Nylon 12 flexible piping. Both types of piping systems are described herein.

All components of the underground piping systems furnished shall be listed with UL. All pipe, fittings, and adhesives must demonstrate performance which meets or surpasses testing specified in UL Subject 971 for all fluids. All underground piping shall be of double-wall construction that will allow for a leak in the primary piping to be detected by sloping to underground low-point sumps.

a. Piping utilized for truck unloading, loading, and filtration shall be Dualoy 3000/LCX coaxial fiberglass 4 inch nominal pipe size for petroleum products or equal. Primary piping and fittings shall be suitable for continuous operation at 125 psi. Secondary piping shall be suitable at 40 psi.

b. Piping utilized for supply and overflow between main storage tanks and emergency generator tanks shall be A.P.T. XP-100-SC, secondarily contained Nylon 12, 1 inch flexible pipe or equal. Primary piping and fittings shall be suitable for continuous operation at 100 psi. Secondary piping shall be suitable at 30 psi. Double-wall piping shall be encased within a 4 inch duct system from the same manufacturer designed for removal of the double wall pipe if necessary without extensive excavation. The duct pipe shall be made from an oil and gasoline resistant nitrile rubber. All pipe connections will be made inside of below grade sumps provided by the same manufacturer.

2.2 FITTINGS

a. Threaded Fittings: ASME B16.11 or ASME B16.3.

b. Socket Welded Fittings: ASME B16.11.

c. Buttwelding Fittings: ASME B16.9. Provide the same material and weight as the piping in which fittings are installed. Backing rings shall conform to ASME B31.3 and be compatible with materials being welded.

d. Flanges: ASME B16.5, Class 150.

e. Unions: ASME B16.39, Class 150. Provide electrically isolating (insulating) unions where indicated.

2.3 GASKETS, BOLTS, NUTS, AND WASHERS

a. Gaskets: Provide one piece, factory cut, 0.0625 inch thick gaskets resistant to the effects of aviation hydrocarbon fuels and manufactured of fire resistant materials. Provide full-face gaskets for flat-face flanged joints, and ring gaskets for raised-face flanged joints.

b. Bolts: ASTM A 193/A 193M, Grade B7. Extend no less than two full threads beyond the nut with the bolts tightened to the required torque.

c. Nuts: ASTM A 194/A 194M, Grade 7, with Teflon coated threads.

d. Washers: Provide steel flat circular washers under bolt heads and nuts.

e. Electrical Insulating Gaskets for Flanges: Provide ASTM D 229 electrical insulating material of 1000 ohms minimum resistance. Material shall be resistant to the effects of aviation hydrocarbon fuels. Provide full face, one piece, factory cut insulating gaskets between flanges. Provide full surface 0.03 inch thick wall thickness, spiral-wound mylar insulating sleeves between bolts and holes in flanges; bolts may have reduced shanks of a diameter not less than the diameter at the root of threads. Provide 0.125 inch thick high strength phenolic insulating washers next to flanges and flat stainless steel washers over insulating washers and under bolt heads and nuts. Provide bolts 0.5 inch longer than standard length to compensate for the thicker insulating gaskets and the washers under bolt heads and nuts.

2.4 VALVES

Steel body for working pressure of ASME Class 150, 275 psig at 100 degrees F. Provide with stems in the horizontal position or not greater than 45 degrees above the horizontal position. Valves shall have flanged end connections, except valves smaller than 2.5 inches shall have union end connections, or threaded end connections with a union on all but one side of the valve. Provide Viton or Teflon seals with metal backup. Provide gear operators with weatherproof housing designed to exclude driving rain.

2.4.1 Ball Valves

API Spec 6D, or brass steel body, ASME Class 150. Provide nonlubricated double seated type, with weatherproof gear operators, except valves 4 inches and smaller may be lever operated with 10 positions or infinitely adjustable positions between full open and full close. Minimum bore size shall be not less than 55 percent of the internal cross sectional area of a pipe of the same nominal diameter. Valves 14 inches and larger shall have balls with trunnion type support bearings. Provide chromium-plated or nickel-plated steel balls. Valves shall have stainless steel stems and trim, and Viton or Teflon seats, body seals, and stem seals.

2.4.2 Plug Valves (Double Block and Bleed Valves)

API Spec 6D, steel body, ASME Class 150. Provide nonlubricated, resilient, double seated, tapered lift, plug type capable of handling two-way shutoff. Provide chrome-plated valve interiors and chrome-plated tapered plug of steel or ductile iron, supported on upper and lower trunnions. Sealing slips shall be steel or ductile iron with Viton seals. Valve design shall permit sealing slips to be replaced from the bottom with the valve mounted in the piping. Valves shall operate from fully open to fully closed by rotation of the handwheel (to lift and turn plug). Valves shall have weatherproof gear operators with mechanical position indicators. Minimum bore size shall be 65 percent of the internal cross sectional area of a pipe of the same nominal diameter, unless the manufacturer can show an equivalent or greater flow rate with a lower percent internal cross sectional area.

a. Valve Operation: Rotation of the plug toward open shall lift the plug without wiping the seals and retract the sealing slips so that clearance is maintained between sealing slips and valve body. Rotation of the handwheel toward closed shall lower the plug after sealing slips are aligned with the valve body and force the sealing slips against the valve body for positive closure. When valve is closed, slips shall form a secondary fire-safe metal to metal seat on both sides of the resilient seal. Maximum number of turns from full close to full open shall be eight.

b. Relief Valves: ASME Class 150, steel body. Provide plug valves with automatic thermal relief valves to relieve pressure buildup in the internal body cavity when the plug valve is closed. Relief valves shall open at 25 psi differential pressure, and discharge to the throat of and to the upstream side of the plug valve.

c. Bleed Valves: ASME Class 150, steel body ball valve or plug valve. Provide manually operated bleed valves that can be opened to verify that double block and bleed valves are not leaking when in the closed position. Provide discharge piping so that released liquid can be contained.

2.4.3 Check Valves

ASME B16.34, Class 150, steel body. Valve shall be spring-loaded, nonsurge globe type with fully guided (top and bottom) disc with Viton renewable seats.

2.4.4 Relief Valves

ASME Class 150, steel body; set relief at pressure indicated.

2.4.5 Butterfly Valves

API Std 609, Class 150, steel body, bubbletight bidirectional shutoff service at 275 psig. Disc shall be Type 304L or Type 316, stainless steel. Stem shall be Type 416 or Type 630, stainless steel. Seal ring shall be Teflon with metal backup. Stem seals shall be capable of withstanding the rated pressure and temperature of the valve seat. Valves 6 inches and larger and valves at pump discharge shall have weatherproof gear operators with handwheel; other valves shall have 10-position throttling handles. Install valves between ASME Class 150 flanges. Do not install valves on other flanges such as equipment, strainer, and valve flanges. Provide spool pieces. Provide fusible link type valves where indicated. Provide fusible link and spring assembly to close the valve automatically when the link material melts at 165 degrees F and to lock valve in the closed position.

2.4.6 Pump Pressure Relief Valves

ASME Class 150, with flanged or threaded end connections, and position indicator. Hydraulically operated, diaphragm type, modulating, globe valve actuated by pipe line pressure through a pilot control system designed to open fast to maintain a constant line pressure but close gradually to prevent surges; fully adjustable, direct acting, spring-loaded, diaphragm type designed to permit flow when the controlled pressure is greater than the predetermined spring setting; aluminum alloy 6061-T6 or 356-T6, stainless steel main valve trim and control pilot system; and rubber parts of Viton or Buna-N. When diaphragm fails, the valve shall close. Provide valve with position indicator, pilot circuit strainer, and pressure gage quick-disconnect fittings located in valve inlet, outlet, and cover.

2.4.7 Surge Control and Check Valves

ASME Class 150, with flanged or threaded end connections and position indicator. Hydraulically operated, pilot controlled, diaphragm type, nonsurge globe valve with closing time of 1 to 5 seconds; locate on discharge side of transfer pump. Valve shall automatically prevent reverse flow and open at a controlled rate to keep pump starting surges from shocking downstream equipment. Opening rate shall be adjustable from 5 to 60 seconds. Aluminum alloy 6061-T6 or 356-T6 valve body, stainless steel main valve trim and control pilot system; and rubber parts of Viton or Buna-N. Provide orifice plates by valve manufacturer. When diaphragm fails, the valve shall open.

2.4.8 Solenoid Control Valves

ASME Class 150, with flanged or threaded end connections. Hydraulically operated, pilot controlled, diaphragm or piston type globe valve, with a tight shutoff down to 200 psig operating pressure. When energized, the solenoid controls shall cause the main valve to open and function normally. When deenergized, the solenoid controls shall cause the main valve to close, providing a driptight shutoff. Provide NEMA 7 solenoids. Bronze valve body; stainless steel main valve trim and control pilot system; and rubber parts of Viton or Buna-N. When diaphragm fails, the valve shall close.

2.4.9 Truck Fueling Flow Control Valve

ASME Class 150, with flanged end connections and position indicator.

Hydraulically operated, pilot controlled, diaphragm type globe valve, capable of limiting flow rate regardless of varying inlet pressures. Provide with an adjustable low-flow start period, and thermal-relief function. Functions shall be externally adjustable. Provide NEMA 7 solenoids for truck fill high-level shutoff and hand held deadman control system. Ductile valve body, stainless steel main valve trim and control pilot system; and rubber parts of Viton or Buna-N. When diaphragm fails, valve shall close.

2.5 EQUIPMENT

Pressure components of equipment shall be for working pressure of ASME Class 150, 275 psig at 100 degrees F.

2.5.1 Fuel Meters

Meters shall be of the continuous duty, positive displacement type, with flanged end connections, and suitable for outdoor installation. Meter adjustment shall be possible while under pressure, without leakage or loss of product and without requiring disassembly other than removal of the cover plate. Meters shall be capable of momentary overspeeding to 125 percent of maximum rated capacity without damage or impairment of accuracy. Provide meters with a two-stage set stop counter register, with seven-figure nonsetback totalizer and five-figure setback run indicator without the tenth-of-gallon indicator. Pressure drop across each meter shall not exceed 6 psig when operated at rated capacity. Each meter shall be factory calibrated.

2.5.2 Fuel Pumps

Design shall provide for nonoverloading characteristics throughout entire head capacity curve under operating conditions. Pump motors shall conform to NEMA MG 1, Design B; NFPA 70, Class I, Division 1, Group D, explosion- and weather-proof, squirrel cage induction type, rated for continuous duty based on 99 degrees F temperature rise and Class B insulation. Centrifugal pumps shall be base mounted.

2.6 ELECTRICAL COMPONENTS

Provide explosion proof motors, controllers, contactors, and disconnects conforming to NFPA 70, Class I, Division 1, Group D, except where NFPA 70, Class I, Division 2, Group D is indicated. Furnish motors, controllers, contactors, and disconnects with respective pieces of equipment. Motors, controllers, contactors, and disconnects shall conform to and shall have electrical connections provided under Division 16, "Electrical." Controllers and contactors shall have a maximum of 120-volt control circuits, and shall have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section.

2.7 PIPING SYSTEM COMPONENTS AND ACCESSORIES

Design pressure and temperature ratings shall be working pressure of ASME Class 150, 150 psig at 100 degrees F.

2.7.1 Pipe Hangers and Supports

MSS SP-58 and MSS SP-69, adjustable type, except as modified herein or

indicated otherwise. Provide steel pipe hangers and supports. Finish of rods, nuts, bolts, washers, hangers, and supports shall be hot-dip galvanized. Cast-iron rollers and bases may be painted with two coats of aluminum paint in lieu of hot-dip galvanized.

a. Pipe Rollers: Provide pipe rollers one pipe size larger than the pipe which the roller supports. Provide stainless steel axles for cast-iron rollers.

b. Pipe Protection Shields: MSS SP-58 and MSS SP-69, Type 40, except material shall be Type 316 stainless steel. Provide at each roller type and slide type pipe hanger and support.

c. Low-Friction Supports: Provide self-lubricating antifriction bearing elements composed of 100 percent virgin tetrafluoroethylene polymer and reinforcing aggregates, prebonded to appropriate backing steel members. Coefficient of static friction between the material shall be 0.06 from initial installation for both vertical and horizontal loads and shall not deform more than 0.002 inch under allowable static loads. Bond between material and steel shall be heat cured, high temperature epoxy. Design pipe hanger and support elements for the loads applied. Antifriction material shall be a minimum of 0.09 inch thick. Steel supports shall be hot-dip galvanized. Units shall be factory designed and manufactured.

d. Miscellaneous Metal: ASTM A 36/A 36M, standard mill finished structural steel shapes, hot-dip galvanized.

e. Anchors, Bolts, Nuts, Washers, and Screws: Hot-dip galvanized steel, except provide Type 316 stainless steel under piers.

2.7.2 Strainers

ASME Class 150, steel body or bronze, with flanged end connections. Provide "Y" pattern. Strainers shall have removable baskets of 7-mesh, Type 316 stainless steel wire screen unless other mesh is indicated. Pressure drop for clean strainer shall not exceed 3 psig at design flow rates.

2.7.3 Gages

Provide single style pressure gage for fuel with 4.5 inchdial, brass or aluminum case, bronze tube, ball valve. Provide scale range suitable for intended service.

2.7.4 Flexible Ball Joints

Provide chromium plated steel balls capable of 360 degree rotation plus 15 degree angular flex movement, ASME Class 150 with flanged end connections. Provide pressure molded composition gaskets resistant to the effects of aviation hydrocarbon fuels and manufactured of fire resistant materials. Joints shall be designed for working pressure of 275 psig.

2.7.5 Flexible Pipe Connectors

Stainless steel, single braided, close helical type hose with ASME Class 150 end connections. Connectors shall have sufficient length to absorb 0.125 inch lateral movement. Hose shall have working pressure of 275 psig

at 100 degrees F.

2.8 BONDING

NFPA 70 for materials and workmanship. All parts of the fuel piping system shall be bonded in metallic contact to provide electrical continuity to fixed and moving components for grounding the entire system. Provide jumpers to overcome insulating effects of gaskets, paints, and nonmetallic components. Ground conductor shall be not less than No. 6 size, single covered, flexible, stranded, copper conductor, Type RR-USE.

2.9 BURIED WARNING AND IDENTIFICATION TAPE

Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved, with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall read CAUTION BURIED FUEL PIPING BELOW OR similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.10 NAMEPLATES

Provide laminated plastic nameplates for equipment, gages, thermometers, and valves. Nameplates shall be melamine plastic, 0.125 inch thick, black with white center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be minimum of 0.25 inch high normal block style. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass, and locate near each system as directed by Contracting Officer. Furnish two copies of each chart and schedule.

PART 3 EXECUTION

3.1 INSTALLATION

Installation of exterior fuel distribution systems including equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ASME B31.3. Install piping straight and true to bear evenly on supports and sand bedding material. Install valves with stems horizontal or above. Provide flanges or unions at valves, strainers, connections to equipment, and as indicated.

a. Fire Protection: Conform to safety and fire regulations of the Station Fire Department when work is in progress. Obtain a "Hot Work" permit each day before performing welding or burning. Piping and the surrounding area shall be inspected for explosive vapors prior to work and frequently during the course of the work. If, in the opinion of the Contracting Officer, a hazardous condition exists, work shall cease until such condition has been corrected.

b. Cutting Existing Pipe: Perform initial cutting of existing pipe with a multiwheel pipe cutter, using a nonflammable lubricant. After cut is made, seal interior of piping with a gas barrier plug

in accordance with API BULL 2209. Interior of piping shall be purged with carbon dioxide or nitrogen during the welding process. Complete method of cutting, sealing, and welding shall be approved in advance of the actual work.

c. Cleaning of Piping: Keep interior and ends of new piping and existing piping affected by the Contractor's operations thoroughly cleaned of water and foreign matter during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of pipe and fittings to prevent entry of water and foreign matter. Inspect piping before placing into position.

d. Demolition: Remove materials to avoid damaging remaining materials. Replace existing work damaged by the Contractor's operations with new work of the same construction.

3.2 PIPING

Test, inspect, and approve piping before burying, covering, or concealing. Provide fittings for changes in direction of piping and for connections. Reducing branch connections in steel piping may be made with forged branch outlet reducing fittings for branches two or more pipe sizes smaller than mains. Branch outlet fittings shall be forged, flared for improved flow where attached to the run, reinforced against external strains, and designed to withstand full pipe bursting strength. Stab type connections will not be permitted. Jointing compound for pipe threads shall be Teflon pipe thread paste. Make changes in piping sizes through tapered reducing pipe fittings.

a. Fittings and End Connections: For sizes less than one inch, provide threaded fittings and end connections. For sizes one to 2 inches provide threaded or socket-welding or buttwelding fittings and end connections; provide threaded connections for threaded valves, strainers, and threaded connections to equipment. For sizes 2.5 inches and larger, provide buttwelding fittings and end connections; provide flanged connections for flanged valves, traps, strainers, and flanged connections to equipment.

b. Welding: ASME B31.3, metallic arc process, including qualifications of welder.

c. Pipe Hangers and Supports: Provide additional pipe hangers and supports for concentrated loads in piping between pipe hangers and supports, such as for valves. Provide ASTM A 36/A 36M miscellaneous steel shapes as required. After installation of piping under piers, provide pipe hangers and supports including rods, bolts, nuts, and washers, with two coats of cold-applied coal tar mastic painting system applied to a minimum total dry film thickness of 30 mils. Support piping as follows:

Nominal Pipe Size (Inches)	1.0 and Under	1.5	2	3	4	6	8	10	12
Maximum Pipe Spacing (Feet)	7	9	10	12	14	17	19	22	23

d. Buried Piping System: Installation including field joints, bedding, and initial backfill shall be in accordance with

ASME B31.3 and NFPA 30.

3.3 FIELD QUALITY CONTROL

3.3.1 Inspections

Prior to initial operation, inspect piping system for compliance with drawings, specifications, and manufacturer's submittals.

3.3.2 Tests

a. Piping Tests: Before final acceptance of the work, test each system as in service to demonstrate compliance with contract requirements. Flush, clean, and dry piping before placing in operation. Correct defects in work and repeat tests until the work is in compliance with contract requirements. Furnish electricity, instruments, connecting devices, and personnel for tests.

3.4 FIELD PAINTING

Coat piping and appurtenances in accordance with the manufacturer's recommendations.

-- End of Section --

SECTION 02630

STORM DRAINAGE

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 198	(2005) Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 48/A 48M	(2003) Gray Iron Castings
ASTM A 536	(1984; R 2004) Ductile Iron Castings
ASTM C 1103	(2003)Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C 231	(2004) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(2005a) Mortar for Unit Masonry
ASTM C 425	(2004) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443	(2005) Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 478	(2003a) Precast Reinforced Concrete Manhole Sections
ASTM C 76	(2005a) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 828	(2003) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 877	(2002; E 2005) External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
ASTM C 923	(2002) Resilient Connectors Between

	Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C 924	(2002) Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM D 1056	(2000) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1171	(1999) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
ASTM D 1751	(2004) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(2004a) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1784	(2003) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2729	(2003) Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 2922	(2004) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(2004) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 698	(2000ae1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
ASTM F 1417	(1992; R 2005) Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
ASTM F 679	(2003) Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Placing Pipe

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

SD-07 Certificates

Pipeline Testing
Hydrostatic Test on Watertight Joints
Determination of Density
Frame and Cover for Gratings

Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed. Certification on the ability of frame and cover or gratings to carry the imposed live load.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

Concrete pipe shall be manufactured in accordance with Section 03411 PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION and conform to ASTM C 76, Class III.

2.1.2 PVC Pipe

ASTM D 2729.

2.1.3 PVC Pipe for Roof Drainage System

The pipe manufacturer's resin certification, indicating the cell classification of PVC used to manufacture the pipe, shall be submitted prior to installation of the pipe.

2.1.3.1 Smooth Wall PVC Pipe

ASTM F 679 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.2 DRAINAGE STRUCTURES

2.2.1 Flared End Sections

Sections shall be of a standard design fabricated from the same material as the pipe.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 4000 psi concrete under Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 2 to 4 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

2.3.2 Mortar

Mortar for connections to existing drainage structures, shall conform to ASTM C 270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.3.3 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall be manufactured in accordance with Section 03411 PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION and conform to ASTM C 478. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure made with flexible watertight, rubber-type gaskets meeting the requirements of paragraph JOINTS.

2.3.4 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron, ASTM A 48/A 48M, Class 35B; cast ductile iron, ASTM A 536, Grade 65-45-12; or cast aluminum. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.

2.3.5 Joints

2.3.5.1 Flexible Watertight Joints

a. Materials: Flexible watertight joints shall be made with plastic or rubber-type gaskets for concrete pipe and with factory-fabricated resilient materials for clay pipe. The design of joints and the physical requirements for plastic gaskets shall conform to AASHTO M 198, and rubber-type gaskets shall conform to ASTM C 443. Factory-fabricated resilient joint materials shall conform to ASTM C 425. Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber-type gasket are permitted if the nominal diameter of the pipe being gasketed exceeds 54 inches.

b. Test Requirements: Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C 443. Certified copies of test results shall be delivered to the Contractor's Quality Control Representative before gaskets or jointing materials are installed. Alternate types of watertight joint may be furnished, if specifically approved.

2.3.5.2 External Sealing Bands

Requirements for external sealing bands shall conform to ASTM C 877.

2.3.5.3 Flexible Watertight, Gasketed Joints

a. Gaskets: When infiltration or exfiltration is a concern for pipe lines, the couplings may be required to have gaskets. The closed-cell expanded rubber gaskets shall be a continuous band approximately 7 inches wide and approximately 3/8 inch thick, meeting the requirements of ASTM D 1056, Type 2, and shall have a quality retention rating of not less than 70 percent when tested for weather resistance by ozone chamber exposure, Method B of ASTM D 1171. Rubber O-ring gaskets shall be 13/16 inch in diameter for pipe diameters of 36 inches or smaller and 7/8 inch in diameter for larger pipe having 1/2 inch deep end corrugation. Rubber O-ring gaskets shall be 1-3/8 inches in diameter for pipe having 1 inch deep end corrugations. O-rings shall meet the requirements of AASHTO M 198 or ASTM C 443. Flexible plastic gaskets shall conform to requirements of AASHTO M 198, Type B.

b. Connecting Bands: Connecting bands shall be of the type, size and sheet thickness of band, and the size of angles, bolts, rods and lugs as indicated or where not indicated as specified in the applicable standards or specifications for the pipe. Exterior rivet heads in the longitudinal seam under the connecting band shall be countersunk or the rivets shall be omitted and the seam welded. Watertight joints shall be tested and shall meet the test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS.

2.4 STEEL LADDER

Steel ladder shall be provided where the depth of the manhole exceeds 12 feet. These ladders shall be not less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers shall be a

minimum 3/8 inch thick and 2-1/2 inches wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123/A 123M.

2.5 DOWNSPOUT BOOTS

Boots used to connect exterior downspouts to the storm-drainage system shall be of gray cast iron conforming to ASTM A 48/A 48M, Class 30B or 35B. Shape and size shall be as indicated.

2.6 RESILIENT CONNECTORS

Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C 923.

2.7 HYDROSTATIC TEST ON WATERTIGHT JOINTS

2.7.1 Concrete Pipe

A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Performance requirements for joints in reinforced and nonreinforced concrete pipe shall conform to AASHTO M 198 or ASTM C 443.

2.8 EROSION CONTROL RIPRAP

Provide nonerodible rock as indicated.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 02300 EARTHWORK and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than indicated on the drawings to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing, where required, shall be placed within the trench width as specified. Contractor shall not overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contractor's Quality Control Representative, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the

Contractor while performing shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe Requirements

When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or pipe arch. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary.

3.3.1 Concrete Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.4 JOINTING

3.4.1 Concrete Pipe

3.4.1.1 Flexible Watertight Joints

Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete or precast reinforced concrete, complete with frames and covers or gratings, and with fixed galvanized

steel ladders where indicated.

3.5.2 Walls and Headwalls

Construction shall be as indicated.

3.6 STEEL LADDER INSTALLATION

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet vertically, and shall be installed to provide at least 6 inches of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

3.7 BACKFILLING

3.7.1 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 8 inches.

3.7.2 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.7.3 Compaction

3.7.3.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands.

3.7.3.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

a. Under unpaved or turfed traffic areas, density shall not be less than 95 percent of maximum density for cohesionless material.

b. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.7.4 Determination of Density

Testing shall be the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 698 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2167 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017 or ASTM D 2922. Test results shall be furnished the Contractor's Quality Control Representative. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.8 PIPELINE TESTING

3.8.1 Leakage Tests

Lines shall be tested for leakage by low pressure air or water testing or exfiltration tests, as appropriate. Low pressure air testing for vitrified clay pipes shall conform to ASTM C 828. Low pressure air testing for concrete pipes shall conform to ASTM C 924. Low pressure air testing for plastic pipe shall conform to ASTM F 1417. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C 828 or ASTM C 924, after consultation with the pipe manufacturer. Testing of individual joints for leakage by low pressure air or water shall conform to ASTM C 1103. Prior to exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contractor's Quality Control Representative. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be reestablished. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by the exfiltration test shall not exceed 0.2 gallons per inch in diameter per 100 feet of pipeline per hour. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished.

-- End of Section --

SECTION 02705

AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2001; R 2004) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457-mm (18-in) Drop
AASHTO T 224	(2001) Correction for Coarse Particles in the Soil Compaction Test

ASTM INTERNATIONAL (ASTM)

ASTM C 117	(2004) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 136	(2005) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002e1) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2922	(2004) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(2004) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 75	(2003) Sampling Aggregates
ASTM E 11	(2004) Wire Cloth and Sieves for Testing Purposes

GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT)

GDOT Specifications (2001) Standard Specifications, Construction of Transportation Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Sampling and Testing
Field Density Tests

Certified copies of test results for approval not less than 30 days before material is required for the work.

Copies of field test results within 24 hours after the tests are performed.

1.3 DEGREE OF COMPACTION

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum dry density. Since ASTM D 1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve shall be expressed as a percentage of the laboratory maximum dry density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved testing laboratory in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Tests shall be performed at the specified frequency. No work requiring testing will be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contractor's Quality Control representative.

1.4.2 Tests

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11.

1.4.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.4.2.3 Moisture-Density Determinations

The laboratory maximum dry density and optimum moisture shall be determined in accordance with ASTM D 1557. If the material gradation has more than 30 percent retained on the 3/4 inch sieve, the laboratory maximum dry density and optimum moisture shall be determined in accordance with AASHTO T 180, Method D and corrected with AASHTO T 224.

1.4.2.4 Field Density Tests

Density shall be field measured in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. For the method presented in ASTM D 1556, the base plate, as shown in the drawing, shall be used. For the method presented in ASTM D 2922, the calibration curves shall be checked and adjusted, if necessary, using only the sand cone method as described in that publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and, when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017.

1.4.3 Testing Frequency

1.4.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements prior to installation.

a. Sieve Analysis
b. Liquid limit and plasticity index
c. Moisture-density relationship

1.4.3.2 In-Place Tests

One of each of the following tests shall be performed on samples taken from the placed and compacted aggregate base course. Samples shall be taken and tested at the rates indicated.

a. Density tests shall be performed on every lift of material placed and at a frequency of one set of tests for every 500 square yards, or portion thereof, of completed area.

b. Sieve Analysis shall be performed on every lift of material placed and at a frequency of one sieve analysis for every 1000 square yards, or portion thereof, of material placed.

c. Liquid limit and plasticity index tests shall be performed at the same frequency as the sieve analysis.

d. The thickness of each course shall be measured at intervals providing at least one measurement for each 500 square yards or part thereof. The thickness measurement shall be made by test holes, at least 3 inches in diameter through the course.

1.4.4 Approval of Material

The source of the material shall be selected 30 days prior to the time the material will be required in the work. Tentative approval will be based on initial test results. Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted course.

1.5 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 EQUIPMENT

All plant, equipment, and tools used in the performance of the work shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 AGGREGATE BASE COURSE MATERIAL

Aggregate base course material shall be Group I, Class A graded crushed stone conforminfg to GDOT Specifications, Section 800.2.01. The material shall meet the gradation and additional quality requirements specified in GDOT Specifications, Section 815.2.01.

PART 3 EXECUTION

3.1 GENERAL

Unless otherwise specified or indicated on the drawings, aggregate base course construction shall be in accordance with GDOT Specifications, Section 310.

3.2 OPERATION OF AGGREGATE SOURCES

Clearing, stripping and excavating shall be the responsibility of the Contractor. The aggregate sources shall be operated to produce the quantity and quality of materials meeting these specifications requirements in the specified time limit. Aggregate sources on private lands shall be conditioned in agreement with local laws and authorities.

3.3 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. Aggregates shall be stockpiled on the cleared and leveled areas to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.4 PREPARATION OF SUBGRADE

Prior to constructing the base course the underlying subgrade shall be cleaned of all foreign substances. The surface of the subgrade shall meet specified compaction and surface tolerances. Soft or unsatisfactory subgrade material shall be removed and replaced with approved material compacted to the specified density requirements. Deviations from the required line and grade shall be corrected by scarifying, reshaping, and recompacting the subgrade, as necessary. The finished subgrade shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the aggregate base course is placed.

3.5 PLACING AGGREGATE BASE COURSE MATERIAL

Aggregate base course material shall be placed to obtain uniformity of the material at the water content specified. The Contractor shall adjust the placing procedures or equipment as necessary to obtain the required grades, minimize segregation, and control moisture loss.

3.6 GRADE CONTROL

The finished base course shall conform to the lines, grades, and cross sections shown. The lines, grades, and cross sections shown shall be maintained by means of line and grade stakes placed by the Contractor at the work site.

3.7 LAYER THICKNESS

The compacted thickness of the completed course shall be as indicated. When a compacted layer of 8 inches is specified, the material may be placed in a single layer; when a compacted thickness of more than 8 inches is required, no layer shall be thicker than 8 inches nor be thinner than 3 inches when compacted.

3.8 COMPACTION

Each layer of the material shall be compacted as specified with approved compaction equipment. Moisture content shall be sufficient during compaction to obtain the required density. In all places not accessible to the rollers, the mixture shall be compacted with hand-operaated power tampers. Compaction of the base course shall continue until each layer is compacted through the full depth to at least 95 percent of laboratory maximum density. The Contractor shall make adjustments in compacting or finishing procedures as necessary to obtain required grades, minimize segregation and degradation, and reduce or increase water content. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.9 SMOOTHNESS TEST

The surface of the top layer shall show no deviations in excess of 3/8 inch when tested with a 12 footstraightedge. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 50 foot intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.10 THICKNESS CONTROL

The completed thickness of the base course shall be as indicated on the drawings. The completed course shall not be more than 1/2 inch deficient in thickness nor more than 1/2 inch above or below the established grade. Where any of these tolerances are exceeded, the Contractor shall correct such areas by scarifying, adding new material of proper gradation or removing material, and compacting, as directed. Where the measured thickness is 1/2 inch or more thicker than shown, the course will be considered acceptable and no rework will be required. The average job thickness shall be the average of the job measurements as specified above but within 1/4 inch of the thickness shown.

3.11 MAINTENANCE

The completed course shall be maintained in a satisfactory condition until accepted.

-- End of Section --

SECTION 02731

AGGREGATE SURFACE COURSE

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2001; R 2004) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457-mm (18-in) Drop
AASHTO T 224	(2001) Correction for Coarse Particles in the Soil Compaction Test

ASTM INTERNATIONAL (ASTM)

ASTM C 117	(2004) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 136	(2005) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002e1) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2922	(2004) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(2004) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 422	(1963; R 2002) Particle-Size Analysis of Soils
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 75	(2003) Sampling Aggregates

ASTM E 11 (2004) Wire Cloth and Sieves for Testing Purposes

GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT)

GDOT Specifications (2001) Standard Specifications, Construction of Transportation Systems

1.2 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated herein as percent of laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Sampling and Testing
Field Density Tests

Copies of field test results within 24 hours after the tests are performed. Test results from samples, not less than 30 days before material is required for the work. Results of laboratory tests for quality control purposes, for approval, prior to using the material.

1.4 EQUIPMENT

All plant, equipment, and tools used in the performance of the work covered by this section will be subject to approval by the Contractor's Quality Control representative before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, and meeting the grade controls, thickness controls, and smoothness requirements set forth herein.

1.5 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory . No work requiring testing will be permitted until the testing laboratory has been approved.

1.5.1 Sampling

Sampling for material gradation, liquid limit, and plastic limit tests shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contractor's Quality Control representative.

1.5.2 Testing

1.5.2.1 Gradation

Aggregate gradation shall be determined in conformance with ASTM C 117, ASTM C 136, and ASTM D 422. Sieves shall conform to ASTM E 11.

1.5.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.5.2.3 Moisture-Density Determinations

The laboratory maximum dry density and optimum moisture shall be determined in accordance with ASTM D 1557. If the material gradation has more than 30 percent retained on the 3/4 inch sieve, the laboratory maximum dry density and optimum moisture shall be determined in accordance with AASHTO T 180, Method D and corrected with AASHTO T 224.

1.5.2.4 Field Density Tests

Density shall be field measured in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. For the method presented in ASTM D 1556, the base plate, as shown in the drawing, shall be used. For the method presented in ASTM D 2922, the calibration curves shall be checked and adjusted, if necessary, using only the sand cone method as described in that publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and, when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017.

1.5.3 Testing Frequency

1.5.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements prior to installation.

a. Sieve Analysis
b. Liquid limit and plasticity index
c. Moisture-density relationship

1.5.3.2 In-Place Tests

One of each of the following tests shall be performed on samples taken from the placed and compacted aggregate base course. Samples shall be taken and tested at the rates indicated.

a. Field Density tests shall be performed on every lift of material placed and at a frequency of one set of tests for every 500 square yards, or portion thereof, of completed area.

b. Sieve Analysis shall be performed on every lift of material placed and at a frequency of one sieve analysis for every 1000 square yards, or portion thereof, of material placed.

c. Liquid limit and plasticity index tests shall be performed at the same frequency as the sieve analysis.

d. The thickness of each course shall be measured at intervals providing at least one measurement for each 500 square yards or part thereof. The thickness measurement shall be made by test holes, at least 3 inches in diameter through the course.

1.5.4 Approval of Materials

The source of the material to be used for producing aggregates shall be selected 30 days prior to the time the material will be required in the work. Approval of sources not already approved by the Corps of Engineers will be based on an inspection by the Contractor's Quality Control representative. Tentative approval of materials will be based on appropriate test results on the aggregate source. Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted surface course.

1.6 WEATHER LIMITATIONS

Aggregate surface courses shall not be constructed when the ambient temperatures is below 35 degrees F and on subgrades that are frozen or contain frost. It shall be the responsibility of the Contractor to protect, by approved method or methods, all areas of surfacing that have not been accepted by the Contractor's Quality Control representative. Surfaces damaged by a freeze, rainfall, or other weather conditions shall be brought to a satisfactory condition by the Contractor.

PART 2 PRODUCTS

2.1 AGGREGATE SURFACE COURSE MATERIAL

Aggregate surface course material shall be Group II, Class A crushed stone conforming to GDOT Specifications, Section 800.2.01. The material shall meet the additional quality requirements specified in GDOT Specifications Section 815.2.01. Aggregate surface course material shall meet the following gradation:

Sieve Size	Percent Passing
1 in.	100
3/8 in.	50-85
No. 4	35-65
No. 10	25-50
No. 40	15-30
No. 200	8-15

2.2 LIQUID LIMIT AND PLASTICITY INDEX REQUIREMENTS

The portion of the aggregate surface course material passing the No. 40 sieve shall have a maximum liquid limit of 35 and a plasticity index of 4 to 9.

PART 3 EXECUTION

Unless otherwise specified or indicated on the drawings, aggregate surface course construction shall be in accordance with GDOT Specifications,

Section 310.

3.1 OPERATION OF AGGREGATE SOURCES

The aggregate sources shall be operated to produce the quantity and quality of materials meeting these specification requirements in the specified time limit. Upon completion of the work, the aggregate sources shall be conditioned in agreement with local laws or authorities.

3.2 STOCKPILING MATERIALS

Prior to stockpiling the material, the storage sites shall be cleared and leveled by the Contractor. All materials shall be stockpiled in the manner and at the locations designated. All aggregates shall be stockpiled in such a manner that will prevent segregation.

3.3 PREPARATION OF SUBGRADE

The underlying subgrade, including shoulders, shall be cleaned of all foreign substances and compacted to the density specified in Section 02300 EARTHWORK. At the time of surface course construction, the subgrade shall contain no frozen material. Ruts or soft yielding spots in the subgrade shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade and recompacting to density requirements specified in Section 02300 EARTHWORK. The completed subgrade shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the surface course is placed.

3.4 GRADE CONTROL

During construction, the lines and grades including crown and cross slope indicated for the aggregate surface course shall be maintained by means of line and grade stakes placed by the Contractor.

3.5 PLACEMENT OF MATERIAL

Aggregate surface course shall be placed to obtain uniformity of the material and a uniform optimum water content for compaction. The Contractor shall make adjustments in placing procedures or equipment to obtain the required lines and grades, minimize segregation of particles, and obtain the desired water content.

3.6 LAYER THICKNESS

The aggregate material shall be placed on the subgrade in layers of uniform thickness. When a compacted layer of 8 inches or less is specified, the material may be placed in a single layer; when a compacted thickness of more than 8 inches is required, no layer shall exceed 8 inches nor be less than 3 inches when compacted.

3.7 COMPACTION

Each layer of the aggregate surface course shall be compacted with approved compaction equipment. Moisture content during compaction shall be sufficient to obtain the required density. In locations not accessible to the rollers, the mixture shall be compacted with mechanical tampers. Compaction shall continue until each layer through the full depth is compacted to at least 95 percent of laboratory maximum density. Any

materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked to produce a satisfactory material.

3.8 SMOOTHNESS TEST

The surface of each layer shall not show any deviations in excess of 3/8 inch when tested with a 10 foot straightedge applied both parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by the Contractor by removing material, replacing with new material, or reworking existing material and compacting, as directed.

3.9 THICKNESS CONTROL

The completed thickness of the aggregate surface course shall be within 1/4 inch, plus or minus, of the thickness indicated on plans. The thickness of the aggregate surface course shall be measured at intervals in such manner that there will be a thickness measurement for at least each 500 square yards of the aggregate surface course. The thickness measurement shall be made by test holes at least 3 inches in diameter through the aggregate surface course. When the measured thickness of the aggregate surface course is more than 1/4 inch deficient in thickness, the Contractor, at no additional expense to the Government, shall correct such areas by scarifying, adding mixture of proper gradation, reblading, and recompacting, as directed. Where the measured thickness of the aggregate surface course is thicker than that indicated, it shall be considered acceptable and no rework will be required. The average job thickness shall be the average of the job measurements determined as specified above, but shall be within 1/4 inch of the thickness indicated. When the average job thickness falls below this criterion, the Contractor shall, at no additional expense to the Government, make corrections by scarifying, adding aggregate surface course material, and reblading and recompacting, as directed.

3.10 FIELD DENSITY TESTS

Density shall be measured in the field in accordance with ASTM D 2922. Calibration curves for the nuclear density meter shall be checked and adjusted, if necessary, using only the sand cone method. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017.

3.11 MAINTENANCE

The aggregate surface course shall be maintained in a condition that will meet all specification requirements until accepted.

-- End of Section --

SECTION 02741

BITUMINOUS CONCRETE PAVEMENT

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 30	(1993; R 1998) Mechanical Analysis of Extracted Aggregate

ASTM INTERNATIONAL (ASTM)

ASTM D 2172	(2001e1) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2950	(1991; R 1997) Density of Bituminous Concrete in Place by Nuclear Methods

GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT)

GDOT Specifications	(2001) Standard Specifications, Construction of Transportation Systems

1.2 RELATED SECTIONS

Bituminous concrete pavement systems shall use Section 02705 AGGREGATE BASE COURSE, Section 02748 BITUMINOUS TACK AND PRIME COATS, Section 02770 CONCRETE SIDEWALKS AND CURBS AND GUTTERS, and Section 02761 PAVEMENT MARKINGS in addition to this section.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submittals having a "SPiRiT" designation shall meet the sustainable design documentation requirements in Section 01335 SUSTAINABLE DESIGN AND DEVELOPMENT. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Aggregate; (SPiRiT)
Asphalt cement; (SPiRiT)

Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.

Local/Regional Materials; (SPiRiT)

Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

SD-06 Test Reports

Bituminous concrete mix designs

Density

Thickness

Straightedge test

Submit reports for testing specified under paragraph entitled "Field Quality Control."

SD-07 Certificates

Asphalt mix delivery tickets

1.4 QUALITY ASSURANCE

1.4.1 Regulatory Requirements

Unless otherwise specified, work and materials shall be in accordance with applicable requirements of GDOT Specifications. Paragraphs in GDOT Specifications entitled "Measurement" and "Payment" shall not apply.

1.4.2 Modification of References

Where term "Engineer" is used in GDOT Specifications it shall be construed to mean Contractor's Quality Control representative.

1.4.3 Mix Delivery Tickets

Record and submit the following information for each load of mix delivered to the job site. Submit within one day after delivery on Contractor-provided forms approved by the Contractor's Quality Control representative:

a. Truck No:

b. Time In:

c. Time Out:

d. Tonnage and Discharge Temperature:

e. Mix Type:

f. Location:

g. Stations or Locations Placed:

1.4.4 Bituminous Concrete Mix Designs

Submit results of laboratory tests performed in establishing each mix design to be used in the work. Testing shall have been accomplished not more than one year prior to date of material placement. Documentation for each mix design shall include the proposed job mix formula.

1.4.5 Field-Constructed Mockup

Install minimum 225 square feet to demonstrate typical joints, surface finish, texture, color, permeability, and standard of workmanship. When Contractor's Quality Control representative determines that mockup does not meet requirements, demolish and remove it from the site and install another until the mockup is accepted. Keep accepted mockup undisturbed during construction as a standard for judging completed paving. Accepted mockup may be incorporated into final work when approved by Contractor's Quality Control representative.

1.5 WEATHER RESTRICTIONS

Do not produce or place bituminous concrete pavement when the weather is rainy or foggy, when the base course is frozen or has excess moisture, or when the ambient temperature is less than 40 degrees F in the shade away from artificial heat.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

PART 2 PRODUCTS

2.1 BITUMINOUS BASE COURSE

Bituminous base course shall be a 19mm Superpave mixture in accordance with GDOT Specifications, Sections 400 and 828, Group II Aggregate. Reclaimed asphalt pavement (RAP) may be incorporated into the bituminous base course mixture in accordance with GDOT Specifications, Section 402. RAP materials shall not contain alluvial gravel, local sand, or Group I aggregate. Reclaimed asphalt shingle (RAS) material shall not be used in the bituminous base course mixture.

2.2 BITUMINOUS SURFACE COURSE

Bituminous surface course shall be a 12.5mm Superpave mixture in accordance with GDOT Specifications, Sections 400 and 828, Group II Aggregate. Reclaimed asphalt pavement (RAP) may be incorporated into the bituminous surface course mixture in accordance with GDOT Specifications, Section 402. RAP materials shall not contain alluvial gravel, local sand, or Group I aggregate. Reclaimed asphalt shingle (RAS) material shall not be used in the bituminous surface course mixture.

2.3 STRIPING

Materials for pavement striping and marking shall be in accordance with

Section 02761 PAVEMENT MARKINGS.

2.4 CURBS AND GUTTERS

Materials for construction of curbs and gutters shall be in accordance with Section 32 16 13 CONCRETE SIDEWALKS AND CURBS AND GUTTERS.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Excavation and Filling

Excavation and filling to establish elevation of subgrade is specified in Section 02300 EARTHWORK.

3.2 CONSTRUCTION

Construction shall be in accordance with the applicable requirements of GDOT Specifications, except where indicated or specified otherwise.

3.2.1 Subgrade

Preparation of subgrade shall be in accordance with Section 02300 EARTHWORK. Verify compacted subgrade, granular base, or stabilized soil is acceptable and ready to support paving and imposed loads.

3.2.2 Aggregate Base Course

Aggregate base course construction shall be in accordance with Section 02705 AGGREGATE BASE COURSE.

3.2.3 Bituminous Base Course

Construction of the base course shall be in accordance with GDOT Specifications, Section 400.3.

3.2.4 Bituminous Surface Course

Construction of the bituminous surface course shall be in accordance with GDOT Specifications, Section 400.3. Placement will not be permitted unless the Contractor has a working asphalt thermometer on site. The finish elevation of the surface course shall be 1/8 to 1/4 inch above adjacent drainage inlets, concrete collars, or channels.

3.2.5 Striping

Application of pavement striping and markings shall be in accordance with Section 02761 PAVEMENT MARKINGS.

3.2.6 Curbs and Gutters

Provide curbs and gutters as indicated on the drawings. The work shall be in accordance with Section 02770 CONCRETE SIDEWALKS AND CURBS AND GUTTERS.

3.3 FIELD QUALITY CONTROL

Samples shall be taken by Contractor as specified herein. Contractor shall replace pavement where sample cores have been removed.

3.3.1 Testing

3.3.1.1 Bituminous Mix Testing

Take one sample of each bituminous mix in use each day paving operations are in progress. Samples may be taken at the plant or from the delivery truck. Perform extraction and sieve analysis tests on the uncompacted sample in accordance with ASTM D 2172 and AASHTO T 30. If a test fails to meet the job mix formula, cease placement operations and make required adjustments to the asphalt plant equipment. Before resuming paving operations, perform extraction and sieve analysis tests on a fresh sample to confirm it meets the job mix formula.

3.3.1.2 Testing of Pavement Courses

a. Density: Determine density of pavement by in-place testing with a nuclear density meter in accordance with ASTM D 2950. A minimum of one test every 500 square yards shall be performed on each lift of bituminous concrete placed. The minimum acceptable density of each course shall correspond to an air void content in the compacted mix of no more than 7.8 percent.

b. Thickness: Determine thickness of the binder and wearing course from cores taken for density test. A minimum of 6 cores shall be taken of the completed paving work at locations selected by the Contractor's Quality Control representative. The average thickness of all cores in a given area shall be equal to or greater than the required value indicated on the drawings. No individual core sample shall be more than 1/4 inch thinner than required. Pavement not meeting these criteria shall be repaired or replaced by the Contractor at no additional cost.

c. Straightedge Test: Test compacted surface of binder course and wearing course with a 10-foot straightedge as work progresses. Apply straightedge parallel with and at right angles to center line after final rolling of the surface course. Variations in the final surface shall not be more than 1/4 inch under the straightedge. Pavement showing irregularities greater than that specified shall be corrected as directed by Contractor's Quality Control representative.

d. Grade Control: The completed pavement shall not be more than 1/2 inch above or below the required finished grade. The completed pavement shall be flooded with water to determine whether any ponding or "bird bath" areas are present. The Contractor shall repair or replace ponding areas at no additional cost.

3.4 MAINTENANCE

The completed pavement shall be protected from damage and maintained in satisfactory condition until it is accepted by the Contractor's Quality Control representative.

-- End of Section --

SECTION 02748

BITUMINOUS TACK AND PRIME COATS

PART 1 GENERAL

1.1 REFERENCES

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

GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT)

GDOT Specifications	(2001) Standard Specifications, Construction of Transportation Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Certificates; G

Certificates of compliance stating that bituminous tack and prime coat materials to be used in the work meet the specified requirements.

1.3 PLANT, EQUIPMENT, MACHINES AND TOOLS

Plant, equipment, machines and tools used in the work are subject to approval and must be maintained in a satisfactory working condition at all times. Calibrated equipment such as asphalt distributors, scales, batching equipment, spreaders and similar equipment, shall have been recalibrated by a calibration laboratory within 12 months prior to commencing work.

1.4 WEATHER LIMITATIONS

Apply prime and tack coats only when the surfaces to which they will be applied are dry. Apply tack and prime coats only when the atmospheric temperature in a the shade is 40 degrees F or above and when the temperature has not been below 35 degrees F for the 12 hours prior to application, unless otherwise directed.

1.5 DELIVERY AND STORAGE

Inspect materials delivered to the site for contamination and damage. Contaminated or unsuitable materials shall be removed from the site.

PART 2 PRODUCTS

2.1 PRIME COAT

Prime coat material shall be cutback asphalt conforming to GDOT Specifications, Section 821.2.01. The asphalt grade used shall be based on the texture and condition of the surface to which the prime coat will be applied, as specified in GDOT Specifications, Section 412.3.05E.

2.2 TACK COAT

Tack coat material shall be asphalt cement conforming to GDOT Specifications, Section 820.2.01. The asphalt cement used shall be as specified in GDOT Specifications, Section 413.2.

PART 3 EXECUTION

3.1 GENERAL

Unless otherwise specified herein or indicated on the drawings, application of prime and tack coat materials shall be in accordance with GDOT Specifications, Section 412 and 413. Weather limitations specified in these sections shall be strictly observed.

3.2 PREPARATION OF SURFACE

Immediately before applying prime coat or tack coat materials, remove all debris, grit, soil, or other objectionable material that may affect a bond with the surface to be treated. Equipment used in cleaning the surface shall include a power broom or blower supplemented with hand brooms. The surface shall be dry and clean at the time of treatment..

3.3 APPLICATION RATE

The Contractor shall adjust the application rates for prime and tack coat materials within the ranges specified below to suit the condition of the surfaces to which they will be applied. The Contractor's Quality Control representative shall approve all application rates used.

3.3.1 Tack Coat

Apply bituminous material for the tack coat in quantities of not less than 0.05 gallon nor more than 0.15 gallon per square yard of pavement surface.

3.3.2 Prime Coat

Apply bituminous material for the prime coat in quantities of not less than 0.15 gallon nor more than 0.30 gallon per square yard of pavement surface.

3.4 APPLICATION TEMPERATURE

The Contractor shall apply prime and tack coat materials at temperatures specified in GDOT Specifications, Sections 412.3.05E and 413.3.05C, respectively. The Contractor shall adjust the application temperatures as necessary to achieve the required coverage. The Contractor's Quality Control representative shall approve all application temperatures used.

3.5 APPLICATION

3.5.1 General

Following preparation and subsequent inspection of the surface, apply the bituminous prime or tack coat with the Bituminous Distributor at the specified rate and temperature with uniform distribution over the surface to be treated. Properly treat all areas and spots missed by the distributor with the hand spray. Until the succeeding layer of pavement is placed, maintain the surface by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, spread clean dry sand to effectively blot up any excess bituminous material. No smoking, fires, or flames other than those from the heaters that are a part of the equipment are permitted within 25 feet of heating, distributing, and transferring operations of bituminous material other than bituminous emulsions. Prevent all traffic, except for paving equipment used in constructing the surfacing, from using the underlying material, whether primed or not, until the surfacing is completed.

3.5.2 Prime Coat

Apply a prime coat at locations shown on the drawings. Apply the prime coat as soon as possible after compaction of the underlying material.

3.5.3 Tack Coat

Apply tack coat at the locations shown on the drawings. Apply the tack coat when the surface to be treated is dry. Apply the bituminous tack coat only as far in advance of the placing of the overlying layer as required for that day's operation.

3.6 CURING PERIOD

Following application of prime and tack coat materials and prior to application of the succeeding layer of pavement, the bituminous coat shall be allowed to cure and to obtain evaporation of any volatiles or moisture. Maintain the coated surface until the succeeding layer of pavement is placed, by protecting the surface against damage and by repairing and recoating deficient areas. Allow the prime coat to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course. Tack coat material shall be allowed to cure until it "breaks" and becomes tacky enough to receive the next lift of asphaltic concrete pavement. Furnish and spread enough sand to effectively blot up and cure excess prime or tack coat materials.

3.7 TRAFFIC CONTROLS

Keep traffic off surfaces freshly treated with prime or tack coat materials. Provide sufficient flagmen, warning signs, and barricades to detour traffic around freshly treated surfaces.

-- End of Section --

SECTION 02752

PORTLAND CEMENT CONCRETE PAVEMENT FOR ROADS AND SITE FACILITIES

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

ACI 301	(2005) Specifications for Structural Concrete
ACI 305R	(1999) Hot Weather Concreting
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting

ASTM INTERNATIONAL (ASTM)

ASTM A 615/A 615M	(2005a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 143/C 143M	(2005) Slump of Hydraulic Cement Concrete
ASTM C 172	(2004) Sampling Freshly Mixed Concrete
ASTM C 231	(2004) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 31/C 31M	(2003a) Making and Curing Concrete Test Specimens in the Field
ASTM C 39/C 39M	(2004a) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94/C 94M	(2004a) Ready-Mixed Concrete

GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT)

GDOT Specifications	(2001) Standard Specifications, Construction of Transportation Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals having a "SPiRiT" designation shall meet the sustainable design documentation requirements in Section 01335 SUSTAINABLE DESIGN AND DEVELOPMENT. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Dowels

Reinforcement

Manufacturer's literature indicating proposed materials meet specified requirements.

Cementitious Materials; (SPiRiT)

Aggregate; (SPiRiT)

Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.

Local/Regional Materials; (SPiRiT)

Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

SD-05 Design Data

Concrete mix design; G, AE (SPiRiT)

Thirty days minimum prior to concrete placement, submit a mix design with supporting test results for each strength and type of concrete, for approval. Submit a complete list of materials including type; brand; source and amount of cement, fly ash, slag, and admixtures; and applicable reference specifications. Provide mix proportion data using at least three different water-cement ratios for each type of mixture, which will produce a range of compressive strength that encompasses the specified design value. Submit a new mix design for each material source change.

SD-06 Test Reports

Concrete slump tests

Air content tests

Compressive strength tests

Copies of all test reports within 24 hours of the completion of the test.

SD-07 Certificates

Batch tickets

SD-11 Closeout Submittals

Local/Regional Materials; (SPiRiT)

Cementitious Materials; (SPiRiT)

Aggregate; (SPiRiT)

1.3 DELIVERY, STORAGE, AND HANDLING

Concrete delivery and handling shall be in accordance with ASTM C 94/C 94M. Dowels and other materials required for construction of Portland cement concrete pavement shall be stored in an approved manner and location.

1.4 QUALITY ASSURANCE

1.4.1 Batch Tickets

Submit mandatory batch ticket information for each load of ready-mixed concrete in accordance with ASTM C 94/C 94M.

1.5 SUSTAINABLE DESIGN REQUIREMENTS

1.5.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Concrete

Concrete shall conform to the applicable requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE, except as otherwise specified. Concrete shall have a minimum compressive strength of 4,000 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

2.1.1.1 Cementitious Materials

Cementitious Materials shall be portland cement, portland blast-furnace slag cement, or portland cement in combination with pozzolan or ground granulated blast furnace slag and shall conform to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Use of cementitious materials in concrete which will have surfaces exposed in the completed work shall be restricted so there is no change in color, source, or type of cementitious material.

2.1.1.2 Air Content

Mixtures shall have air content by volume of concrete of 3.5 to 7 percent, based on measurements made immediately after discharge from the mixer.

2.1.1.3 Slump

The concrete slump shall be 3 inches, plus or minus 1 inch.

2.1.2 Reinforcement

2.1.2.1 Dowels Bars

Dowels shall be smooth steel bars conforming to ASTM A 615/A 615M, Grade 60. The diameters and lengths of the dowel bars shall be as indicated on the drawings. Remove all burrs and projections from the bars prior to installation.

2.1.2.2 Tie Bars

Tie bars shall be deformed steel bars conforming to ASTM A 615/A 615M Grade 60.

2.1.2.3 Reinforcement

Where indicated on the drawings, bar reinforcement shall conform to ASTM A 615/A 615M, Grade 60.

2.1.3 Liquid Membrane-Forming Curing Compound

ASTM C 309, white pigmented, Type 2, Class B, free of paraffin or petroleum.

2.1.4 Joint Fillers and Sealants

Provide as specified in Section 02760 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.

PART 3 EXECUTION

3.1 GENERAL

Prior to pavement construction verify that the compacted subgrade or aggregate base course is acceptable and ready to support paving and imposed loads. Unless otherwise specified herein, construction of Portland cement concrete pavement shall be in accordance with GDOT Specifications, Section 430.

3.2 FORMS

3.2.1 Construction

Construct forms to be removeable without damaging the concrete.

3.2.2 Coating

Before placing the concrete, coat the contact surfaces of forms with a non-staining mineral oil or form coating compound.

3.2.3 Grade and Alignment

Check and correct grade elevations and alignment of the forms immediately before placing the concrete.

3.3 REINFORCEMENT

3.3.1 Dowel Bars

Install bars accurately aligned, vertically and horizontally, at indicated

locations and to the dimensions and tolerances indicated. Before installation thoroughly grease the sliding portion of each dowel. Dowels shall remain in position during concrete placement and curing.

3.3.2 Tie Bars

Install bars, accurately aligned horizontally and vertically, at indicated locations.

3.3.3 Setting Slab Reinforcement

When indicated on the drawings, reinforcement shall be positioned on suitable chairs prior to concrete placement. At expansion, contraction and construction joints, place the reinforcement as indicated. Reinforcement shall be free of mud, oil, scale or other foreign materials. Place reinforcement accurately and wire securely. The laps at splices shall be 12 inches minimum and the distances from ends and sides of slabs and joints shall be as indicated.

3.4 MEASURING, MIXING, CONVEYING, AND PLACING CONCRETE

3.4.1 Measuring

Measuring shall be in accordance with ASTM C 94/C 94M.

3.4.2 Mixing

Mixing shall be in accordance with ASTM C 94/C 94M, except as modified herein. Begin mixing within 30 minutes after cement has been added to aggregates. When the air temperature is greater than 85 degrees F, reduce mixing time and place concrete within 60 minutes. Additional water may be added to bring slump within required limits as specified in Section 11.7 of ASTM C 94/C 94M, provided that the specified water-cement ratio is not exceeded.

3.4.3 Conveying

Conveying shall be in accordance with ASTM C 94/C 94M.

3.4.4 Placing

Follow guidance of ACI 301, except as modified herein. Do not exceed a free vertical drop of 5 feet from the point of discharge. Place concrete continuously at a uniform rate, with minimum amount of segregation, without damage to the grade and without unscheduled stops except for equipment failure or other emergency.

3.4.5 Vibration

Immediately after spreading concrete, consolidate it with internal type vibrating equipment along the boundaries of all slabs regardless of slab thickness, and interior of all concrete slabs 6 inches or more in thickness. Limit duration of vibration to that necessary to produce consolidation of concrete. Excessive vibration will not be permitted. Vibrators shall not be operated in concrete at one location for more than 15 seconds. The Contractor's Quality Control representative shall approve all consolidation methods and equipment.

3.4.5.1 Vibrating Equipment

Operate equipment, except hand-manipulated equipment, ahead of the finishing machine. Select the number of vibrating units and power of each unit to properly consolidate the concrete. Vibrators may be pneumatic, gas driven, or electric, and shall be operated at frequencies within the concrete of not less than 8,000 vibrations per minute. Amplitude of vibration shall be such that noticeable vibrations occur at 1.5 foot radius when the vibrator is inserted in the concrete to the depth specified.

3.4.6 Cold Weather

The placing of concrete when the ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing temperatures within 24 hours shall receive prior approval from the Contractor's Quality Control representative. When an approved concrete pour is likely to be subjected to freezing within 24 hours after placing, heat concrete materials so that temperature of concrete when deposited is between 50 and 80 degrees F. Methods of heating materials are subject to approval of the Contractor's Quality Control representative. Do not heat mixing water above 165 degrees F. Remove lumps of frozen material and ice from aggregates before placing aggregates in mixer. Follow practices found in ACI 306.1.

3.4.7 Hot Weather

Maintain required concrete temperature in accordance with Figure 2.1.5 in ACI 305R to prevent evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. After placement, use fog spray, apply monomolecular film, or use other suitable means to reduce the evaporation rate. Start curing when surface of fresh concrete is sufficiently hard to permit curing without damage. Cool underlying material by sprinkling lightly with water before placing concrete. Follow practices found in ACI 305R.

3.5 PAVING

Install surface elevation of the paving system 1/8 to 1/4 inch above adjacent drainage inlets, concrete collars, or channels. Pavement may be constructed using hand placement and finishing methods, or with paving and finishing equipment utilizing fixed forms. Slipform equipment may be utilized if approved in advance.

3.5.1 Consolidation

The paver vibrators shall be inserted into the concrete not closer to the underlying material than 2 inches. The vibrators or any tamping units in front of the paver shall be automatically controlled so that they shall be stopped immediately as forward motion ceases. Excessive vibration shall not be permitted. Concrete in small, odd-shaped slabs or in locations inaccessible to the paver mounted vibration equipment shall be vibrated with a hand-operated immersion vibrator. Vibrators shall not be used to transport or spread the concrete.

3.5.2 Operation

When paving equipment is operated between or adjacent to previously constructed pavement (fill-in lanes), provisions shall be made to prevent

damage to the previously constructed pavement, including keeping the existing pavement surface free of any debris. Transversely oscillating screeds and extrusion plates shall overlap the existing pavement the minimum distance possible.

3.5.3 Required Results

The paving equipment and methods used shall produce a thoroughly consolidated slab throughout, true to line and grade within specified tolerances. The operation shall produce a surface finish free of irregularities, tears, voids of any kind, and any other discontinuities. It shall produce a minimal amount of paste at the surface. Multiple passes of paving equipment shall not be permitted. No water, other than true fog sprays (mist), shall be applied to the concrete surface during paving and finishing.

3.5.4 Fixed Form Paving

Forms shall be steel, except that wood forms may be used for curves having a radius of 150 feet or less, and for fillets. Forms may be built up with metal or wood, added only to the base, to provide an increase in depth of not more than 25 percent. The base width of the form shall be not less than eight-tenths of the vertical height of the form, except that forms 8 inches or less in vertical height shall have a base width not less than the vertical height of the form. Wood forms for curves and fillets shall be adequate in strength and rigidly braced. Forms shall be set on firm material cut true to grade so that each form section when placed will be firmly in contact with the underlying layer for its entire base. Forms shall not be set on blocks or on built-up spots of underlying material. Forms shall remain in place at least 12 hours after the concrete has been placed. Forms shall be removed without damaging the concrete.

3.5.5 Slipform Paving

If the use of a slipform paver is approved, the paver shall shape the concrete to the required cross section in one pass, and shall finish the surface and edges so that only a minimal amount of hand finishing is required. Dowels shall not be installed by dowel inserters attached to the paver or by any other means of inserting the dowels into the plastic concrete.

3.5.6 Placing Reinforcing Steel

Reinforcement shall be positioned on suitable chairs securely fastened to the subgrade prior to concrete placement.

3.5.7 Placing Dowels and Tie Bars

Placement of dowels and tie bars shall be within a horizontal tolerance of plus or minus 1 inch and a vertical tolerance of plus or minus 1/2 inch. The portion of each dowel intended to move within the concrete or expansion cap shall be painted with one coat of rust inhibiting primer paint, and then oiled just prior to placement.

3.5.7.1 Contraction Joints

Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place by means of rigid metal basket assemblies. The dowels and tie bars shall be welded to the

assembly or held firmly by mechanical locking arrangements that will prevent them from becoming distorted during paving operations. The basket assemblies shall be held securely in the proper location by means of suitable anchors.

3.6 FINISHING CONCRETE

Start finishing operations immediately after placement of concrete. Concrete finishing shall be performed using a finishing machine wherever possible. Hand finishing may be used for concrete slabs in inaccessible locations or of such shapes or sizes that machine finishing is impracticable. Finish pavement surface on both sides of a joint to the same grade. Provide hand finishing equipment for use at all times. Transverse and longitudinal surface tolerances shall be 1/4 inch in 10 feet.

3.6.1 Machine Finishing

Strike off and screed concrete to the required slope and cross-section by a power-driven finishing machine. Transverse rotating tube or pipe shall not be permitted unless approved by the Contractor's Quality Control representative. Elevation of concrete shall be such that, when consolidated and finished, pavement surface will be adequately consolidated and at the required grade. Equip finishing machine with two screeds which are readily and accurately adjustable for changes in pavement slope and compensation for wear and other causes. Make as many passes over each area of pavement and at such intervals as necessary to give proper consolidation, retention of coarse aggregate near the finished surface, and a surface of uniform texture, true to grade and required crown or cross-slope. Do not permit excessive operation over an area, which will result in an excess of mortar and water being brought to the surface.

3.6.1.1 Equipment Operation

Maintain the travel of machine on the forms without lifting, wobbling, or other variation of the machine which may tend to affect the precision of concrete finish. Keep the tops of the forms clean. During the first pass of the finishing machine, maintain a uniform ridge of concrete ahead of the front screed for its entire length.

3.6.1.2 Joint Finish

Before concrete is hardened, correct edge slump of pavement, exclusive of edge rounding, in excess of 1/4 inch. Finish concrete surface on each side of construction joints to the same plane, and correct deviations before newly placed concrete has hardened.

3.6.1.3 Hand Finishing

Strike-off and screed surface of concrete to elevations slightly above finish grade so that when concrete is consolidated and finished the final pavement surface is at the required elevation. Vibrate entire surface until required compaction and reduction of surface voids is secured with a strike-off template.

3.6.1.4 Longitudinal Floating

After initial finishing, further smooth and consolidate concrete by means of hand-operated longitudinal floats. Use floats that are not less than 12 feet long and 6 inches wide and stiffened to prevent flexing and warping.

3.6.2 Texturing

Before the surface sheen has disappeared and before the concrete hardens, the surface of the pavement shall be given a texture as described herein. Following initial texturing on the first day of placement, the Contractor shall inspect the texturing for compliance with design requirements. After curing is complete, all textured surfaces shall be thoroughly power broomed to remove all debris.

3.6.2.1 Burlap Drag Finish

Before concrete becomes non-plastic, finish the surface of the slab by dragging on the surface a strip of clean, wet burlap measuring from 3 to 10 feet long and 2 feet wider than the width of the pavement. Select dimension of burlap drag so that at least 3 feet of the material is in contact with the pavement. Drag the surface so as to produce a finished surface with a fine granular or sandy texture without leaving disfiguring marks.

3.6.2.2 Brooming

Finish the surface of the slab by sweeping the surface with a new bristle broom at least 18 inches in width. Gently pull the broom over the surface of the pavement from edge to edge just before the concrete becomes non-plastic. Slightly overlap adjacent strokes of the broom. Broom perpendicular to centerline of pavement so that corrugations produced will be uniform in character and width, and not more than 1/16 inch in depth. Broomed surface shall be free from porous spots, irregularities, depressions, and small pockets or rough spots such as may be caused by accidentally disturbing particles of coarse aggregate embedded near the surface.

3.6.3 Edging

At the time the concrete has attained a degree of hardness suitable for edging, carefully finish slab edges, including edges at formed joints, with an edge having a maximum radius of one-eighth inch. Edge transverse joints before starting brooming, then operate broom to obliterate as much as possible the mark left by the edging tool without disturbing the rounded corner left by the edger. Clean by removing loose fragments and soupy mortar from corners or edges of slabs which have crumbled and areas which lack sufficient mortar for proper finishing. Refill voids solidly with a mixture of suitable proportions and consistency and refinish. Remove unnecessary tool marks and edges. Remaining edges shall be smooth and true to line.

3.6.4 Repair of Surface Defects

Follow guidance of ACI 301.

3.7 CURING AND PROTECTION

Protect concrete adequately from damage by sun, rain, flowing water, frost, mechanical impact, tire marks and oil stains. Do not allow concrete to dry out from the time it is placed until the expiration of the minimum curing periods specified herein. Use liquid membrane-forming compound, except as specified otherwise herein. Do not use membrane-forming compound on surfaces where its appearance would be objectionable, on surfaces to be

painted, where coverings are to be bonded to concrete, or on concrete to which other concrete is to be bonded. Maintain temperature of air next to concrete above 40 degrees F for the full curing periods.

3.7.1 Liquid Membrane-Forming Curing Compound

Apply curing compound immediately after surface loses its water sheen and has a dull appearance and before joints are sawed. The method of curing compound application and the application rate shall be in accordance with the manufacturer's recommendations. Compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. Apply an additional coat of compound immediately to areas where film is defective. Respray concrete surfaces that are subject to heavy rainfall within 3 hours after curing compound has been applied in the same manner.

3.7.1.1 Protection of Treated Surfaces

Keep concrete surfaces to which liquid membrane-forming compounds have been applied free from vehicular traffic and other sources of abrasion for not less than 72 hours. Foot traffic is allowed after 24 hours for inspection purposes. Maintain continuity of coating for entire curing period and repair damage to coating immediately.

3.8 FIELD QUALITY CONTROL

3.8.1 Sampling

The Contractor's approved laboratory shall collect samples of fresh concrete in accordance with ASTM C 172 each day paving operations are in progress as required to perform tests specified herein. The laboratory technician shall make test specimens in accordance with ASTM C 31/C 31M.

3.8.2 Slump Tests

The Contractor's approved laboratory shall perform concrete slump tests in accordance with ASTM C 143/C 143M. Take samples for slump determination from concrete during placement. Perform tests at the beginning of a concrete placement operation and and for each batch (minimum) or every 50 cubic yards (maximum) of concrete to ensure that specification requirements are met. In addition, perform tests each time test cylinders are made.

3.8.3 Compressive Strength Tests

The Contractor's approved laboratory shall test for compressive strength in accordance with ASTM C 39/C 39M. Make four test specimens for each set of tests. Test one specimen at 7 days, and two at 28 days. One cylinder shall be retained as a spare. Concrete strength will be considered satisfactory when the average of the 28-day test results equals or exceeds the specified 28-day compressive strength, and no individual strength test is more than 500 psi below the specified strength. Samples for strength tests shall be taken at least once every 100 cubic yards, or fraction thereof, of concrete placed each day paving operations are in progress. Concrete which is determined to be defective, based on the strength acceptance criteria herein, shall be removed and replaced with acceptable concrete at no additional cost.

3.8.4 Air Content Tests

Test air-entrained concrete for air content at the same frequency as specified for slump tests. Determine percentage of air in accordance with ASTM C 231 on samples taken during placement of concrete in forms.

3.8.5 Surface Testing

Surface testing for surface smoothness and plan grade shall be performed as indicated below by the Testing Laboratory. The measurements shall be properly referenced in accordance with paving lane identification and stationing, and a report given to the Contractor's Quality Control representative within 24 hours after measurement is made.

3.8.5.1 Surface Smoothness Requirements

The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more, and variations in final pervious surface shall not be more than 1/4 inch under a 10 foot straightedge. Pavement not meeting smoothness requirements shall be repaired by the Contractor at no additional cost.

3.8.5.2 Surface Smoothness Testing Method

The surface of the pavement shall be tested with the straightedge to identify all surface irregularities exceeding the tolerances specified above. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines approximately 15 feet apart. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface, in the area between these two high points.

3.8.6 Plan Grade Testing and Conformance

The surfaces shall vary not more than 1/2 inch above or below the plan grade line or elevation indicated.

3.8.7 Test for Pavement Thickness

Measure during concrete placement to determine in-place thickness of concrete pavement.

3.8.8 Reinforcement

Inspect reinforcement prior to installation to assure it is free of loose flaky rust, loose scale, oil, mud, or other objectionable material.

3.8.9 Dowels

Inspect dowel placement prior to placing concrete to assure that dowels are of the size indicated, and are spaced, aligned, painted, and oiled as specified.

3.9 MAINTENANCE

The Contractor shall protect the completed pavement from damage and maintain it in satisfactory condition until it is accepted by the Contractor's Quality Control representative.

-- End of Section --

SECTION 02760

FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C 509	(2000) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C 920	(2005) Elastomeric Joint Sealants
ASTM D 789	(2004) Determination of Relative Viscosity and Moisture Content of Polyamide (PA)

GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT)

GDOT Specifications	(2001) Standard Specifications, Construction of Transportation Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Manufacturer's Recommendations; G

Where installation procedures, or any part thereof, are required to be in accordance with the manufacturer's recommendations, submit printed copies of these recommendations. Installation of the material will not be allowed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

Materials

Manufacturer's literature of materials proposed for use in joint sealing work, indicating conformance with specified requirements.

Joint Sealant
Backup Materials

1.3 EQUIPMENT

Machines, tools, and equipment used in the performance of the work required

by this section shall be approved before the work is started and shall be maintained in satisfactory condition at all times.

1.3.1 Sealing Equipment

1.3.1.1 Hot-Poured Sealing Equipment

The unit applicators used for heating and installing hot-poured joint sealant materials shall be mobile and shall be equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the joint to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. The applicator unit shall be designed so that the sealant will circulate through the delivery hose and return to the inner kettle when not in use.

1.3.1.2 Cold-Applied, Single-Component Sealing Equipment

The equipment for installing single component joint sealants shall consist of an extrusion pump, air compressor, following plate, hoses, and nozzle for transferring the sealant from the storage container into the joint opening. The dimension of the nozzle shall be such that the tip of the nozzle will extend into the joint to allow sealing from the bottom of the joint to the top. The approved equipment shall be maintained in good working condition, serviced in accordance with the supplier's instructions, and shall not be altered in any way without obtaining prior approval. Hand -held air-powered equipment (i.e., caulking guns) may be used for small applications.

1.4 DELIVERY AND STORAGE

Materials delivered to the job site shall be inspected for defects, unloaded, and stored with a minimum of handling to avoid damage. Storage facilities shall be provided by the Contractor at the job site for maintaining materials at the temperatures and conditions recommended by the manufacturer.

1.5 ENVIRONMENTAL CONDITIONS

The ambient air temperature and the pavement temperature within the joint shall be a minimum of 50 degrees F and rising at the time of application of the materials. Sealant shall not be applied if moisture is observed in the joint.

PART 2 PRODUCTS

2.1 SEALANTS

Materials for sealing joints in the various paved areas indicated on the drawings shall be as follows:

Area	Sealing Material
Portland Cement Concrete Pavement	GDOT Specifications, Section 833.2.02
Sidewalks, Curbs, and Gutters	ASTM C 920

Area	Sealing Material

2.2 PRIMERS

When primers are recommended by the manufacturer of the sealant, their use shall be in accordance with the recommendation of the manufacturer.

2.3 BACKUP MATERIALS

The backup material (premolded expansion joint filler) shall be a compressible, nonshrinking, nonstaining, nonabsorbing material and shall be nonreactive with the joint sealant. The material shall have a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D 789. The material shall have a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C 509. The backup material shall be 25 plus or minus 5 percent larger in diameter than the nominal width of the crack.

PART 3 EXECUTION

3.1 PREPARATION OF JOINTS

Immediately before the installation of the sealant, the joints shall be thoroughly cleaned to remove all laitance, curing compound, filler, and protrusions of hardened concrete from the sides and upper edges of the joint space to be sealed.

3.1.1 Back-Up Material

When the joint opening is of a greater depth than indicated for the sealant depth, the lower portion of the joint opening shall be plugged or sealed off using a back-up material to prevent the entrance of the sealant below the specified depth. Care shall be taken to ensure that the backup material is placed at the specified depth and is not stretched or twisted during installation.

3.1.2 Bond Breaking Tape

Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, a bond breaker separating tape will be inserted to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. The tape shall be securely bonded to the bottom of the joint opening so it will not float up into the new sealant.

3.1.3 Rate of Progress of Joint Preparation

The stages of joint preparation which include air pressure cleaning and placing of the back-up material shall be limited to only that lineal footage that can be sealed during the same day.

3.2 PREPARATION OF SEALANT

3.2.1 Hot-Poured Sealants

Hot-poured sealants shall not be heated in excess of the safe heating temperature recommended by the manufacturer as shown on the sealant

containers. Sealant that has been overheated or subjected to application temperatures for over 4 hours or that has remained in the applicator at the end of the day's operation shall be withdrawn and wasted.

3.2.2 Single-Component, Cold-Applied Sealants

Single component, cold-applied sealant and containers shall be inspected prior to use. Any materials that contain water, hard caking of any separated constituents, nonreversible gel, or materials that are otherwise unsatisfactory shall be rejected. Settlement of constituents in a soft mass that can be readily and uniformly remixed in the field with simple tools will not be cause for rejection.

3.3 INSTALLATION OF SEALANT

3.3.1 Time of Application

Joints shall be sealed immediately following cleaning of the joint walls and following the placement of the separating or backup material. Open joints that cannot be sealed under the conditions specified, or when rain interrupts sealing operations shall be recleaned and allowed to dry prior to installing the sealant.

3.3.2 Sealing Joints

Immediately preceding, but not more than 50 feet ahead of the joint sealing operations, a final cleaning with compressed air shall be performed. The joints shall be filled from the bottom up, leaving a recess below the pavement surface as indicated on the drawings. Excess or spilled sealant shall be removed from the pavement by approved methods and shall be discarded. The sealant shall be installed in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the Contractor's Quality Control representative. When a primer is recommended by the manufacturer, it shall be applied evenly to the joint faces in accordance with the manufacturer's instructions. Joints shall be checked frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

3.4 INSPECTION

3.4.1 Joint Cleaning

Joints shall be inspected during the cleaning process to correct improper equipment and cleaning techniques that damage the concrete pavement in any manner. Cleaned joints shall be approved prior to installation of the separating or back-up material and joint sealant.

3.4.2 Joint Sealant Application Equipment

The application equipment shall be inspected to ensure conformance to temperature requirements, proper proportioning and mixing (if two-component sealant) and proper installation. Evidences of bubbling, improper installation, failure to cure or set shall be cause to suspend operations until causes of the deficiencies are determined and corrected.

3.4.3 Joint Sealant

The joint sealant shall be inspected for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified herein at no additional cost to the Government.

3.5 CLEAN-UP

Upon completion of the project, all unused materials shall be removed from the site and the pavement shall be left in a clean condition.

-- End of Section --

SECTION 02761

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 REFERENCES

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.

FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2003, Rev. 1) Manual on Uniform Traffic Control Devices for Streets and Highways
SHS	(2004) Standard Highway Signs

GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT)

GDOT Specifications	(2001) Standard Specifications, Construction of Transportation Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Paints for roads and streets

Manufacturer's literature showing paint materials that will be provided to meet the specified requirements.

SD-07 Certificates

Volatile Organic Compound, (VOC)

Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

1.3 DELIVERY AND STORAGE

Deliver paints and paint materials in original sealed containers that plainly show the designated name, specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer. Provide storage facilities at the job site, only in areas approved by the Contractor's Quality Control representative for maintaining materials at temperatures recommended by the manufacturer.

1.4 WEATHER LIMITATIONS

Apply paint to clean, dry surfaces, and unless otherwise approved, only when the air and pavement surface temperature is at least 5 degrees above the dew point and the air and pavement temperatures are above 40 degrees F.

1.5 EQUIPMENT

Machines, tools, and equipment used in the performance of the work shall be of suitable capacity and maintained in satisfactory operating condition.

1.5.1 Mobile and Maneuverable

Application equipment shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

1.5.2 Paint Application Equipment

1.5.2.1 Hand-Operated, Push-Type Machines

Provide hand-operated push-type applicator machine of a type commonly used for application of paint to pavement surfaces. Paint applicator machine shall be appropriate for marking small street and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Applicator for water-based markings shall be equipped with non-stick coated hoses; metal parts in contact with the paint material shall be constructed of stainless steel.

1.5.2.2 Self-Propelled or Mobile-Drawn Pneumatic Spraying Machines

Provide self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. Provide machine having a speed during application capable of applying the stripe widths indicated at the paint coverage rate specified herein, with uniform thickness and clear-cut edges. Equipment used shall be capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines, or a combination of solid and intermittent lines using the colors of paint as specified. Provide paint applicator with paint reservoirs or tanks of sufficient capacity and suitable gages to apply paint in accordance with requirements specified. Equip tanks with suitable air-driven mechanical agitators. Equip spray mechanism with quick-action valves conveniently located, and include necessary pressure regulators and gages in full view and reach of the operator. Install paint strainers in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. Provide pneumatic spray guns for hand application of paint in areas where the mobile paint applicator cannot be used. Applicator for water-based markings shall be equipped with non-stick coated hoses; metal parts in contact with the paint material shall be constructed of stainless steel.

1.5.3 Traffic Controls

Suitable warning signs shall be placed near the beginning and well ahead of the work area to alert all approaching traffic when striping operations are in progress. Small markers shall be placed along newly painted lines to control traffic and prevent damage to newly painted surfaces. Painting equipment shall be marked with large warning signs indicating slow-moving

painting equipment in operation.

1.6 MAINTENANCE OF TRAFFIC

When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

PART 2 PRODUCTS

2.1 MATERIALS

Provide materials conforming to the requirements specified herein.

2.1.1 Paints for Roads and Streets

Paint materials for traffic stripes, symbols, text, and parking lot striping shall conform to GDOT Specifications, Section 652.2. The paint colors required shall be as indicated on the drawings.

PART 3 EXECUTION

3.1 GENERAL

Unless otherwise specified herein or indicated on the drawings, pavement marking shall be in accordance with GDOT Specifications, Section 652.

3.2 SURFACE PREPARATION

Allow new pavement surfaces to cure for a period of not less than 30 days before application of marking materials. Thoroughly clean surfaces to be marked before application of the paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required. Remove residual curing compounds and other coatings adhering to the pavement by water blasting or approved chemical removal method. Scrub affected areas, where oil or grease is present on old pavements to be marked, with several applications of trisodium phosphate solution or other approved detergent or degreaser and rinse thoroughly after each application. After cleaning oil-soaked areas, seal with shellac or primer recommended by the manufacturer to prevent bleeding through the new paint. Do not commence painting in any area until pavement surfaces are dry and clean.

3.3 APPLICATION

3.3.1 Testing for Moisture

Apply pavement markings to dry pavement only. The Contractor shall test the pavement surface for moisture before beginning work after each period of rainfall, fog, high humidity, or cleaning, or when the ambient temperature has fallen below the dew point. Do not commence marking until the pavement is sufficiently dry and the pavement condition has been approved by the Contractor's Quality Control representative. Employ the "plastic wrap method" to test the pavement for moisture as follows: Cover the pavement with a 12 inch by 12 inch section of clear plastic wrap and seal the edges with tape. After 15 minutes, examine the plastic wrap for any visible moisture accumulation inside the plastic. Do not begin marking operations until the test can be performed with no visible moisture accumulation inside the plastic wrap.

3.3.2 Rate of Application

Pavement marking paint shall be applied at the rates specified in GDOT Specifications, Section 652.3.05B.

3.3.3 Painting

Apply paint pneumatically with approved equipment at rate of coverage specified herein. Provide guidelines and templates as necessary to control paint application. Take special precautions in marking numbers, letters, and symbols. Manually paint numbers, letters, and symbols. Sharply outline all edges of markings. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. Discontinue painting operations if there is a deficiency in drying of the markings until cause of the slow drying is determined and corrected.

3.3.4 Pavement Striping

Unless otherwise specified herein or indicated on the drawings, pavement striping on access roads shall be 5 inches wide in accordance with GDOT Specifications, Section 652.3.05B. Striping provided in parking lots to define parking stall locations shall be 4 inches wide. All traffic striping provided on access roads shall be laid out in accordance with FHWA MUTCD requirements.

3.3.5 Pavement Symbols

Symbols and text included in the pavement markings shall conform to the patterns, dimensions, and layouts specified in FHWA SHS.

3.4 TRAFFIC CONTROL AND PROTECTION

Protect all pavement markings from vehicle and pedestrian traffic by providing barriers adjacent to the work area as required until the paint has dried.

-- End of Section --

SECTION 02770

CONCRETE SIDEWALKS AND CURBS AND GUTTERS

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM A 185	(2002) Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 615/A 615M	(2005a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 143/C 143M	(2005) Slump of Hydraulic Cement Concrete
ASTM C 172	(2004) Sampling Freshly Mixed Concrete
ASTM C 173/C 173M	(2001e1) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 231	(2004) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 309	(2003) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31/C 31M	(2003a) Making and Curing Concrete Test Specimens in the Field
ASTM C 39/C 39M	(2004a) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94/C 94M	(2004a) Ready-Mixed Concrete
ASTM C 979	(1999) Pigments for Integrally Colored Concrete
ASTM D 1751	(2004) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(2004a) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Concrete Color Pigments
Releasing Agent
Acid Wash
Antiquing Colorant
Sealer

Submit product data for products described herein.

SD-06 Test Reports

Field Quality Control

Copies of all test reports within 24 hours of completion of the test.

SD-07 Certificates

Batch tickets

Copies of batch tickets for all concrete used in the work.

1.3 WEATHER LIMITATIONS

1.3.1 Placing During Cold Weather

Concrete placement shall not take place when the air temperature reaches 40 degrees F and is falling, or is already below that point. Placement may begin when the air temperature reaches 35 degrees F and is rising, or is already above 40 degrees F. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement and protection shall be approved in writing. Approval will be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F. Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.3.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 90 degrees F. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contractor's Quality Control representative shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

1.4.2 Slip Form Equipment

Any slip form paver or curb forming machine used in the work shall be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in 1 pass.

1.4.3 QUALITY ASSURANCE

1.4.3.1 Batch Tickets

Submit mandatory batch ticket information for each load of ready-mixed concrete in accordance with ASTM C 94/C 94M.

PART 2 PRODUCTS

2.1 CONCRETE

Concrete shall conform to the requirements of Section 02752 PORTLAND CEMENT CONCRETE PAVEMENT FOR ROADS AND SITE FACILITIES except as otherwise specified. Concrete shall have a minimum compressive strength of 3000 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches. Colored concrete used in stamped concrete patio shall have specified concrete color pigment added.

2.1.1 Air Content

Mixtures shall have air content by volume of concrete of 3.5 to 7 percent, based on measurements made immediately after discharge from the mixer.

2.1.2 Slump

The concrete slump shall be 3 inches plus or minus 1 inch for hand-placed concrete; 1 inch plus or minus 1/2 inch for slipformed concrete.

2.1.3 Reinforcement Steel

Where indicated on the drawings, reinforcement bars shall conform to ASTM A 615/A 615M. Wire mesh reinforcement shall conform to ASTM A 185.

2.2 CONCRETE CURING MATERIALS

2.2.1 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

2.3 JOINT FILLER STRIPS

2.3.1 Expansion Joint Filler, Premolded

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 1/2 inch thick, unless otherwise indicated.

2.4 JOINT SEALANTS

Joint sealant, cold-applied shall be in accordance with Section 02760 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.

2.5 FORM WORK

Form work shall be designed and constructed to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, and of sufficient strength to resist springing during depositing and consolidating concrete.

2.5.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

2.5.2 Curb and Gutter Forms

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together. In lieu of inside forms for curbs, a curb "mule" may be used for forming and finishing this surface, provided the results are approved.

2.6 STAMPED CONCRETE MATERIALS

2.6.1 Concrete Color Pigments

Provide concrete coloring pigments that meet or exceed ASTM C 979. The pigments shall be pure mineral oxide pigments in a dry power form that deposit in the cement matrix a high intensity color fast pigment. The pigment shall be composed of inorganic pigments of metallic iron oxides, earth oxides, chrome oxides, cobalt oxides, and furnace black as required to produce the desired color. The concrete color pigment shall be LAMBCO COLOR Autumn Brown as manufactured by the Lambert Corporation or approved equal.

2.6.2 Releasing Agent

Provide a liquid concrete releasing agent that forms a moisture barrier between the stamping tool and the wet concrete to facilitate the release of the flexible tool. The releasing agent shall be LIQUID RELEASE as manufactured by Increte Systems, Inc. or approved equal. The releasing

agent shall be clear.

2.6.3 Acid Wash

Provide an acid wash that is composed of 65-75 percent water and 25-35 percent hydrochloric acid. The acid wash shall be CROWN MURIATIC ACID as provided by Packaging Services Co., Inc. or approved equal.

2.6.4 Antiquing Colorant

Provide an antiquing colorant designed to tint grout lines and stamped impressions without affecting the base color of the colored concrete. The antiquing colorant shall be THIN-CRETE ANTIQUING COLORANT as manufactured by Increte Systems, Inc. or approved equal. Color shall be Red Clay.

2.6.5 Sealer

Provide a solvent-based concrete sealer formulated with acrylic resins designed for deep penetration. The sealant shall be resistant to salt spray, acids, alkali, water, ultraviolet rays and wet and dry abrasion. It shall have a very high resistance to traffic. The sealer shall be CLEAR SEAL as manufactured by Increte Systems, Inc. or approved equal.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted in accordance with Section 31 00 00 EARTHWORK.

3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

3.1.2 Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.

3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected to produce a subgrade free from frost when the concrete is deposited.

3.2 FORM SETTING

Forms shall be set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms. Forms shall be removed without damaging the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete

found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that when freezing temperatures are likely, oiling is mandatory.

3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10 foot long section. After forms are set, grade and alignment shall be checked with a 10 foot straightedge. Unless otherwise indicated on the drawings, forms shall incorporate a transverse slope of 1/4 inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

3.2.2 Curbs and Gutters

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms at the back of curb shall remain in place until the face and top of the curb have been finished, as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a strike off.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished with a float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness

will be up to 1/4 inch.

3.3.5 Stamped Concrete

Following the placement of colored concrete for the patio as indicated for sidewalks above, apply the releasing agent after initial concrete set in accordance with manufacturer's recommendations. Using a stamping tool of the approved design, stamp the concrete to provide the desired pattern. After approximately 48 hours, acid wash the surface of the stamped concrete. After approximately an additional 24 hours, apply antiquing colorant to the stamped concrete followed by the clear sealer.

3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

3.4.1 Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators. Curve shaped gutters shall be finished with a standard curb "mule".

3.4.2 Curb and Gutter Finishing

Approved slipformed curb and gutter machines may be used in lieu of hand placement.

3.4.3 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 1/2 inch. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

3.4.4 Joint Finishing

Curb edges at formed joints shall be finished as indicated.

3.4.5 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Unless otherwise indicated on the drawings, transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion

joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.

3.5.1 Sidewalk Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

3.5.2 Sidewalk Expansion Joints

Expansion joints shall be formed with 1/2 inch joint filler strips. Joint filler shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be cleaned and filled with cold-applied joint sealant. Joint sealant shall be gray or stone in color. Joints shall be sealed as specified in Section 02760 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.

3.5.3 Reinforcement Steel Placement

Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

3.5.4 Joints in Stamped Concrete

Both control and expansion joints as described above are to be placed in the stamped concrete patio slabs as indicated on the drawings.

3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

3.6.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet in length. The contraction joints shall be tooled or saw cut across the entire curb and gutter. The depth of the joint shall be at least one-fourth of the gutter/curb depth and 1/8 inch in width.

3.6.2 Expansion Joints

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement, and shall

be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 1/2 inch in width shall be provided at intervals not less than 30 feet nor greater than 120 feet. Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit. Joints shall be sealed as specified in Section 02760 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.

3.7 CURING AND PROTECTION

3.7.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.7.1.1 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. The method of curing compound application and the application rate shall be in accordance with the manufacturer's recommendations.

The curing compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes.

Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from damage caused by pedestrian and vehicular traffic.

3.7.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.7.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and

reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

3.8 FIELD QUALITY CONTROL

3.8.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

3.8.2 Concrete Testing

3.8.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 100 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. A minimum of three cylinders for acceptance shall be molded from each sample in conformance with ASTM C 31/C 31M by an approved testing laboratory. Each cylinder shall be tested at 28 days in accordance with ASTM C 39/C 39M, unless otherwise specified or approved. Concrete will be considered satisfactory if the averages of all sets of three cylinder strength test results equal or exceed the specified strength, and no individual cylinder test result falls below the specified strength by more than 500 psi. Concrete which is determined to be defective, based on the strength acceptance criteria herein, shall be removed and replaced with acceptable concrete at no additional cost.

3.8.2.2 Air Content

Air content shall be determined in accordance with ASTM C 173/C 173M or ASTM C 231. ASTM C 231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

3.8.2.3 Slump Test

Two slump tests shall be made in accordance with ASTM C 143/C 143M on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests shall be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

3.8.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.

3.8.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

3.9 SURFACE DEFICIENCIES AND CORRECTIONS

3.9.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

3.9.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 1/4 inch. Pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

3.9.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

-- End of Section --

SECTION 02810

UNDERGROUND SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1012	(2002) Backflow Preventer with Intermediate Atmospheric Vent
ASSE 1013	(2005) Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C509	(2001) Resilient-Seated Gate Valves for Water Supply Service

ASME INTERNATIONAL (ASME)

ASME B1.2	(1983; R 2001) Gages and Gaging for Unified Inch Screw Threads
ASME B40.100	(2006) Pressure Gauges and Gauge Attachments

ASTM INTERNATIONAL (ASTM)

ASTM D 2241	(2005) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2287	(1996; R 2001) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM D 2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(2004e1) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

ASTM D 2774 (2004e1) Underground Installation of Thermoplastic Pressure Piping

ASTM D 2855 (1996; R 2002) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

ASTM F 441/F 441M (2002) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR Manual (1988e9) Manual of Cross-Connection Control

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80 (2003) Bronze Gate, Globe, Angle and Check Valves

MSS SP-85 (2002) Standard for Cast Iron Globe & Angle Valves, Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (2000; Errata 2002; R 2005; Errata 2006) Standard for Industrial Control and Systems: Controllers, Contractors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC: Part 8 - Disconnect Devices for Use in Industrial Control Equipment

NEMA ICS 6 (2006) Standard for Industrial Controls and Systems Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2005; TIA 2005) National Electrical Code

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201 (1992) Water Hammer Arresters Standard

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Sprinkler System

Detail drawings for valves, sprinkler heads, backflow

preventers, automatic controllers, emitter heads, and water hammer arresters. Drawings shall include a complete list of equipment and materials, and manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed system layout, type and number of heads and emitters, zone valves, drain pockets, backflow devices, controllers, and mounting details of controllers. As-built Drawings which provide current factual information showing locations of mains, heads, valves, and controllers including deviations from and amendments to the drawings and changes in the work shall be included. These drawings shall have dimensions from easily located stationary points (cross measured). The as-built drawings shall be produced in AutoCAD 2004 format. Contractor shall provide two reproducible prints of as-built drawings and the digital AutoCAD files to the Owner at conclusion of project.

SD-03 Product Data

Framed Instructions

Labels, signs, and templates of operating instructions that are required to be mounted or installed on or near the product for normal, safe operation.

Field Training

Information describing training to be provided, training aids to be used, samples of training materials to be provided, and schedules and notification of training.

Sprinkler System

Detailed procedures defining the Contractor's provisions for accident prevention, health protection, and other safety precautions for the work to be done.

Spare Parts

Spare parts data for each different item of material and equipment specified.

Design Analysis and Calculations

Design analyses and pressure calculations verifying that system will provide the irrigation requirements.

SD-06 Test Reports

Field Tests

Performance test reports, in booklet form, showing all field tests performed to adjust each component; and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of control

valves.

SD-07 Certificates

Sprinkler System

The material supplier's or equipment manufacturer's statement that the supplied material or equipment meets specified requirements. Each certificate shall be signed by an official authorized to certify in behalf of material supplier or product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply.

SD-10 Operation and Maintenance Data

Sprinkler System

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set prior to field testing and the remainder upon acceptance. Manuals shall be approved prior to the field training course. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule.

1.3 PERFORMANCE REQUIREMENTS

System shall operate with a minimum water pressure of 75 psi at connection to meter and 30 psi minimum at the last spray head in each zone and 50 psi minimum at the last rotor head in each rotor zone. The Contractor shall submit Design Analysis and Calculations as specified in the Submittals paragraph.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be protected from the weather; excessive humidity and temperature variation; direct sunlight (in the case of plastic or rubber materials); and dirt, dust, or other contaminants. Pipe to be stored neatly and orderly. All piping shall be set gently in place, not dropped.

1.5 FIELD MEASUREMENTS

The Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 SPARE PARTS

The Contractor shall submit spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than the start of the field tests. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer who has produced similar systems which have performed well for a minimum period of 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.2 Nameplates

Each item of equipment, excluding heads, shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.1.3 Extra Stock

The following extra stock shall be provided: Two sprinkler heads of each size and type, two valve keys for operating manual valves, two wrenches for removing and installing each type of head, two quick coupler keys and hose swivels, and four irrigation controller housing keys.

2.2 PIPING MATERIALS

2.2.1 Polyvinyl Chloride (PVC) Pipe, Fittings and Solvent Cement

2.2.1.1 PVC Pipe

Pipe shall conform to the requirements of ASTM D 2241, PVC 1120 SDR 21, Class 200.

2.2.1.2 PVC Fittings

Solvent welded socket type fittings shall conform to requirements of ASTM D 2466, Schedule 40. Threaded type fittings shall conform to requirements of ASTM D 2464, Schedule 80.

2.2.1.3 Solvent Cement

Solvent cement shall conform to the requirements of ASTM D 2564.

2.2.2 Dielectric Fittings

Dielectric fittings shall conform to ASTM F 441/F 441M, Schedule 80, CPVC threaded pipe nipples, 4 inch minimum length.

2.2.3 Emitter Hose and Distribution Tubing

Emitter hose and distribution tubing shall conform to ASTM D 2287, maximum inside diameter of 1/2 inch, minimum wall thickness of 90 mils, vinyl plastic extruded from non-rigid chloride, integrally algae-resistant, homogeneous throughout, smooth inside and outside, free from foreign materials, cracks, serrations, blisters and other effects. Slip fittings shall be provided.

2.3 SPRINKLER AND EMITTER HEADS

2.3.1 Pop-Up Spray Heads

2.3.1.1 General Requirements

Pop-up spray heads lay flush with housing, then pop up when water pressure 3 0 psi is activated in system. The rising member supporting the nozzle shall be identical on full, half, third or quarter pattern sprinklers so that nozzles will be interchangeable. The sprinkler head shall be designed to be adjustable for coverage and flow. The nozzle shall be removable so head does not have to be removed for flushing or cleaning. Nozzle rises a minimum of 4 inches above the body. The body shall be constructed with a 1/2 inch female thread for installation in a fixed underground pipe system.

2.3.1.2 Shrubbery Sprinkler Heads

Sprinkler heads shall be conical spray with adjustable or non-adjustable coverage and designed for permanent aboveground mounting on riser or pop-ups at a height compatible with ground covers, typically 12 inches.

2.3.2 Rotary Pop-Up Sprinklers

Sprinklers shall be capable of covering 30-40 feet diameter at 40-50 psi with a distribution rate of .85-6.8 gpm, 5 inches pop-up, trajectory of 24-27 degrees. Construction shall be high impact molded plastic with filter screen, reducible watering radius, and choice of eight nozzles and have adjustable radius capabilities.

2.3.3 Bubbler Sprinkler Heads

Heads shall be multiple-spray bubbler with adjustable flow and designed for permanent aboveground mounting on risers.

2.3.4 Emitter Heads

Emitter heads shall be self-cleaning, pressure compensating diaphragm with one or six self-piercing barbed outlets; each capable of emitting from 1/4 to 2 gallons/hour flow. Emitter body shall be ultraviolet stabilized, algae, and heat resistant plastic construction.

2.4 VALVES

2.4.1 Gate Valves, Less than 3 Inches

Gate valves shall conform to the requirements of MSS SP-80, Type 1, Class 150, threaded ends.

2.4.2 Gate Valves, 3 Inches and Larger

Gate valves shall conform to the requirements of AWWA C509 and have encapsulated resilient wedge, parallel seats, non-rising stems, and open by counterclockwise turning. End connections shall be flanged. Interior construction of valves shall be bronze including stem containing a maximum 2 percent aluminum and maximum 16 percent zinc.

2.4.3 Angle Valves, Less Than 2-1/2 Inches

Angle valves shall conform to the requirements of MSS SP-80, Type 3, Class

150 threaded ends.

2.4.4 Angle Valves, 2-1/2 Inches and Larger

Angle valves shall conform to the requirements of MSS SP-85, Type II, Class 250 flanged ends.

2.4.5 Quick Coupling Valves

Quick coupling valves shall have brass parts and shall be two-piece unit consisting of a coupler water seal valve assembly and a removable upper body to allow spring and key track to be serviced without shutdown of main. Lids shall be lockable vinyl with spring for positive closure on key removal.

2.4.6 Remote Control Valves, Electrical

Remote control valves shall be solenoid actuated globe valves of 3/4 to 3 inch size, suitable for 24 volts, 60 cycle, and designed to provide for shut-off in event of power failure. Valve shall be cast bronze or brass or plastic housing suitable for service at 200 psi operating pressure with external flow control adjustment for shut-off capability, external plug at diaphragm chamber to enable manual operation, filter in control chamber to prevent valve body clogging with debris, durable diaphragm, and accessibility to internal parts without removing valve from system.

2.4.7 Drain Valves

2.4.7.1 Manual Valves

Manual valves shall conform to requirements of MSS SP-80, Type 3, Class 150 threaded ends for sizes less than 2-1/2 inches and MSS SP-85, Type II, Class 250 flanged ends for sizes 2-1/2 inches and larger.

2.4.8 Pressure Regulating Master Valve

Pressure regulating master valve shall be automatic mechanical self-cleaning, self-purging control system having an adjustable pressure setting operated by a solenoid on alternating current with 0.70 amperes at 24 volts. Valve shall close slowly and be free of chatter in each diaphragm position, have manual flow stem to adjust closing speed and internal flushing, and [one] [two] inlet tappings capable of being installed as a straight pattern valve. Body shall be cast bronze or brass with removable brass seat serviceable from top without removing valve body from system. Valve shall operate at 150 psi working pressure and pilot range from 10 to 125 psi.

2.4.9 Backflow Preventers

Reduced pressure principle assemblies and double check valve assemblies, shall be tested, approved, and listed in accordance with FCCCHR Manual. Backflow preventers with intermediate atmospheric vent shall be in accordance with ASSE 1012. Reduced pressure principle backflow preventers shall be in accordance with ASSE 1013.

2.4.9.1 Reduced Pressure Type Backflow Preventers

Backflow preventers shall be 150 pound flanged cast iron or bronze mounted gate valve and strainer, 304 stainless steel or bronze, internal parts.

Total pressure drop through complete assembly shall be a maximum of 7.5psi at rated flow. Piping shall be galvanized steel pipe and fittings. Strainers shall be bronze or brass construction with gasket caps. Units shall have 200-mesh stainless steel screen elements.

2.5 ACCESSORIES AND APPURTENANCES

2.5.1 Valve Keys for Manually Operated Valves

Valve keys shall be 1/2 inch diameter by 3 feet long, tee handles and keyed to fit valves.

2.5.2 Valve Boxes and Concrete Pads

2.5.2.1 Valve Boxes

Valve boxes shall be plastic lockable, for each gate valve, manual control valve and remote control valve. Box sizes shall be adjustable for valve used, refer to details. Word "IRRIGATION" shall be cast on cover. Shaft diameter of box shall be minimum 5-1/4 inches. Cast iron box shall have bituminous coating.

2.5.2.2 Concrete Pads

Concrete pads shall be for reduced pressure type backflow preventers.

2.5.3 Pressure Gauges

Pressure gauges shall conform to requirements of ASME B40.100, single style pressure gauge for water with 4-1/2 inch dial brass or aluminum case, bronze tube, gauge cock, pressure snubber, and siphon. Scale range shall be suitable for irrigation sprinkler systems.

2.5.4 Service Clamps

Service clamps shall be bronze flat, double strap, with neoprene gasket or "O"-ring seal.

2.5.5 Water Hammer Arresters

Water hammer arrester shall conform to the requirements of PDI WH 201; stainless steel construction with an encased and sealed bellows compression chamber.

2.5.6 Emitter Head Accessories

2.5.6.1 Strainer

Strainer shall be provided at inlet to each drip line. Strainer shall have stainless steel screen having equivalent of 140-mesh filtration capacity and incorporate flush valves within strainer to clean screen without disassembling unit.

2.5.6.2 Pressure Regulator

Pressure regulator shall be provided at each drip system if supply pressure exceeds 50 psi.

2.5.6.3 Riser Adapters

Riser adapters shall be provided with a rigid piping system.

2.5.6.4 Tubing Stakes

Tubing stakes shall be plastic coated steel, or other non-corrosive strong material to secure tubing.

2.5.6.5 Emitter Outlet Check Valve (Bug Cap)

Check valves shall be provided at end of each emitter outlet distribution line. Valves shall permit free flow of water with minimum restriction; prevent back siphoning, entry of insects, and contamination into outlet ports.

2.5.6.6 Access Sleeve

Access sleeve shall be provided at buried emitters placed in covered boxes. Lids of access sleeve shall be secured with removable lugs. Drip hose in both vertical and horizontal axis shall be secured.

2.5.6.7 Closure Caps

Closure caps shall be in accordance with manufacturer's recommendations.

2.6 AUTOMATIC CONTROLLERS, ELECTRICAL

Controller shall conform to the requirements of NEMA ICS 2 with 120-volt single phase service, operating with indicated stations, and grounded chassis. Enclosure shall conform to NEMA ICS 6 Type 3R, with locking hinged cover, [pedestal-mounted] [wall-mounted]. Controller shall be programmed for various schedules by setting switches and dials equipped with the following features: A switch for each day of week for two schedules, allowing each station to be scheduled individually as to days of watering; a minute switch for each station with a positive increment range of 0 to 3 hours, set time within one percent; a switch allowing selected schedules to be repeated after each completion of initial watering schedule and allowing each operation to be scheduled throughout a 24-hour day; a circuit breaker for surge protection; and circuit for a 9-volt rechargeable NiCad battery.

2.7 ELECTRICAL WORK

Wiring and rigid conduit for electrical power shall be in accordance with NFPA 70, and Section 16302 UNDERGROUND ELECTRICAL DISTRIBUTION .

2.8 CONCRETE MATERIALS

Concrete shall have a compressive strength of 2500 psi at 28 days as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.9 WATER SUPPLY MAIN MATERIALS

Tapping sleeves, service cut off valves, and connections to water supply mains shall be in accordance with Section 02510 WATER DISTRIBUTION.

2.10 INSULATING JOINTS

Insulating joints and dielectric fittings shall be in accordance with Section 02510 WATER DISTRIBUTION.

PART 3 EXECUTION

3.1 INSTALLATION

Sprinkler system shall be installed after site grading has been completed. Excavation, trenching, and backfilling for sprinkler system shall be in accordance with the applicable provisions of Section 02300 EARTHWORK, except as modified herein.

3.1.1 Trenching

Trench around roots shall be hand excavated to pipe grade when roots of 2 inches diameter or greater are encountered. Trench width shall be 4 inches minimum or 1.5 times diameter of pipe, whichever is wider. Backfill shall be hand tamped over excavation. When rock is encountered, trench shall be excavated 4 inches deeper and backfilled with silty sand (SM) or well-graded sand (SW) to pipe grade. Trenches shall be kept free of obstructions and debris that would damage pipe. Subsoil shall not be mixed with topsoil. Existing concrete walks, drives and other obstacles shall be bored at a depth conforming to bottom of adjacent trenches. Pipe sleeves for bored pipe shall be two pipe diameters larger than cumulativesprinkler pipe. The top 12 inches of backfill shall be topsoil, free of rocks, subsoil, or trash. Any open trenches or partially-backfilled trenches left overnight or left unsupervised shall be barricaded to prevent undue hazard to the public. The Contractor shall backfill in 6 inch compacted lifts, as needed to bring the soil to its original density. In the Spring, following the year of installation, the Contractor shall repair any settlement of the trenches by bringing them to grade with topsoil, and seeding with the existing lawn type(s). Watering and maintenance of the repaired areas shall be the Owner's responsibility.

3.1.2 Piping System

3.1.2.1 Cover

Underground piping shall be installed to meet the minimum depth of backfill cover specified.

3.1.2.2 Clearances

Minimum horizontal clearances between lines shall be 4 inches for pipe 2 inches and less; 12 inches for 2-1/2 inches and larger. Minimum vertical clearances between lines shall be 1 inch.

3.1.2.3 Minimum Slope

Minimum slope shall be 6 inches per 100 feet in direction of drain valves.

3.1.3 Piping Installation

3.1.3.1 Polyvinyl Chloride (PVC) Pipe

a. Solvent-cemented joints shall conform to the requirements of ASTM D 2855.

b. Threaded joints shall be full cut with a maximum of three threads remaining exposed on pipe and nipples. Threaded joints shall be made tight without recourse to wicks or fillers, other than polytetrafluoroethylene thread tape.

c. Piping shall be joined to conform with requirements of ASTM D 2774 or ASTM D 2855, and pipe manufacturer's instructions. Pipe shall be installed in a serpentine (snaked) manner to allow for expansion and contraction in trench before backfilling. Pipes shall be installed at temperatures over 40 degrees F.

d. The joints shall be allowed to set at least 24 hours before pressure is applied to the system on PVC pipe.

3.1.3.2 Threaded Brass or Galvanized Steel Pipe

Prior to installation, pipe shall be reamed. Threads shall be cut in conformance with ASME B1.2. Pipe joint compound shall be applied to male end only.

3.1.3.3 Insulating Joints

Insulating and dielectric fittings shall be provided where pipes of dissimilar metal are joined and at connections to water supply mains as shown. Installation shall be in accordance with Section 02510 WATER DISTRIBUTION.

3.1.3.4 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimentions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Grove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with the coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

3.1.4 Installation of Valves

3.1.4.1 Manual Valves

Valves shall be installed in a valve box extending from grade to below valve body, with a minimum of 4 inches cover measured from finish grade to top of valve stem.

3.1.4.2 Automatic Valves

Valve shall be set plumb in a valve box extending from grade to below valve body, with minimum of 4 inch cover measured from grade to top of valve. Automatic valves shall be installed beside sprinkler heads with a valve box.

3.1.4.3 Drain Valves

Entire system shall be manually or automatically drainable. Low points of

system shall be equipped with drain valve draining into an excavation containing 1 cubic foot gravel. Gravel shall be covered with building paper then backfilled with excavated material and 6 inches of topsoil.

3.1.5 Sprinklers and Quick Coupling Valves

Sprinklers and valves shall be installed plumb and level with terrain.

3.1.6 Installation of Drip Irrigation System

3.1.6.1 Emitter Hose

Emitter laterals shall be buried 4 inches deep with mulch cover. Connections shall be solvent welded in accordance with manufacturer's recommendation to standard weight Schedule 40 PVC fittings and bushings. Hose shall be installed in a serpentine manner. When cutting hose, shearing tool such as a pipe cutter, knife, or shears shall be used. Manufacturer's recommended tool and procedures when punching hose for emitters shall be followed.

3.1.6.2 Emitter Heads

Emitters shall be installed in a plastic emitter box. Emitter on a rigid PVC nipple shall be connected to PVC drip lateral with a tee or elbow. Tubing shall be attached to barbed fitting and daylight distribution tubing at root ball secured with stake, with bug cap at end of secured distribution tubing. After installing emitters and before operating system, end of drip lateral shall be opened and flushed clean. The number of emitters on a line shall not exceed manufacturer's recommendations for that hose or distribution tubing size and length.

3.1.6.3 Tubing Stakes

Main irrigation line shall be secured with stakes where line is aboveground. Stakes shall be spaced to ensure that hose does not shift location in presence of foot traffic, operations, gravity on slope installations, or environmental effects. Discharge of the emitter distribution tubing shall be staked to ensure that discharge point of emitter will be maintained at specified position in relation to plant material to be irrigated.

3.1.7 Backflow Preventers

Backflow preventer shall be installed in new connection to existing water distribution system, between connection and control valves. Backflow preventer shall be installed with concrete pads.

3.1.7.1 Reduced Pressure Type

Pipe lines shall be flushed prior to installing reduced pressure device; device shall be protected by a strainer located upstream. Device shall not be installed in pits or where any part of device could become submerged in standing water.

3.1.8 Control Wire and Conduit

3.1.8.1 Wires

Low voltage wires may be buried beside pipe in same trench. Rigid conduit

shall be provided where wires run under paving. Wires shall be number tagged at key locations along main to facilitate service. One control circuit shall be provided for each zone and a circuit to control sprinkler system.

3.1.8.2 Loops

A 24 inch loop of wire shall be provided at each valve where controls are connected.

3.1.8.3 Expansion and Contraction

Multiple tubes or wires shall be bundled and taped together at 20 foot intervals with 24 inch loop for expansion and contraction.

3.1.8.4 Splices

Electrical splices shall be waterproof.

3.1.9 Automatic Controller

Exact field location of controllers shall be determined before installation. Coordinate the electrical service to these locations. Install in accordance with manufacturer's recommendations and NFPA 70.

3.1.10 Thrust Blocks

Concrete shall be placed so that sides subject to thrust or load are against undisturbed earth, and valves and fittings are serviceable after concrete has set. Thrust blocks shall be as specified in Section 02510 WATER DISTRIBUTION.

3.1.11 Backfill

3.1.11.1 Minimum Cover

Depth of cover shall be 18 inches for mainline piping; 12 inches for laterial line piping; 24 inches for pipes under traffic loads; and 12 inches for low-voltage wires. Remainder of trench or pipe cover shall be filled to within 3 inches of top with excavated soil, and compact soil with plate hand-held compactors to same density as undisturbed adjacent soil.

3.1.11.2 Restoration

Top 3 inches shall be filled with topsoil and compacted with same density as surrounding soil. Lawns and plants shall be restored in accordance with Sections 02921 SEEDING, 02922 SODDING, and Section 02930 EXTERIOR PLANTS.

3.1.12 Adjustment

After grading, seeding, and rolling of planted areas, sprinkler heads shall be adjusted flush with finished grade. Adjustments shall be made by providing new nipples of proper length or by use of heads having an approved device, integral with head, which will permit adjustment in height of head without changing piping.

3.1.13 Disinfection

Sprinkler system fed from a potable water system shall be disinfected

upstream of backflow preventer in accordance with Section 02511 WATER DISTRIBUTION.

3.1.14 Cleaning of Piping

Prior to the hydrostatic and operation tests, the interior of the pipe shall be flushed with clean water until pipe is free of all foreign materials. Flushing and cleaning out of system pipe, valves, and components shall not be considered completed until witnessed and accepted by Contracting Officer.

3.2 FIELD TESTS

All instruments, equipment, facilities, and labor required to conduct the tests shall be provided by Contractor.

3.2.1 Hydrostatic Pressure Test

Piping shall be tested hydrostatically before backfilling and proved tight at a hydrostatic pressure of 150 psi without pumping for a period of one hour with an allowable maximum pressure drop of 5 psi. If hydrostatic pressure cannot be held for a minimum of 4 hours, Contractor shall make adjustments or replacements and the tests repeated until satisfactory results are achieved and accepted by the Contracting Officer.

3.2.2 Leakage Tests

Leakage tests for service main shall be in accordance with Section 02511 WATER DISTRIBUTION.

3.2.3 Operation Test

At conclusion of pressure test, sprinkler heads or emitter heads, quick coupling assemblies, and hose valves shall be installed and entire system tested for operation under normal operating pressure. Operation test consists of the system operating through at least one complete programmed cycle for all areas to be sprinkled.

3.3 FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system. After as-built drawings are approved by Contracting Officer, controller charts and programming schedule shall be prepared. One chart for each controller shall be supplied. Chart shall be a reduced drawing of actual as-built system that will fit the maximum dimensions inside controller housing. Black line print for chart and a different pastel or transparent color shall indicate each station area of coverage. After chart is completed and approved for final acceptance, chart shall be sealed between two 20 mil pieces of clear plastic.

3.4 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the

items contained in the operating and maintenance manuals.

3.5 CLEANUP

Upon completion of installation of system, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

SECTION 02821

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C 94	(1994) Ready-Mixed Concrete
ASTM F 883	(2004) Padlocks

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-F-191	(Rev K) Fencing, Wire and Post Metal (and Gates, Chain-Link Fence Fabric, and Accessories)
FS RR-F-191/1	(Rev D) Fencing, Wire and Post, Metal (Chain-Link Fence Fabric)
FS RR-F-191/3	(Rev D) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)
FS RR-F-191/4	(Rev D) Fencing, Wire and Post, Metal (Chain-Link Fence Accessories)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Gates

Post spacing

Location of gate, corner, end, and pull posts

SD-03 Product Data

Chain-link fencing components

Accessories

SD-06 Test Reports

Weight in grams ounces for zinc coating

SD-07 Certificates

Fabric

Posts

Braces

Framing

Rails

Tension wires

Gates

Padlocks

SD-08 Manufacturer's Instructions

Fence

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

1.4 QUALITY ASSURANCE

1.4.1 Required Report Data

Submit reports of listing of chain-link fencing and accessories regarding Weight in grams ounces for zinc coating.

PART 2 PRODUCTS

2.1 CHAIN-LINK FENCING AND ACCESSORIES

FS RR-F-191 and detailed specifications as referenced and other requirements as specified.

2.1.1 Fabric

FS RR-F-191/1; Type I, zinc-coated steel, 9 gage. Mesh size, 2 inches. Provide selvage knuckled on bottom selvage and twisted and barbed on the top selvage. Height of fabric, as indicated.

2.1.2 Gates

Gates shall be as indicated on the drawings. Shape and size of gate frame, as indicated. Framing and bracing members, round or square of steel alloy. Steel member finish, zinc-coated. Gate fabric, as specified for fencing fabric. Barbed wire top on gate, as specified herein. Coating for steel latches, stops, hinges, keepers, and accessories, galvanized. Gate latches, fork type. Special gate frames, as indicated. Gate leaves more than 8 feet wide shall have intermediate members as necessary to provide rigid construction, free from sag or twist. Attach gate fabric to gate

frame as indicated. Arrange padlocking latches to be accessible from both sides of gate, regardless of latching arrangement.

2.1.3 Posts , Bottom Rails and Braces

FS RR-F-191/3 line posts; Class 1, steel pipe, Grade A. End, corner, and pull posts; Class 1, steel pipe, Grade A. Braces and rails; Class 1, steel pipe, Grade A, in size as indicated.

2.1.4 Fencing Accessories

FS RR-F-191/4. Provide wire ties as indicated.

2.1.5 Concrete

ASTM C 94, using 3/4 inch maximum-size aggregate, and having minimum compressive strength of 3000 psi at 28 days.

2.1.6 Padlocks

ASTM F 883, Type EPB, Size 1-3/4 inch.

PART 3 EXECUTION

3.1 SITE PREPARATION

3.1.1 Clearing and Grading

Clear fence line of trees, brush, and other obstacles to install fencing. Establish a graded, compacted fence line prior to fencing installation. Compact fill used to establish fence line.

3.1.2 Excavation

Excavate to dimensions indicated for concrete-embedded items. Clear post holes of loose material. Dispose of waste material.

3.2 FENCE INSTALLATION

Install fence on prepared surfaces to line and grade indicated. Secure fastening and hinge hardware in place to fence framework by peening or welding. Allow for proper operation of components. Coat peened or welded areas with a repair coating matching original coating. Install fence in accordance with fence manufacturer's written installation instructions except as modified herein.

3.2.1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 10 feet on center. Provide gate posts spaced as necessary for size of gate openings. Do not exceed 500 feet on straight runs between braced posts. Provide corner or pull posts, with bracing in both directions, for changes in direction of 15 degrees or more, or for abrupt changes in grade. Provide drawings showing location of gate, corner, end, and pull posts.

3.2.2 Post Setting

Set posts plumb. Allow concrete to cure a minimum of 72 hours before performing other work on posts.

3.2.2.1 Earth

Provide concrete bases of dimensions indicated. Compact concrete to eliminate voids, and finish to a dome shape.

3.2.3 Bracing

Brace gate, corner, end, and pull posts to nearest post with a horizontal brace used as a compression member, placed at least 12 inches below top of fence, and a diagonal truss rod and truss tightener used as a tension member.

3.2.4 Bottom Rails

Install bottom rails before installing chain-link fabric. Provide expansion coupling spaced as indicated. bottom rail shall be installed as indicated on the drawings. Bolts shall be peened to prevent easy removal.

3.2.5 Top Tension Wires

Install top tension wires before installing chain-link fabric, and pull wires taut. Place top tension wires within 4 inches of respective fabric line. Tension wires shall be installed as indicated and attached to terminal posts of each stretch of fence.

3.2.6 Fabric

Pull fabric taut and secure fabric to bottom rail and top wire, close to both sides of each post and at maximum intervals of 24 inches on center. Secure fabric to posts using ties spaced 12 inches on center. Install fabric on opposite side of posts from area being secured. Install fabric so that bottom of fabric is 1 inch maximumabove ground level. Install fence fabric to provide approximately 2 inch deflection at center of fabric span between two posts, when a force of approximately 30 pounds is applied perpendicular to fabric. Fabric should return to its original position when force is removed.

3.3 ACCESSORIES INSTALLATION

3.3.1 Post Caps

Install post caps as indicated.

3.3.2 Supporting Arms

Design supporting arms to accommodate top rail. Install supporting arms as recommended by manufacturer. In addition to manufacturer's standard connections, permanently secure supporting arms to posts. Studs driven by low-velocity powder-actuated tools may be used with steel or wrought iron.

3.3.3 Barbed Wire

Install barbed wire on supporting arms above fence posts. Extend each end member of gate frames sufficiently above top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence. Pull each strand taut and securely fasten each strand to each supporting arm or extended member. Secure wires in accordance with fence manufacturer's recommendations.

3.3.4 Gates

Install swing gates to swing through 90 degrees from closed to open. Gate shall be installed at the locations shown. Latches and keepers shall be installed as required.

3.3.5 Padlocks

Provide padlocks for gate openings. Provide padlocks keyed alike, and provide two keys for each padlock.

3.4 GROUNDING

Ground fencing as indicated.

3.5 SECURITY

Install new security fencing, where indicated, and perform related work to provide continuous security for facility. Schedule and fully coordinate work with Contractor's Quality Control Representative and cognizant Security Officer.

3.6 STANDARD CHAIN LINK FENCING

Install standard chain link fencing, where indicated, and perform related work to provide continuous protection for facility. Schedule and fully coordinate work with the Contractor's Quality Control Representative.

3.7 CLEANUP

Remove waste fencing materials and other debris from the project site.

-- End of Section --

SECTION 02840

ACTIVE VEHICLE BARRIERS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2006) Structural Welding Code - Steel

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G
Equipment; G
Electrical Work; G

Detail drawings containing complete wiring and schematic diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including foundation and clearances for maintenance and operation. Detail drawings shall include a copy of the Department of State certificate of barrier performance.

SD-03 Product Data

Vehicle Barriers; G

A complete list of equipment, materials, including industrial standards used and how they apply to the applicable component and manufacturer's descriptive data and technical literature, catalog cuts, and installation instructions. Information necessary to document a minimum 1-year successful field operation performance history for each type of vehicle barrier installed.

Spare Parts

Spare parts data for each different item of material and equipment used, after approval of the detail drawings. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-06 Test Reports

Field Testing; G

Test reports in booklet form showing all field tests, including component adjustments and demonstration of compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-10 Operation and Maintenance Data

Vehicle Barriers; G
Operating and Maintenance Instructions

Data Package 4 in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

Six copies of operation and maintenance manuals, a minimum of 2 weeks prior to field training. One complete set prior to performance testing and the remainder upon acceptance. Manuals shall be approved prior to acceptance. Operation manuals shall outline the step-by-step procedures required for system startup, operation, and shutdown. The manuals shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall include routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include piping layout, equipment layout, and simplified wiring and control diagrams of the system as installed. The manuals shall also include synthetic biodegradable hydraulic oil types to be used for ambient temperature ranges of minus 30 degrees F to 150 degrees F to cover winter operation, summer operation, and ambient temperature ranges in between.

1.3 GENERAL REQUIREMENTS

Vehicle Barriers furnished shall in all respects be identical to the unit tested and certified. Vehicle barriers shall be crash rated. Crash ratings shall be certified by the Department of State (DOS), as indicated. Crash test shall be performed and data compiled by an approved independent testing agency. Test vehicle shall not vault or penetrate the barrier during the test. The design and structural materials of the vehicle barrier furnished shall be the same as those used in the crash tested barrier.

1.4 NAMEPLATES

Nameplate data shall be permanently attached to each vehicle barrier. The data shall be legibly marked on corrosion-resistant metal plates and shall consist of at least the following:

a. Manufacturer's name.

b. Model number.

c. Serial number.

d. Date of manufacture.

1.5 DELIVERY AND STORAGE

Components placed in storage shall be protected from the weather, humidity, and temperature variation, dirt and dust, or other contaminants. Structural materials shall be stored on sleepers or pallets and shall be protected from rust and objectionable materials such as dirt, grease, or oil.

1.6 SPARE PARTS

A manufacturer's standard recommended spare parts list, with current unit prices and source of supply complete with detailed manuals on parts replacement, shall be provided with each barrier. Particular consideration shall be given to system components which are not readily available from local or commercial sources and which are critical to the operation of the system.

1.7 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment supplied shall be available. The representative shall supervise the installation, adjustment, and testing of the equipment.

PART 2 PRODUCTS

2.1 VEHICLE BARRIERS

Vehicle beam, bollards, and wedge barriers furnished shall in all respects be identical to the unit tested and certified. Vehicle beam, bollards, and wedge barriers shall be crash rated by DOS. Vehicle beam, bollards, and wedge barriers shall be the make and model, as indicated on the drawings.

2.2 ELECTRICAL WORK

Motors, manual or automatic motor control equipment except where installed in motor control centers and protective or signal devices required for the operation specified herein shall be provided in accordance with Section 16402 INTERIOR DISTRIBUTION SYSTEM. Communication lines, and power circuits shall have surge protection. Any wiring required for the operation specified herein, but not shown on the electrical plans, shall be provided under this section in accordance with Sections 16402 INTERIOR DISTRIBUTION SYSTEM and 16302 UNDERGROUND ELECTRICAL DISTRIBUTION SYSTEM.

2.3 CONTROL PANEL

A control panel and control circuit shall be provided to interface between all barrier control stations and the power unit. A control panel shall be provided for the inbound lanes and a separate one for the outbound lanes where the barriers are located. The control station is defined as the main control panel and the remote control panel as shown. The control circuit shall contain all relays, timers, and other devices or an industrial programmable controller programmed as necessary for the barrier operation. The control panel shall allow direct interface with auxiliary equipment such as card readers, remote switches, infrared sensors, and sliding gate limit switches. The enclosure shall be NEMA 4. All device interconnect lines shall be run to terminal strips.

2.3.1 Voltage

The control circuit shall operate from a 120 volt 60 Hz supply. The control circuit voltage shall be 24dc for all external control panels.

2.3.2 Main Control Panel

A main control panel shall be supplied to control barrier function. This panel shall have a key-lockable main switch with main power "ON" and panel "ON" lights. Buttons to raise and lower each barrier shall be provided. Barrier "UP" and "DOWN" indicator lights shall be included for each barrier. An emergency fast operate circuit (EFO) shall be operated for only the hydraulic wedge barrier from a push button larger than the normal controls and have a flip safety cover installed over the push button or toggle switch. The EFO shall also be furnished with an EFO-active light and reset button. The main control panel shall have a key lockable switch to arm or disable the remote control panel. An indicator light shall show if the remote control panel is enabled.

2.3.3 Remote Control Panel

A remote control panel, one panel for the inbound lane(s) and a separate panel for the outbound lane(s), shall have a panel "ON" light that is lit when enabled by a key lockable switch on the main control panel. Buttons to raise and lower each barrier shall be provided. Barrier "UP" and "DOWN" indicator lights shall be included for each barrier. The EFO shall be operated from a push button larger than the normal controls and have a flip safety cover installed over the push button or toggle switch. Activation of either EFO will operate all barriers. The EFO shall be interconnected with an EFO-active light. When the remote control panel EFO is pushed, operation of the barrier will not be possible from this panel until reset at the main control panel.

2.4 MISCELLANEOUS EQUIPMENT

2.5 CONCRETE

The concrete shall conform to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.6 WELDING

Welding shall be in accordance with AWS D1.1/D1.1M.

2.7 PAVEMENT

After placement of the vehicle barrier, the pavement sections shall be replaced to match the section and depth of the surrounding pavement. Pavement shall be warped to match the elevations of existing pavement. Positive surface drainage, away from the vehicle barrier, shall be provided by pavement slope.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with manufacturers instructions and in the presence of a representative of the manufacturer. Manufacturer's representative shall be experienced in the installation, adjustment, and

operation of the equipment provided. The representative shall also be present during adjustment and testing of the equipment.

3.2 FIELD TESTING

Upon completion of construction, a field test shall be performed for each vehicle barrier. The test shall include raising and lowering the barrier, both electrically and manually, through its complete range of operation. Each vehicle barrier shall then be continuously cycled for not less than 30 minutes to test for heat build-up in the hydraulic system. The Owner's Security Officer shall be notified at least 7 days prior to the beginning of the field test. The Contractor shall furnish all equipment and make all necessary corrections and adjustments prior to tests witnessed by the Owner's Security Officer. Any conditions that interfere with the proper operation of the barrier disclosed by the test shall be corrected at no additional cost to the Government. Adjustments and repairs shall be done by the Contractor under the direction of the Owner's Security Officer. After adjustments are made to assure correct functioning of components, applicable tests shall be completed.

3.3 FIELD TRAINING

A field training course shall be provided for designated operating staff members. Training shall be provided for a total period of not less than 8 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance instructions.

-- End of Section --

SECTION 02921

SEEDING

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C 602	(1995a; R 2001) Agricultural Liming Materials
ASTM D 4427	(1992; R 2002e1) Peat Samples by Laboratory Testing
ASTM D 4972	(2001) pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act
DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 02300 EARTHWORK, Section 02810 UNDERGROUND SPRINKLER SYSTEMS, Section 02922 SODDING, Section 02930 EXTERIOR PLANTS, and Section 02935 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fertilizer for Turf Areas

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

SD-07 Certificates

State certification and approval for seed

SD-08 Manufacturer's Instructions

Erosion Control Materials

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer, Gypsum, Sulfur, Iron, and Lime Delivery

Deliver in volumes as determined by laboratory soil analysis of the soils at the job site to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws.

1.5.2 Storage

1.5.2.1 Seed, Fertilizer, Gypsum, Sulfur, Iron, and Lime Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classifications

2.1.1.1 Turf Seed

Provide Endophyte-enhanced seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected.

2.1.1.2 Native Seed Mix

Seed for native seed mix will be harvested from a donor site that was prepared by a late spring-early summer burning and will be seeded onto the prepared recipient site. Arrangements for a donor site will be made early enough so that it can have a growing season burn to encourage seed production by wiregrass and other associated species. The donor site will have a healthy and diverse grass, sedge, and wildflower component.

Several visits will be made to the donor site before and during mechanical harvesting begins to hand collect species that ripen earlier and/or are shorter than the harvesting level. Some wet prairie species may be added to supplement seeding on wet edges. All hand collected seed will be kept dried and/or stored until site seeding begins.

Mechanical harvesting will be done with a green silage cutter with 14 foot to 17 foot cutting blades. The harvester will cut material at heights to get a maximum of seed with as little chaff as possible. The material is then collected by screw, slightly chopped, and blown into the attached wagon. when the wagon is full, it is disconnected from the harvester and attached to a truck cab for transport to the seeding site. Another wagon is attached to the harvester for continuous operation. On an open site about 24 acres can be harvested per day.

Prior to seeding, all hand collected seed is weighed, and measured out into bag lots to accommodate one load each of seeding mix which covers approximately one acre. Each bag lot will be formulated to include species that are appropriate for a specific wetness zone.

2.1.2 Turf Planting Dates

Planting Season	Planting Dates
Season 1	November 15 - March 15
Temporary Seeding	September 1 - October 15

2.1.3 Turf Seed Purity

Botanical Name	Common Name	Min. Percent Pure Seed	Min. Percent Germination and Hard Seed	Max. Percent Weed Seed
Cynodon Dactyln	Common Bermuda	85	80	50

2.1.4 Turf Seed Mixture by Weight

Planting Season	Variety	Percent (by Weight)
Season 1	Common Bermuda	6 pounds per 1000 sq ft
Temporary Seeding	Annual Rye Grass	4-5 pounds per 1000 sq ft

Proportion seed mixtures by weight. Temporary seeding must later be replaced by Season 1 plantings for a permanent stand of grass. The same requirements of turf establishment for Season 1 apply for temporary seeding.

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 02300 EARTHWORK.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor.

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D 4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials. Other components shall conform to the following limits:

Silt	25-50 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.0
Soluble Salts	600 ppm maximum

2.3 SOIL CONDITIONERS FOR TURF AREAS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.3.1 Lime

Commercial grade hydrate limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C 602 of not less than 80 percent.

2.3.2 Aluminum Sulfate

Commercial grade.

2.3.3 Sulfur

100 percent elemental

2.3.4 Iron

100 percent elemental

2.3.5 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D 4427. Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation.

2.3.6 Sand

Clean and free of materials harmful to plants.

2.3.7 Perlite

Horticultural grade.

2.3.8 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.3.8.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.3.8.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.3.9 Gypsum

Coarsely ground gypsum comprised of calcium sulfate dihydrate 61 percent, calcium 22 percent, sulfur 17 percent; minimum 96 percent passing through 20 mesh screen, 100 percent passing thru 16 mesh screen.

2.3.10 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent shall pass a No. 8 sieve; a minimum 99 percent shall be retained on a No. 60 sieve; and a maximum 2 percent shall pass a No. 100 sieve. Bulk density: A maximum 40 pounds per cubic foot.

2.4 FERTILIZER FOR TURF AREAS

2.4.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following nitrogen, phosphorus, potassium, sulfer, and iron, in amounts recommended

in soil reports from 4 qualified soil testing agencies of plant food nutrients:

2.4.2 Hydroseeding Fertilizer

Controlled release fertilizer, to use with hydroseeding and composed of pills coated with plastic resin to provide a continuous release of nutrients for at least 6 months and containing the following minimum percentages, by weight, of plant food nutrients.

16 percent available nitrogen
45 percent available phosphorus
7 percent available potassium

2.5 MULCH

Mulch shall be free from noxious weeds, mold, and other deleterious materials.

2.5.1 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

2.5.2 Hay

Air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay shall be sterile, containing no fertile seed.

2.6 WATER

Source of water shall be approved by Contracting Officer and of suitable quality for irrigation, containing no elements toxic to plant life.

2.7 EROSION CONTROL MATERIALS

Erosion control material shall conform to the following:

2.7.1 Erosion Control Blanket

100 percent agricultural straw stitched with a degradable nettings, designed to degrade within 12 months.

2.7.2 Erosion Control Fabric

Fabric shall be knitted construction of polypropylene yarn with uniform mesh openings 3/4 to 1 inch square with strips of biodegradable paper. Filler paper strips shall have a minimum life of 6 months.

2.7.3 Hydrophilic Colloids

Hydrophilic colloids shall be physiologically harmless to plant and animal life without phytotoxic agents. Colloids shall be naturally occurring, silicate powder based, and shall form a water insoluble membrane after curing. Colloids shall resist mold growth.

2.7.4 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.1.1 Topsoil

Provide 4 inches of top soil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer, pH adjusters, soil conditioners into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.1.2 Soil Conditioner Application Rates

Apply soil conditioners for turf areas at rates as determined by laboratory soil analysis of the soils at the job site.

3.1.1.3 Fertilizer Application Rates

Apply fertilizer for turf areas at rates as determined by laboratory soil analysis of the soils at the job site.

3.2 SEEDING

3.2.1 Turf Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy frozen or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.2.2 Turf Seed Application Method

Seeding method shall be broadcasted and drop seeding or hydroseeding.

3.2.2.1 Broadcast and Drop Seeding For Turf

Seed shall be uniformly broadcast at the rate of 6 pounds per 1000 square feet. Use broadcast or drop seeders. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover

seed uniformly to a maximum depth of 1/4 inch in clay soils and 1/2 inch in sandy soils by means of spike-tooth harrow, cultipacker, raking or other approved devices.

3.2.2.2 Turf Hydroseeding

First, mix water and fiber. Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. Fiber shall be added at 1,000 pounds, dry weight, per acre. Then add and mix seed and fertilizer to produce a homogeneous slurry. Seed shall be mixed to ensure broadcasting at the rate of 6 pounds per 1000 square feet. When hydraulically sprayed on the ground, material shall form a blotter like cover impregnated uniformly with grass seed. Spread with one application with no second application of mulch.

3.2.2.3 Native Seeding

Seed will be sown using a Grasslander seeder that is able to seed fluffy and chaffy seed. The seeding rate will be 50 seed or more per square foot. Seed mixes will be tailored to the zones on the site according to the predicted moisture levels.

3.2.3 Mulching

3.2.3.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.2.3.2 Non-Asphaltic Tackifier

Hydrophilic colloid shall be applied at the rate recommended by the manufacturer, using hydraulic equipment suitable for thoroughly mixing with water. A uniform mixture shall be applied over the area.

3.2.4 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer.

3.2.5 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --

SECTION 02922

SODDING

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C 602	(2006) Agricultural Liming Materials
ASTM D 4427	(1992; R 2002e1) Peat Samples by Laboratory Testing
ASTM D 4972	(2001) pH of Soils

TURFGRASS PRODUCERS INTERNATIONAL (TPI)

TPI GSS	(1995) Guideline Specifications to Turfgrass Sodding

U.S. DEPARTMENT OF AGRICULTURE (USDA)

DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

100 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 02300 EARTHWORK, Section 02810 UNDERGROUND SPRINKLER SYSTEMS, Section 02921 SEEDING, Section 02930 EXTERIOR PLANTS, and Section 02935 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fertilizer

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

SD-07 Certificates

Sod farm certification for sods. Indicate type of sod in accordance with TPI GSS.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Sod Protection

Sod shall be harvested within 24 hours prior to delivery. Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer, Gypsum, Sulfur, Iron, and Lime Delivery

Deliver in volumes as determined by laboratory soil analysis of the soils at the job site to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws.

1.5.2 Storage

1.5.2.1 Sod Storage

Lightly sprinkle with water, cover with moist burlap, straw, or other approved covering; and protect from exposure to wind and direct sunlight until planted. Provide covering that will allow air to circulate so that internal heat will not develop. Do not store sod longer than 24 hours. Do not store directly on concrete or bituminous surfaces.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Sod

Place sod a maximum of thirty six hours after initial harvesting, in

accordance with TPI GSS as modified herein. Begin irrigation within 30 minutes of installation.

PART 2 PRODUCTS

2.1 SODS

2.1.1 Classification

Nursery grown, certified as classified in the TPI GSS. Machine cut sod at a uniform thickness of 3/4 inch within a tolerance of 1/4 inch, excluding top growth and thatch. Each individual sod piece shall be strong enough to support its own weight when lifted by the ends. Broken pads, irregularly shaped pieces, and torn or uneven ends will be rejected. Wire staples for anchorage shall be as recommended by sod supplier.

2.1.2 Purity

Sod species shall be genetically pure, free of weeds, pests, and disease.

2.1.3 Planting Dates

Lay sod from June to July for warm season spring planting and from September to October for cool season fall planting.

2.1.4 Composition

2.1.4.1 Proportion

Sod species shall be Zoysia Japonica.

]2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 02300 EARTHWORK.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor.

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D 4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials. Other components shall conform to the following limits:

Silt	25-50 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.0

Soluble Salts	600 ppm maximum

2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.3.1 Lime

Commercial grade hydrate lime containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C 602 of not less than 110 percent.

2.3.2 Aluminum Sulfate

Commercial grade.

2.3.3 Sulfur

100 percent elemental

2.3.4 Iron

100 percent elemental

2.3.5 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D 4427. Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation.

2.3.6 Sand

Clean and free of materials harmful to plants.

2.3.7 Perlite

Horticultural grade.

2.3.8 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.3.8.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.3.8.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.3.9 Gypsum

Coarsely ground gypsum comprised of calcium sulfate dihydrate 91 percent, calcium 22 percent, sulfur 17 percent; minimum 96 percent passing through 20 mesh screen, 100 percent passing thru 16 mesh screen.

2.3.10 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent shall pass a No. 8 sieve; a minimum 99 percent shall be retained on a No. 60 sieve; and a maximum 2 percent shall pass a No. 100 sieve. Bulk density: A maximum 40 pounds per cubic foot.

2.4 FERTILIZER

2.4.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following: nitrogen, phosphorus, potassiuim, sulfur, and iron, in amounts recommended in soil reports from a qualified soil-testing agency of plant food nutrients.

2.5 WATER

Source of water shall be approved by Contracting Officer and of suitable quality for irrigation containing no element toxic to plant life.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation (including soil conditioners), fertilizing, and sodding of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.2 Soil Preparation

Provide 4 inches of on-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer, pH adjusters, soil conditioners as recommended in soil report into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.2.1 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

3.1.2.2 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site.

3.2 SODDING

3.2.1 Finished Grade and Topsoil

Prior to the commencement of the sodding operation, the Contractor shall verify that finished grades are as indicated on drawings; the placing of topsoil, smooth grading, and compaction requirements have been completed in accordance with Section 02300 EARTHWORK.

The prepared surface shall be a maximum 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove from the surface debris and stones over a minimum 5/8 inch in any dimension.

3.2.2 Placing

Place sod a maximum of 36 hours after initial harvesting, in accordance with TPI GSS as modified herein.

3.2.3 Sodding Slopes and Ditches

For slopes 2:1 and greater, lay sod with long edge perpendicular to the contour. For V-ditches and flat bottomed ditches, lay sod with long edge perpendicular to flow of water. Anchor each piece of sod with wood pegs or wire staples maximum 2 feet on center.

3.2.4 Finishing

After completing sodding, blend edges of sodded area smoothly into surrounding area. Air pockets shall be eliminated and a true and even surface shall be provided. Frayed edges shall be trimmed and holes and missing corners shall be patched with sod.

3.2.5 Rolling

Immediately after sodding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width.

3.2.6 Watering

Start watering areas sodded as required by daily temperature and wind conditions. Apply water at a rate sufficient to ensure thorough wetting of soil to minimum depth of 6 inches. Run-off, puddling, and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or plant material shall be prevented.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --

SECTION 02930

EXTERIOR PLANTS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300	(1995) Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance
ANSI Z133.1	(2006) Arboricultural Operations - Safety Requirements for Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush
ANSI Z60.1	(1996) Nursery Stock

ASTM INTERNATIONAL (ASTM)

ASTM A 580/A 580M	(2006) Standard Specification for Stainless Steel Wire
ASTM C 602	(2006) Agricultural Liming Materials
ASTM D 1527	(1999; R 2005) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80
ASTM D 1972	(1997; R 2005) Standard Practice for Generic Marking of Plastic Products
ASTM D 4427	(1992; R 2002e1) Peat Samples by Laboratory Testing
ASTM D 4972	(2001) pH of Soils
ASTM D 5203	(1991; R 2002) Polyethylene Plastics Molding and Extrusion Meterials from Recycled Post-Consumer (HDPE) Sources
ASTM D 5268	(2002) Topsoil Used for Landscaping Purposes
ASTM D 5852	(2000) Standard Test Method for Erodibility Determination of Soil in the Field or in the Laboratory by the Jet Index Method
ASTM D 6629	(2001) Selection of Methods for Estimating Soil Loss by Erosion

ASTM F 405 (1997) Corrugated Polyethylene (PE) Tubing and Fittings

FOREST STEWARDSHIP COUNCIL (FSC)

FSC STD 01 001 (2000) Principles and Criteria for Forest Stewardship

L.H. BAILEY HORTORIUM (LHBH)

LHBH (1976) Hortus Third

U.S. DEPARTMENT OF AGRICULTURE (USDA)

DOA SSIR 42 (1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

U.S. ARMY CORPS OF ENGINEERS (USACE)

SPiRiT (2002) Sustainable Project Rating Tool (SPiRiT) Version 1.4.1

1.2 RELATED REQUIREMENTS

Section 02300 EARTHWORK, Section 02810 UNDERGROUND SPRINKLER SYSTEMS, Section 02921 SEEDING, Section 02922 SODDING, and Section 02935 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

State Landscape Contractor's License

Time Restrictions and Planting Conditions

Indicate anticipated dates and locations for each type of planting.

SD-03 Product Data

Local/Regional Materials; (SPiRiT)

Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site.

Peat
Composted Derivatives
Rotted Manure
Organic Mulch Materials

Submit documentation indicating type of biobased material in product and biobased content.

Gypsum; (SPiRiT)
Drainage Pipe; (SPiRiT)
Mulch; G
Ground Stakes
Hose; (SPiRiT)

Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product.

Fertilizer

Weed control fabric; G
Photographs

SD-04 Samples

Mulch; G

Submit one pint.

SD-06 Test Reports

Topsoil composition tests; Soil Test of proposed area and Soil Test location map

Percolation Test; Percolation Test of proposed area

SD-07 Certificates

Forest Stewardship Council (FSC) Certification; (SPiRiT)

Nursery certifications

Indicate names of plants in accordance with the LHBH, including type, quality, and size.

SD-10 Operation and Maintenance Data

Plastic Identification

When not labeled, identify types in Operation and Maintenance Manual.

1.4 QUALITY ASSURANCE

1.4.1 Topsoil Composition Tests

Commercial test from an independent testing laboratory including basic soil groups (moisture and saturation percentages, Nitrogen-Phosphorus-Potassium (N-P-K) ratio, pH (ASTM D 4972), soil salinity), secondary nutrient groups (calcium, magnesium, sodium, Sodium Absorption Ratio (SAR)), micronutrients (zinc, manganese, iron, copper), toxic soil elements (boron, chloride, sulfate), cation exchange and base saturation percentages, and soil amendment and fertilizer recommendations with quantities for plant material being transplanted. Soil required for each test shall include a maximum

depth of 18 inches of approximately 1 quart volume for each test. Areas sampled should not be larger than 1 acre and should contain at least 6-8 cores for each sample area and be thoroughly mixed. Problem areas should be sampled separately and compared with samples taken from adjacent non-problem areas. The location of the sample areas should be noted and marked on a parcel or planting map for future reference.

1.4.2 Nursery Certifications

a. Indicate on nursery letterhead the name of plants in accordance with the LHBH, including botanical common names, quality, and size.

b. Mycorrhizal fungi inoculum for plant material treated

1.4.3 State Landscape Contractor's License

Construction company shall hold a landscape contractors license in the state where the work is performed and have a minimum of five years landscape construction experience. Submit copy of license and three references for similar work completed in the last five years.

1.4.4 Plant Material Photographs

Contractor shall submit nursery photographs, for government approval prior to ordering, for each tree larger than 24-inch box/ 2-inch caliper size.

1.4.5 Percolation Test

Immediately following rough grading operation, identify a typical location for one of the largest trees and or shrubs and excavate a pit per the project details. Fill the pit with water to a depth of 12 inches. The length of time required for the water to percolate into the soil, leaving the pit empty, shall be measured by the project Landscape Architect and verified by the Contracting Officer. Within six hours of the time the water has drained from the pit, the Contractor, with the Contracting Officer and project Landscape Architect present, shall again fill the pit with water to a depth of 12 inches. If the water does not completely percolate into the soil within 9 hours, a determination shall be made whether a drainage system or a soil penetrant will be required for each tree and or shrub being transplanted.

1.4.6 Erosion Assessment

Assess potential effects of soil management practices on soil loss in accordance with ASTM D 6629. Assess erodibility of soil with dominant soil structure less than 2.8 to 3.1 inches in accordance with ASTM D 5852.

1.4.7 Pre-Installation Meeting

Convene a pre-installation meeting a minimum of one week prior to commencing work of this section. Require attendance of parties directly affecting work of this section. Review conditions of operations, procedures and coordination with related work. Agenda shall include the following:

a. Tour, inspect, and discuss conditions of planting materials.

b. Review planting schedule and maintenance.

c. Review required inspections.

d. Review environmental procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Branched Plant Delivery

Deliver with branches tied and exposed branches covered with material which allows air circulation. Prevent damage to branches, trunks, root systems, and root balls and desiccation of leaves.

1.5.1.2 Soil Amendment Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, gypsum, sulfur, iron, and lime may be furnished in bulk with a certificate indicating the above information. Store in dry locations away from contaminates.

1.5.1.3 Plant Labels

Deliver plants with durable waterproof labels in weather-resistant ink. Provide labels stating the correct botanical and common plant name and variety as applicable and size as specified in the list of required plants. Attach to plants, bundles, and containers of plants. Groups of plants may be labeled by tagging one plant. Labels shall be legible for a minimum of 60 days after delivery to the planting site.

1.5.2 Storage

1.5.2.1 Plant Storage and Protection

Store and protect plants not planted on the day of arrival at the site as follows:

a. Shade and protect plants in outside storage areas from the wind and direct sunlight until planted.

b. Heel-in bare root plants.

c. Protect balled and burlapped plants from freezing or drying out by covering the balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering which allows air circulation.

d. Keep plants in a moist condition until planted by watering with a fine mist spray.

e. Do not store plant material directly on concrete or bituminous surfaces.

1.5.2.2 Fertilizer, Gypsum, pH Adjusters and Mulch Storage

Store in dry locations away from contaminants.

1.5.2.3 Topsoil

Prior to stockpiling topsoil, eradicate on site undesirable growing vegetation. Clear and grub existing vegetation three to four weeks prior to stockpiling existing topsoil.

1.5.2.4 Weed Control Fabric

Store materials on site in enclosures or under protective covering in dry location. Store under cover out of direct sunlight. Do not store materials directly on ground.

1.5.3 Handling

Do not drop or dump plants from vehicles. Avoid damaging plants being moved from nursery or storage area to planting site. Handle balled and burlapped container plants carefully to avoid damaging or breaking the earth ball or root structure. Do not handle plants by the trunk or stem. Remove damaged plants from the site.

1.5.4 TIME LIMITATION

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum of 30 days with a maximum of 10 days on-site storage. The time limitation between installing the plant material and placing the mulch shall be a maximum of 24 hours.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

Coordinate installation of planting materials during optimal planting seasons for each type of plant material required.

1.6.1 Planting Dates

Plant all plants from October 1 to June 1.

1.7 GUARANTEE

All plants shall be guaranteed for one year beginning on the date of inspection by the Contracting Officer to commence the plant establishment period, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by the Government or by weather conditions unusual for the warranty period..

Remove and replace dead planting materials immediately unless required to plant in the succeeding planting season. At end of warranty period, replace planting materials that die or have 25 percent or more of their branches that die during the construction operations or the guarantee period.

1.8 SUSTAINABLE DESIGN REQUIREMENTS

1.8.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.8.2 Plastic Identification

Verify that plastic products to be incorporated into the project are labeled in accordance with ASTM D 1972. Where products are not labeled, provide product data indicating polymeric information in Operation and Maintenance Manual.
Type 1: Polyethylene Terephthalate (PET, PETE).
Type 2: High Density Polyethylene (HDPE).
Type 3: Vinyl (Polyvinyl Chloride or PVC).
Type 4: Low Density Polyethylene (LDPE).
Type 5: Polypropylene (PP).
Type 6: Polystyrene (PS).
Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

1.8.3 Forest Stewardship Council (FSC) Certification

Use FSC-certified wood where specified. Provide letter of certification signed by lumber supplier. Indicate compliance with FSC STD 01 001 and identify certifying organization. Submit FSC certification numbers; identify each certified product on a line-item basis. Submit copies of invoices bearing the FSC certification numbers.

PART 2 PRODUCTS

2.1 PLANTS

2.1.1 Regulations and Varieties

Existing trees and shrubs to remain shall be protected and a planting plan be arranged around them. Furnish nursery stock in accordance with ANSI Z60.1, except as otherwise specified or indicated. Each plant or group of planting shall have a "key" number indicated on the nursery certifications of the plant schedule. Furnish plants, including turf grass, grown under climatic conditions similar to those in the locality of the project. Plants specified shall be indigenous, low maintenance varieties, tolerant of site's existing soils and climate. Spray plants budding into leaf or having soft growth with an antidesiccant before digging. Plants of the same specified size shall be of uniform size and character of growth. Plants shall be chosen with their mature size and growth habit in mind to avoid over-planting and conflict with other plants, structures or underground utility lines. All plants shall comply with all Federal and State Laws requiring inspection for plant diseases and infestation.

2.1.2 Shape and Condition

Well-branched, well-formed, full-head, sound, vigorous, healthy planting stock free from disease, sunscald, windburn, abrasion, and harmful insects or insect eggs and having a healthy, normal, and undamaged root system.

2.1.2.1 Deciduous Trees and Shrubs

Symmetrically developed and of uniform habit of growth, with straight trunk, straight boles or stems, and free from objectionable disfigurements. Single leader (unless otherwise indicated).

2.1.2.2 Evergreen Trees and Shrubs

Well developed symmetrical tops with typical spread of branches full-to-ground (pyramidal evergreens) for each particular species or variety.

2.1.2.3 Ground Covers and Vines

Number and length of runners and clump sizes indicated, and of the proper age for the grade of plants indicated, furnished in removable containers, integral containers, or formed homogeneous soil section.

2.1.3 Plant Size

Minimum sizes measured after pruning and with branches in normal position, shall conform to measurements indicated, based on the average width or height of the plant for the species as specified in ANSI Z60.1. Plants larger in size than specified may be provided with approval of the Contracting Officer. When larger plants are provided, increase the ball of earth or spread of roots in accordance with ANSI Z60.1.

2.1.4 Root Ball Size

All box-grown, field potted, field boxed, collected, plantation grown, bare root, balled and burlapped, container grown, processed-balled, and in-ground fabric bag-grown root balls shall conform to ANSI Z60.1. All wrappings and ties shall be biodegradable. Root growth in container grown plants shall be sufficient to hold earth intact when removed from containers. Root bound plants will not be accepted.

2.1.4.1 Mycorrhizal fungi inoculum

Before shipment, root systems shall contain mycorrhizal fungi inoculum.

2.1.5 Growth of Trunk and Crown

2.1.5.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANSI Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

b. Multi-stem: All full, even countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 6 inches from ground level.

2.1.5.2 Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANSI Z60.1. Acceptable plant material shall be well shaped, full, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

2.1.5.3 Coniferous Evergreen Plant Material

Coniferous Evergreen plant material shall have the height-to-spread ratio recommended by ANSI Z60.1. The coniferous evergreen trees shall not be "poled" or the leader removed. Acceptable plant material shall be exceptionally heavy, well shaped with full-to-ground foliage and hand-trimmed (no mechanical sheering permitted) to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated.

2.1.5.4 Broadleaf Evergreen Plant Material

Broadleaf evergreen plant material shall have the height-to-spread ratio recommended by ANSI Z60.1. Acceptable plant material shall be well shaped and recognized by the trade as typical for the variety grown in the region of the project. If trimmed, by hand (no mechanical sheering permitted).

2.1.5.5 Ground Cover and Vine Plant Material

Ground cover and vine plant material shall have the minimum number of runners and length of runner recommended by ANSI Z60.1. Plant material shall have heavy, well developed and balanced crown with vigorous, well developed root system and shall be furnished in containers.

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 02300 EARTHWORK.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor.

2.2.3 Composition

Evaluate soil for use as topsoil in accordance with ASTM D 5268. From 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D 4972. Topsoil shall be free of sticks, stones, roots, plants, and other debris and objectionable materials. Other components shall conform to the following limits:

Silt	25-50 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.0
Soluble Salts	600 ppm maximum

2.3 SOIL CONDITIONERS

Provide singly or in combination as required to meet specified requirements for topsoil. Soil conditioners shall be nontoxic to plants.

2.3.1 Lime

Commercial grade hydrated limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C 602 of not less than 80 percent.

2.3.2 Aluminum Sulfate

Commercial grade.

2.3.3 Sulfur

100 percent elemental

2.3.4 Iron

100 percent elemental

2.3.5 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D 4427 as modified herein. Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation. Biobased content shall be a minimum of 100 percent. Peat shall not contain invasive species, including seeds.

2.3.6 Sand

Clean and free of materials harmful to plants.

2.3.7 Perlite

Horticultural grade.

2.3.8 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, invasive species, including seeds, and soil stabilized with nitrogen and having the following properties:

2.3.8.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.3.8.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.3.8.3 Biobased Content

Minimum 100 percent.

2.3.9 Gypsum

Coarsely ground gypsum from recycled scrap gypsum board comprised of calcium sulfate dihydrate 91 percent, calcium 22 percent, sulfur 17 percent; minimum 96 percent passing through 20 mesh screen, 100 percent passing thru 16 mesh screen.

2.3.10 Vermiculite

Horticultural grade for planters.

2.3.11 Rotted Manure

Well rotted horse or cattle manure containing maximum 25 percent by volume of straw, sawdust, or other bedding materials; free of seeds, stones, sticks, soil, and other invasive species.

2.4 PLANTING SOIL MIXTURES

Sandy topsoil: one part topsoil to one part peat; clay topsoil: two parts topsoil to one part peat. Thoroughly mix all parts of planting soil mixture to a uniform blend throughout.

2.5 FERTILIZER

Fertilizer for groundcover, wildflowers and grasses is not permitted. Fertilizer for trees, plants, and shrubs shall be as recommended by plant supplier, except synthetic chemical fertilizers are not permitted. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not permitted.

2.6 WEED CONTROL FABRIC

2.6.1 Roll Type Polypropylene or Polyester Mats

Fabric shall be woven, needle punched or non-woven and treated for protection against deterioration due to ultraviolet radiation. Fabric shall be minimum 99 percent opaque to prevent photosynthesis and seed germination from occurring, yet allowing air, water and nutrients to pass thru to the roots. Minimum weight shall be 5 ounces per square yard with a minimum thickness of 20 mils with a 20 year (minimum) guarantee.

2.7 DRAINAGE PIPE FOR PLANT PITS AND BEDS

Plastic HDPE pipe, 6 inches in diameter, perforated conforming to ASTM D 5203. Minimum 100 percent post-consumer recycled content. Plastic ABS pipe, 6 inches in diameter, perforated conforming to ASTM D 1527. Minimum 50 percent post-consumer recycled content. Corrugated plastic drainage tubing, 6 inches in diameter, perforated conforming to ASTM F 405.

2.8 MULCH

2.8.1 Organic Mulch Materials

Pine needles. Biobased content shall be a minimum of 100 percent. Pine needles shall be fresh and golden in color (grey needles not permitted.

2.9 STAKING AND GUYING MATERIAL

2.9.1 Staking Material

2.9.1.1 Ground Stakes

FSC-certified or salvaged wood or 100 percent post-consumer recycled content plastic, 2 inches square are by 3 feet long, pointed at one end.

2.9.2 Guying Material

2.9.2.1 Guying Wire

12 gauge annealed galvanized steel, ASTM A 580/A 580M.

2.9.3 Hose Chafing Guards

New or used 2 ply 3/4 inch diameter reinforced rubber or plastic hose, black or dark green, all of same color.

2.10 ANTIDESICCANTS

Sprayable, water insoluble vinyl-vinledine complex which produce a moisture retarding barrier not removable by rain or snow. Film shall form at temperatures commonly encountered out of doors during planting season and have a moisture vapor transmission rate (MVT) of the resultant film of maximum 10 grams per 24 hours at 70 percent humidity.

2.11 EROSION CONTROL MATERIALS

Erosion control material shall conform to the following:

2.11.1 Erosion Control Blanket

70 percent agricultural staw/30 percent coconut fiber matrix stitched with a degradable nettings, designed to degrade within 12 months.

2.11.2 Erosion Control Fabric

Fabric shall be knitted construction of polypropylene yarn with uniform mesh openings 3/4 to 1 inch square with strips of biodegradable paper. Filler paper strips shall have a minimum life of 6 months.

2.12 WATER

Source of water to be approved by Contracting Officer and suitable quality for irrigation and shall not contain elements toxic to plant life, including acids, alkalis, salts, chemical pollutants, and organic matter. Use collected storm water or graywater when available.

2.12.1 Hose

Hoses used for watering shall be a minimum of 60 percent post-consumer rubber or plastic.

2.13 MYCORRHIZAL FUNGI INOCULUM

Mycorrhizal fungi inoculum shall be composed of multiple-fungus inoculum as recommended by the manufacturer for the plant material specified.

2.14 SOURCE QUALITY CONTROL

The Contracting Officer and Landscape Architect of Record will inspect plant materials at the project site and approve them, if satisfactory. Tag plant materials for size and quality.

PART 3 EXECUTION

3.1 EXTENT OF WORK

Provide soil preparation, fertilizing, tree, shrub, vine, groundcover, and planting, staking and guying, weed control fabric, erosion control material and root control barrier installation and a mulch topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.2 PREPARATION

3.2.1 Protection

Protect existing and proposed landscape features, elements, and sites from damage or contamination. Protect trees, vegetation, and other designated features by erecting high-visibility, reusable construction fencing. Locate fence no closer to trees than the drip line. Plan equipment and vehicle access to minimize and confine soil disturbance and compaction to areas indicated on Drawings.

3.2.2 Layout

Stake out approved plant material locations and planter bed outlines on the project site before digging plant pits or beds. The Contracting Officer reserves the right to adjust plant material locations to meet field conditions. Do not plant closer than 12 inches to a building wall, pavement edge, fence or wall edge and other similar structures. Provide on-site locations for excavated rock, soil, and vegetation.

3.2.3 Erosion Control

Provide erosion control and seeding with native plant species to protect slopes.

3.2.4 Soil Preparation

3.2.4.1 pH Adjuster Application Rates

Apply pH adjuster at rates as determined by laboratory soil analysis of the soils at the job site.

3.2.4.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.3.2.4.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site.

3.2.5 Subsoil Drainage for Plant Pits and Beds

Provide as indicated. Lay perforated drain pipe with perforations down. Backfill trenches as specified in Section 02300 EARTHWORK.

3.3 PLANT BED PREPARATION

Verify location of underground utilities prior to excavation. Protect existing adjacent turf before excavations are made. Do not disturb topsoil and vegetation in areas outside those indicated on Drawings. Where planting beds occur in existing turf areas, remove turf to a depth that will ensure removal of entire root system. Measure depth of plant pits from finished grade. Depth of plant pit excavation shall be as indicated and provide proper relation between top of root ball and finished grade. Install plant material as specified in paragraph entitled "Plant Installation." Do not install trees within 10 feet of any utility lines or building walls.

3.4 PLANT INSTALLATION

3.4.1 Individual Plant Pit Excavation

Excavate pits at least twice as large in diameter as the size of ball or container to depth shown.

3.4.2 Plant Beds with Multiple Plants

Excavate plant beds continuously throughout entire bed as outlined to depth shown.

3.4.3 Handling and Setting

Move plant materials only by supporting the root ball or container. Set plant materials, in relation to surrounding finish grade, one to 2 inches above root flare. Replace plant material whose root balls are cracked or damaged either before or during the planting process.

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas.

3.4.3.1 Balled and Burlapped Stock

Backfill with prepared soil mixture to approximately half the depth of ball and then tamp and water. Carefully remove or fold back excess burlap and tying materials from the top a minimum 1/3 depth from the top of the rootball. Tamp and complete backfill, place mulch topdressing, and water. Remove wires and non-biodegradable materials from plant pit prior to backfill operations.

3.4.3.2 Container Grown Stock

Remove from container and prevent damage to plant or root system.

3.4.3.3 Ground Covers and Vines

Plant after placing mulch topdressing. Do not remove plant materials from flats or containers until immediately before planting. Space at intervals

indicated. Plant at a depth to sufficiently cover all roots. Start watering areas planted as required by temperature and wind conditions. Apply water at a rate sufficient to ensure thorough wetting of soil to a depth of 6inches without run off or puddling. Smooth planting areas after planting to provide even, smooth finish. Mulch as indicated.

3.4.4 Earth Mounded Watering Basin for Individual Plant Pits

Form with topsoil around each plant by replacing a mound of topsoil around the edge of each plant pit. Watering basins shall be 6 inches deep for trees and 4 inches deep for shrubs. Eliminate basins around plants in plant beds containing multiple plants.

3.4.5 Weed Control Fabric Installation

Remove grass and weed vegetation, including roots, from within the area enclosed by edging. Completely cover areas enclosed by edging with specified weed control fabric prior to placing mulch layer. Overlap cut edges 6 inches.

3.4.6 Erosion Control Material

Install in accordance with manufacturer's instructions.

3.4.7 Mulch Topdressing

Provide mulch topdressing over entire planter bed surfaces and individual plant surfaces including earth mound watering basin around plants to a depth of 3 inches after completion of plant installation and before watering. Keep mulch out of the crowns of shrubs. Place mulch a minimum 2 to 3 inches away from trunk of shrub or tree. Place on top of any weed control fabric.

3.4.8 Fertilization

3.4.8.1 Granular Fertilizer

Apply granular fertilizer as a top coat prior to placing mulch layer and water thoroughly.

3.4.9 Watering

Start watering areas planted as required by temperature and wind conditions. Slow deep watering shall be used. Apply water at a rate sufficient to ensure thorough wetting of soil to a depth of 12inches without run off or puddling. Watering of other plant material or adjacent areas shall be prevented.

3.4.10 Staking and Guying

3.4.10.1 Staking

Stake plants with the number of stakes indicated complete with double strand of 12 gage guy wire as detailed. Attach guy wire half the tree height but not more than 5 feet high. Drive stakes to a depth of 2 1/2 to 3 feet into the ground outside the plant pit. Do not injure the root ball. Use hose chafer guards where guy wire comes in contact with tree trunk.

3.4.10.2 Guying

Guy plants as indicated. Attach two strands of guying wire around the tree trunk at an angle of 45 degrees at approximately 1/2 of the trunk height. Protect tree trunks with chafing guards where guying wire contacts the tree trunk. Anchor guys to wood ground stakes. Fasten flags to each guying wire approximately 2/3 of the distance up from ground level.

3.4.10.3 Chafing Guards

Use hose chafing guards, as specified where guy wire will contact the plant.

3.4.10.4 Wood Ground Stakes

Drive wood ground stakes into firm ground outside of plant pit with top of stake flush with ground. Place equal distance from tree trunk and around the plant pit.

3.4.11 Pruning

Prune in accordance with safety requirement of ANSI Z133.1.

3.4.11.1 Trees and Shrubs

Remove dead and broken branches. Prune to correct structural defects only. Retain typical growth shape of individual plants with as much height and spread as practical. Do not cut central leader on trees. Make cuts with sharp instruments. Do not flush cut with trunk or adjacent branches. Collars shall remain in place. Pruning shall be accomplished by trained and experienced personnel and shall be accordance with ANSI A300.

3.4.11.2 Wound Dressing

Do not apply tree wound dressing to cuts.

3.5 RESTORATION AND CLEAN UP

3.5.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

3.5.2 Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite at an approved landfill, recycling center, or composting center. Adjacent paved areas shall be cleared.

-- End of Section --

SECTION 02935

LANDSCAPE ESTABLISHMENT

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z133.1	(2006) Arboricultural Operations - Safety Requirements for Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush

ASTM INTERNATIONAL (ASTM)

ASTM D 5851	(1995; R 2000) Planning and Implementing a Water Monitoring Program

U.S. ARMY CORPS OF ENGINEERS (USACE)

SPiRiT	(2002) Sustainable Project Rating Tool (SPiRiT) Version 1.4.1

1.2 DEFINITIONS

1.2.1 Pesticide

Any substance or mixture of substances, including biological control agents, that may pervent, destroy, repel, or mitigate pests and are specifically labeled for use by the U.S. Environmental Protection Agency (EPA). Also, any substance used as a plant regulator, defoliant, disinfectant, or biocide. Examples of pesticides include fumigants, herbicides, insecticides, fungicides, nematicides, molluscicides and rodenticides.

1.2.2 Stand of Turf

100 percent ground cover of the established species.

1.2.3 Planter Beds

A planter bed is defined as an area containing one or a combination of the following plant types: shrubs, vines, wildflowers, annuals, perennials, ground cover, and a mulch topdressing excluding turf. Trees may also be found in planter beds.

1.3 RELATED REQUIREMENTS

Section 02810 UNDERGROUND SPRINKLER SYSTEMS applies to this section for installation of irrigation equipment requirements, with additions and modifications herein.

Section 02921 SEEDING and Section 02922 SODDING applies to this section for installation of seed and sod requirements, with additions and modifications herein.

Section 02930 EXTERIOR PLANTS applies to this section for installation of trees, shrubs, ground cover, vines, and wildflower, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Integrated Pest Management Plan; G

SD-03 Product Data

Local/Regional Materials; (SPiRiT)

Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site.

Fertilizer; G

Mulches Topdressing; (SPiRiT)

Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.

Organic Mulch Materials

Submit documentation indicating type of biobased material in product and biobased content.

SD-07 Certificates

Maintenance inspection report

Plant quantities; G

SD-10 Operation and Maintenance Data

Maintenance

SD-11 Closeout Submittals

Tree, staking and guying removal

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Delivery

Deliver fertilizer to the site in original containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer may be furnished in bulk with a certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Fertilizer, Lime, Iron, and Mulch Storage

Material shall be stored in designated areas. Lime and fertilizer shall be stored in cool, dry locations away from contaminants.

1.5.2.2 Antidessicants Storage

Do not store with fertilizers or other landscape maintenance materials.

1.5.3 Handling

Do not drop or dump materials from vehicles.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.7 MAINTENANCE

Submit Operation and Maintenance (O&M) Manuals for planting materials. Include instructions indicating procedures during one typical year including variations of maintenance for climatic conditions throughout the year. Provide instructions and procedures for watering; promotion of growth, including fertilizing, pruning, and mowing; and integrated pest management. O&M Manuals shall include pictures of planting materials cross referenced to botanical and common names, with a description of the normal appearance in each season.

Develop a water monitoring program for surface and ground water on the project site in accordance with ASTM D 5851 and consistent with the water management program utilized during construction operations.

PART 2 PRODUCTS

2.1 POST-PLANT FERTILIZER

Fertilizer for groundcover, wildflowers, and grasses is not permitted. Fertilizer for trees, plants, and shrubs shall be as recommended by plant supplier, except synthetic chemical fertilizers are not permitted. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not permitted.

2.1.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following: nitrogen, phosphorus, potassium, sulfur, and iron, in amounts recommended in soil reports from four qualified soil testing agencies of plant food nutrients:

2.2 WATER

Source of water shall be approved by the Contracting Officer, and be of suitable quality for irrigation. Use collected storm water or graywater when available.

2.2.1 Hose

Hoses used for watering shall be a minimum of 70 percent post-consumer rubber or plastic.

2.3 MULCHES TOPDRESSING

Free from noxious weeds, mold, pesticides, or other deleterious materials.

2.3.1 Organic Mulch Materials

Pine straw mulch from site when available. Biobased content shall be a minimum of 100 percent. Pine needles shall be fresh and golden in color (grey needles not permitted).

2.4 PESTICIDES

Pesticides and herbicides are not permitted. Submit an Integrated Pest Management Plan, including weed and pest management strategies. Use biological pest controls as approved in the Plan.

PART 3 EXECUTION

3.1 EXTENT OF WORK

Provide landscape construction maintenance to include irrigation equipment cleaning and adjustments, mowing, edging, overseeding, aeration, fertilizing, watering, weeding, pruning, stake and guy adjusting, for all newly installed landscape areas, unless indicated otherwise, and at all areas inside or outside the limits of the construction that are disturbed by the Contractor's operations.

3.1.1 Policing

The Contractor shall police all landscaped areas. Policing includes removal of leaves, branches and limbs regardless of length or diameter, dead vegetation, paper, trash, cigarette butts, garbage, rocks or other debris. Policing shall extend to both sides of fencing or walls. Collected debris shall be promptly removed and disposed of at an approved disposal site.

3.1.2 Drainage System Maintenance

The Contractor shall remove all obstructions from surface and subsurface drain lines to allow water to flow unrestricted in swales, gutters, catch basins, storm drain curb inlets, and yard drains. Remove grates and clear

debris in catch basins. Open drainage channels are to be maintained free of all debris and vegetation at all times. Edges of these channels shall be clear of any encroachment by vegetation.

3.2 IRRIGATION ESTABLISHMENT PERIOD

The irrigation establishment period will commence on the date that inspection by the Contracting Officer shows that the new irrigation equipment furnished under this contract have been satisfactorily installed and is functional and shall continue for a period of 365 days.

3.2.1 Maintenance During the Irrigation Establishment Period

Begin maintenance immediately after irrigation equipment has been installed and is functional. Inspect irrigation equipment at least once a week during the installation and establishment period and perform needed maintenance promptly. Automatic controllers not equipped with rain shut-off sensors shall be turned off during periods of rain that exceed twelve hours of continuous rainfall in one day or during rain storms of one day or more. Once the rain has subsided timers shall be reactivated. Irrigation controllers shall be inspected and reprogrammed after power outages. Contractor shall be responsible for winterization and startup. Sprinkler heads shall direct water away from buildings and hard surfaced areas.

3.2.2 Water Restrictions

The Contractor shall abide by state, local or other water conservation regulations in force during the establishment period. Automatic controller shall be adjusted to comply with the water conservation regulations schedule.

3.2.3 Fire Hydrants

To use a fire hydrant for irrigation, the Contractor shall obtain prior clearance from the Contracting Officer and provide the tools and connections approved for use on fire hydrants. If a fire hydrant is used, Contractor shall provide a reduced pressure backflow preventer for each connection between hose and fire hydrant. Backflow preventer used shall be tested once per month by a certified backflow preventer tester.

3.2.4 Final Acceptance

Operation and coverage test is acceptable if system operates through at least one complete cycle for areas to be irrigated and all leaks or repairs have been completed.

3.2.5 Controller Charts

Provide one chart for each controller supplied. Indicate in chart area controlled by the automatic controller. The chart is a reduction of the actual plans that will fit the maximum dimensions inside the controller housing. Use a black line print for the chart and a different pastel or transparent color to indicate each station zone of coverage. After chart is completed and approved for final acceptance, seal chart between two 20 mil pieces of clear plastic.

3.3 GROUNDCOVER ESTABLISHMENT PERIOD

Groundcover establishment period will commence on the date that inspection by the Contracting Officer shows that the new turf furnished under this contract has been satisfactorily installed to a 100 percent stand of coverage. The establishment period shall continue for a period of 365 days.

3.3.1 Frequency of Maintenance

Begin maintenance immediately after turf has been installed. Inspect areas once a week during the installation and establishment period and perform needed maintenance promptly.

3.3.2 Promotion of Growth

Groundcover shall be maintained in a manner that promotes proper health, growth, natural color.Turf shall have a neat uniform manicured appearance, free of bare areas, ruts, holes, weeds, pests, dead vegetation, debris, and unwanted vegetation that present an unsightly appearance. Mow, remove excess clippings, eradicate weeds, water, fertilize, overseed, aerate, topdress and perform other operations necessary to promote growth, as approved by Contracting Officer and consistent with approved Integrated Pest Management Plan. Remove noxious weeds common to the area from planting areas by mechanical means.

3.3.3 Mowing

3.3.3.1 Turf

Turf shall be mowed at a uniform finished height. Mow turfed areas to a minimum average height of 3 inches when average height of grass becomes 4 inches for spring/summer maintenance and to a minimum average height of 3 inches when the average height of grass reaches 4 inches for fall winter maintenance. The height of turf is measured from the soil. Mowing of turf shall be performed in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Prior to mowing, all rubbish, debris, trash, leaves, rocks, paper, and limbs or branches on a turf area shall be picked up and disposed. Adjacent paved areas shall be swept/vacuumed clean.

3.3.3.2 Native Grasses

Mow above height of native grass seedlings (approximately 3.5 to 4 inches). Mow during spring or early summer. Do not mow after early summer during the second growing season.

3.3.3.3 Wildflowers

Mow three times per season above height of the wildflowers (approximately 12 to 15 inches).

3.3.4 Turf Edging and Trimming

Perimeter of planter bed edges, sidewalks, driveways, curbs, and other paved surfaces shall be edged. Uniformly edge these areas to prevent encroachment of vegetation onto paved surfaces and to provide a clear cut division line between planter beds, turf, and ground cover. Edging is to be accomplished in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Edging shall be performed on the same day that turf is mowed. Use of string line trimmers is permitted in "soft" areas

such as an edge between turfgrass and a planter bed. Care shall be exercised to avoid damage to any plant materials, structures, and other landscape features.

Trimming around trees, fences, poles, walls, irrigation valve boxes and other similar objects is to be accomplished to match the height and appearance of surrounding mowed turf growth. Trimming shall be performed on the same day the turf's mowed. Care shall be exercised to avoid "Girdling" trees located in turf areas. The use of protective tree collars on trees in turf areas may be utilized as a temporary means to avoid injury to tree trunks. At the end of the plant establishment period Contractor will be responsible for removing all protective tree collars.

3.3.5 Post-Fertilizer Application

Do not fertilize wildflowers, groundcover, and grasses. Apply turf fertilizer in a manner that promotes health, growth, vigor, color and appearance of cultivated turf areas. The method of application, fertilizer type and frequencies shall be determined by the laboratory soil analysis results the requirements of the particular turf species. Organic fertilizer shall be used. In the event that organic fertilizer is not producing the desired effect, the Contractor shall contract the Contracting Officer for approval prior to the use of a synthetic type of fertilizer. Fertilizer shall be applied by approved methods in accordance with the manufacturer's recommendations.

3.3.6 Turf Watering

The Contractor shall perform irrigation in a manner that promotes the health, growth, color and appearance of cultivated vegetation and that complies with all Federal, State, and local water agencies and authorities directives. The Contractor shall be responsible to prevent over watering, water run-off, erosion, and ponding due to excessive quantities or rate of application. The Contractor shall abide by state, local or other water conservation regulations or restrictions in force during the establishment period.

3.3.7 Turf Aeration

Upon completion of weed eradication operations and Contracting Officer's approval to proceed, aerate turf areas by approved device. Core, by pulling soil plugs, to a minimum depth of 3 inches. Leave all soil plugs that are produced in the turf area. After aeration operations are complete, topdress entire area 1/4 inch of topsoil.

Blend all parts of topdressing mixture to a uniform consistency throughout.] Keep clean at all times at least one paved pedestrian access route and one]3.3.8 Turf Clearance Area

Trees located in turf areas shall be maintained with a growth free clearance of3 feet from the tree trunk base. The use of mechanical weed whips to accomplish the turf growth free bed area is prohibited.

3.3.9 Replanting

Replant in accordance with Section 02921 SEEDING and Section 02922 SODDING and within specified planting dates areas which do not have a satisfactory stand of turf. Replant areas which do not have a satisfactory stand of other groundcover and grasses.

3.3.10 Final Inspection and Acceptance

Final inspection will be make upon written request from the Contractor at least 10 days prior to the last day of the turf establishment period. Final turf acceptance will be based upon a satisfactory stand of turf. Final acceptance of wildflower and grass areas will be based upon a stand of 95 percent groundcover of established species.

3.3.11 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by Contracting Officer.

3.4 EXTERIOR PLANT ESTABLISHMENT PERIOD

The exterior plant establishment period will commence on the date that inspection by the Contracting Officer shows that the new plants furnished under this contract have been satisfactorily installed and shall continue for a period of 365 days.

3.4.1 Frequency of Maintenance

Begin maintenance immediately after plants have been installed. Inspect exterior plants at least twice a month during the installation and establishment period and perform needed maintenance promptly.

3.4.2 Promotion of Plant Growth and Vigor

Water, prune, fertilize, mulch, adjust stakes, guys and turnbuckles, eradicate weeds and perform other operations necessary to promote plant growth, and vigor.

3.4.3 Planter Bed Maintenance

Planter beds shall be weeded, fertilized, irrigated, kept pest free, turf free, pruned, and mulch levels maintained. Planter beds will not be allowed to encroach into turf areas. A definite break shall be maintained between turf areas and planter beds. Fertilize exterior planting materials to promote healthy plant growth without encouraging excessive top foliar growth. Remove noxious weeds common to the area from planting areas by mechanical means.

3.4.3.1 Shrub Selective Maintenance

In addition to the above requirements, shrubs shall be selectively pruned, and shaped for health and safety when the following conditions exist: Remove growth in front of windows, over entrance ways or walks, and any growth which will obstruct vision at street intersections or of security personnel; Remove dead, damaged or diseased branches or limbs; where shrub growth obstructs pedestrian walkways; where shrub growth is found growing against or over structures; where shrub growth permits concealment of unauthorized persons. All pruning debris shall be disposed of in a proper manner.

3.4.3.2 Tree Maintenance

Tree maintenance shall include adjustment of stakes, ties, guy supports, watering, fertilizing, pest control, mulching, pruning for health and safety. Fertilize exterior trees to promote healthy plant growth without encouraging excessive top foliar growth. Stakes, ties, guy supports shall be inspected and adjusted to avoid girdling and promote natural development. All trees within the project boundaries, regardless of caliper, shall be selectively pruned for safety and health reasons. These include but are not limited to removal of dead and broken branches and correction of structural defects. Prune trees according to their natural growth characteristics leaving trees well shaped and balanced. Pruning of all trees including palm trees shall be accomplished by or in the presence of a certified member of the International Society of Arboriculture and in accordance with ANSI Z133.1. All pruning debris generated shall be disposed of in a proper manner.

3.4.4 Slope Erosion Control Maintenance

The Contractor shall provide slope erosion control maintenance to prevent undermining of all slopes in newly landscaped and natural growth areas. Maintenance tasks include immediate repairs to weak spots in sloped areas, and maintaining clean, clear culverts, and graded berms, and terraces to intercept and direct water flow to prevent development of large gullies and slope erosion and during periods of extended rainfall, irrigation systems shall be secured. Eroded areas shall be filled with amended topsoil and replanted with the same plant species. Erosion control netting blankets damaged due to slope erosion shall be reinstalled.

3.4.5 Removal of Dying or Dead Plants

Remove dead and dying plants and provide new plants immediately upon commencement of the specified planting season, and replace guys, mulch and eroded earth mound water basins. No additional plant establishment period will be required for replacement plants beyond the original warranty period. A tree shall be considered dying or dead when the main leader has died back, or a minimum of 20 percent of the crown has died. A shrub or ground cover shall be considered dying or dead when a minimum of 20 percent of the plant has died. This condition shall be determined by scraping on a branch an area 1/16 inch square, maximum, to determine the cause for dying plant material and shall provide recommendations for replacement. The Contractor shall determine the cause for dying plant material and provide recommendations for replacement.

3.4.6 Tracking of Unhealthy Plants

Note plants not in healthy growing condition, as determined by the Contracting Officer, and as soon as seasonal conditions permit, remove and replace with plants of the same species and sizes as originally specified. Install replacement plantings in accordance with Section 02930 EXTERIOR PLANTS.

3.4.7 Final Inspection

Final inspection will be made upon written request from the Contractor at least 10 days prior to the last day of the establishment period. Final inspection will be based upon satisfactory health and growth of plants and on the following:

3.4.7.1 Total Plants on Site

Plants have been accepted and required number of replacements have been installed.

3.4.7.2 Mulching and Weeding

Planter beds and earth mound water basins are properly mulched and free of weeds.

3.4.7.3 Tree Supports

Guys and turnbuckles are in good condition.

3.4.7.4 Remedial Work

Remedial measures directed by the Contracting Officer to ensure plant material survival and promote healthy growth have been completed.

3.4.8 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by Contracting Officer.

3.5 FIELD QUALITY CONTROL

3.5.1 Maintenance Inspection Report

Provide maintenance inspection report to assure that landscape maintenance is being performed in accordance with the specifications and in the best interest of plant growth and survivability. Site observations shall be documented at the start of the establishment period, then quarterly following the start, and at the end of establishment period. Results of site observation visits shall be submitted to the Contracting Officer within 7 calendar days of each site observation visit.

3.5.2 Plant Quantities

The Contractor shall provide Contracting Officer with the number of plant quantities. In addition, provide total exterior area of hardscape and landscaping such as turf and total number of shrubs.

3.5.3 Tree Staking and Guying Removal

The Contractor shall provide a certified letter that all stakes and guys are removed from all project trees at the end of the establishment period.

-- End of Section --

SECTION 03100

STRUCTURAL CONCRETE FORMWORK

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

ACI 347R (2003) Guide to Formwork for Concrete

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA PS1 (1995) Construction and Industrial Plywood (APA V995)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Formwork; G

Drawings showing details of formwork, including dimensions of fiber voids, joints, supports, studding and shoring, and sequence of form and shoring removal.

SD-03 Product Data

Manufacturer's product data for composite wood and plywood indicating bonding agent used in each contains no added urea-formaldehyde.

Manufacturer's product data including percentages of post-consumer recycled content and post-industrial recycled content.

Manufacturer's letter certifying that products specified as regionally manufactured materials were manufactured in a facility within 500 miles from the project site. Provide a written statement of the cost of each product.

Manufacturer's product data or MSDS for all field applied coatings indicating coating systems meet or exceed the VOC and chemical

component limits of Green Seal requirements.

Manufacturer's product data or MSDS for all field applied adhesives and sealants indicating adhesives that meet or exceed VOC limits of SCAQMD Rule # 1168 and sealants meet or exceed Bay Area Resources Board Reg. 8, Rule 51.

Design

Design analysis and calculations for form design and methodology used in the design.

Form Materials

Manufacturer's data including literature describing form materials, accessories, and form releasing agents.

Form Releasing Agents

Manufacturer's recommendation on method and rate of application of form releasing agents.

1.3 DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

PART 2 PRODUCTS

2.1 FORM MATERIALS

2.1.1 Forms For Class A and Class B Finish

Forms for Class A and Class B finished surfaces shall be plywood panels conforming to APA PS1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels.

2.1.2 Forms For Class C Finish

Forms for Class C finished surfaces shall be shiplap lumber; plywood conforming to APA PS1, Grade B-B concrete form panels, Class I or II; tempered concrete form hardboard conforming to AHA A135.4; other approved concrete form material; or steel.

2.1.3 Forms For Class D Finish

Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

2.1.4 Retain-In-Place Metal Forms

Retain-in-place metal forms for concrete slabs and roofs shall be as

specified in Section 05310 STEEL DECKS.

2.1.5 Form Ties

Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal. Solid backing shall be provided for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 1/4 inch nor more than 1 inch deep and not more than 1 inch in diameter. Removable tie rods shall be not more than 1-1/2 inches in diameter.

2.1.6 Form Releasing Agents

Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

2.2 FIBER VOID RETAINERS

2.2.1 Precast Concrete

Precast concrete units shall have a compressive strength of not less than 5000 psi, reinforced to resist loads imposed by project requirements unless indicated.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Formwork

Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and conforming to construction tolerance given in TABLE 1. Where concrete surfaces are to have a Class A or Class B finish, joints in form panels shall be arranged as approved. Where forms for continuous surfaces are placed in successive units, the forms shall fit over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

3.2 CHAMFERING

Except as otherwise shown, external corners that will be exposed shall be chamfered, beveled, or rounded by moldings placed in the forms.

3.3 COATING

Forms for Class A and Class B finished surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class C and D finished surfaces

may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures, coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.4 REMOVAL OF FORMS

Forms shall be removed preventing injury to the concrete and ensuring the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement.

TABLE 1

TOLERANCES FOR FORMED SURFACES

1.	Variations from the plumb:	In any 10 feet of length ---------- 1/4 inch
	a. In the lines and surfaces, piers, walls and in arises	Maximum for entire length ---------- 1 inch
	b. For control-joint grooves, and other conspicuous lines	In any 20 feet of length ---------- ---- 1/4 inch Maximum for entire length---------- 1/2 inch
2.	Variation from the level or from the grades indicated on the drawings:	In any 10 feet of length ----------1/4 inch In any bay or in any 20 feet of length---------- 3/8 inch
	a. In arises, measured before removal of supporting shores	Maximum for entire length ---------- 3/4 inch
	b. In exposed conspicuous lines	In any bay or in any 20 feet of length ---------- ----- 1/4 inch Maximum for entire length---------- 1/2 inch
3.	Variation of the linear building lines from established position in plan	In any 20 feet --------- 1/2 inch Maximum ----------1 inch
4.	Variation of distance between walls	1/4 inch per 10 feet of distance, but not more than 1/2 inch in any one bay,and not more than 1 inch total variation
5.	Variation in the sizes and locations of sleeves, floor	Minus ---------- 1/4 inch Plus ---------- 1/2 inch

TABLE 1

TOLERANCES FOR FORMED SURFACES

	openings, and wall opening	
6.	Footings:	
	a. Variation of dimensions in plan	Minus ---------- 1/2 inch Plus ---------- 2 inches when formed or plus 3 inches when placed against unformed excavation
	b. Misplacement of eccentricity	2 percent of the footing width in the direction of misplacement but not more than 2 inches
	c. Reduction in thickness of specified thickness	Minus ---------- 5 percent
8.	Variation in steps:	Riser ---------- 1/8 inch
	a. In a flight of stairs	Tread ---------- 1/4 inch
	b. In consecutive steps	Riser ---------- 1/16 inch Tread ---------- 1/8 inch

-- End of Section --

SECTION 03150

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 111	(1983; R 2000) Inorganic Matter or Ash in Bituminous Materials

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1995) Basic Hardboard

ASTM INTERNATIONAL (ASTM)

ASTM A 1011	(2005) Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy and High-Strength Low-Alloy With Improved Formability
ASTM A 109	(2003) Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled
ASTM A 167	(2004) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 480	(2004a) General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
ASTM B 152	(2000) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 370	(2003) Copper Sheet and Strip for Building Construction
ASTM C 919	(2002) Use of Sealants in Acoustical Applications
ASTM C 920	(2005) Elastomeric Joint Sealants
ASTM D 1751	(2004) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D 1752	(2004a) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 2628	(1991; R 2005) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D 2835	(1989; R 2003) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements
ASTM D 4	(1986; R 2004) Bitumen Content
ASTM D 412	(1998a; R 2002e1) Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 471	(1998e1) Rubber Property - Effect of Liquids
ASTM D 5249	(1995; R 2000) Backer Material for Use with Cold-and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
ASTM D 6	(1995; R 2000e1) Loss on Heating of Oil and Asphaltic Compounds

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 513	(1974) Specifications for Rubber Waterstops
COE CRD-C 572	(1974) Specifications for Polyvinylchloride Waterstops

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval.

SD-02 Shop Drawings

Waterstops

Shop drawings and fabrication drawings provided by the manufacturer or prepared by the Contractor.

SD-03 Product Data

Preformed Expansion Joint Filler
Sealant
Waterstops

Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers (when required by sealant manufacturer); preformed compression seals; and waterstops. Manufacturer's recommended instructions for installing preformed

fillers, field-molded sealants; preformed compression seals; and waterstops; and for splicing non-metallic waterstops.

SD-04 Samples

Lubricant for Preformed Compression Seals

Specimens identified to indicate the manufacturer, type of material, size and quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 9 ft of 1 inch nominal width or wider seal or a piece not less than 12 ft of compression seal less than 1 inch nominal width. One quart of lubricant shall be provided.

Field-Molded Type

One gallon of field-molded sealant and one quart of primer (when primer is recommended by the sealant manufacturer) identified to indicate manufacturer, type of material, quantity, and shipment or lot represented.

Non-metallic Materials

Specimens identified to indicate manufacturer, type of material, size, quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 12 inch long cut from each 200 ft of finished waterstop furnished, but not less than a total of 4 ft of each type, size, and lot furnished. One splice sample of each size and type for every 50 splices made in the factory and every 10 splices made at the job site. The splice samples shall be made using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop. The total length of each splice shall be not less than 12 inches long.

SD-07 Certificates

Preformed Expansion Joint Filler
Sealant
Waterstops

Certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified.

1.3 DELIVERY AND STORAGE

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.1 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 1/8 inch thick tempered hardboard conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips

specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 3/8 inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

2.3 SEALANT

Joint sealant shall conform to the following:

2.3.1 Preformed Polychloroprene Elastomeric Type

ASTM D 2628.

2.3.2 Lubricant for Preformed Compression Seals

ASTM D 2835.

2.3.3 Field-Molded Type

ASTM C 920, Type M, Grade P or NS, Class 25, Use T for horizontal joints except interior non-traffic areas that use NT. Type M, Grade NS, Class 25, Use NT for vertical joints. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

2.4 WATERSTOPS

Intersection and change of direction waterstops shall be shop fabricated.

2.4.1 Flexible Metal

Copper waterstops shall conform to ASTM B 152 and ASTM B 370, O60 soft anneal temper and 20 oz mass per sq ft sheet thickness. Stainless steel waterstops shall conform to ASTM A 167 and ASTM A 480, UNS S30453 (Type 304L), and 20 gauge thick strip.

2.4.2 Rigid Metal

Flat steel waterstops shall conform to ASTM A 109, No. 2 (half hard) temper, No. 2 edge, No. 1 (matte or dull) finish or ASTM A 1011, Grade 40.

2.4.3 Non-Metallic Materials`

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

2.4.4 Non-Metallic Hydrophilic

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D 412 as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Hardness shall be 50 minimum on the type A durometer and the volumetric expansion ratio in distilled water at 70 degrees F shall be 3 to 1 minimum.

2.4.5 Preformed Elastic Adhesive

Preformed plastic adhesive waterstops shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler, and shall contain no solvents, asbestos, irritating fumes or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength.

2.4.5.1 Chemical Composition

The chemical composition of the sealing compound shall meet the requirements shown below:

PERCENT BY WEIGHT

COMPONENT	MIN.	MAX.	TEST
Bitumen (Hydrocarbon plastic)	50	70	ASTM D 4
Inert Mineral Filler	30	50	AASHTO T 111
Volatile Matter		2	ASTM D 6

2.4.5.2 Adhesion Under Hydrostatic Pressure

The sealing compound shall not leak at the joints for a period of 24 hours under a vertical 6 foot head pressure. In a separate test, the sealing compound shall not leak under a horizontal pressure of 10 psi which is reached by slowly applying increments of 2 psi every minute.

2.4.5.3 Sag of Flow Resistance

Sagging shall not be detected when tested as follows: Fill a wooden form 1 inch wide and 6 inches long flush with sealing compound and place in an oven at 135 degrees F in a vertical position for 5 days.

2.4.5.4 Chemical Resistance

The sealing compound when immersed separately in a 5% solution of caustic potash, a 5% solution of hydrochloric acid, 5% solution of sulfuric acid and a saturated hydrogen sulfide solution for 30 days at ambient room temperature shall show no visible deterioration.

PART 3 EXECUTION

3.1 JOINTS

Joints shall be installed at locations indicated and as authorized.

3.1.1 Contraction Joints

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a

steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Joints shall be approximately 1/8 inch wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

3.1.1.1 Joint Strips

Strips shall be of the required dimensions and as long as practicable. Joint strips shall not be used in areas where appearance is important or where concrete slabs are not covered. After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, the top portion of the strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC or HIPS strips shall be discarded and the insert left in place. True alignment of the strips shall be maintained during insertion.

3.1.1.2 Sawed Joints

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

3.1.2 Expansion Joints

Preformed expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust which shall be blown out of the groove with oil-free compressed air.

3.1.3 Joint Sealant

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

3.1.3.1 Joints With Preformed Compression Seals

Compression seals shall be installed with equipment capable of installing joint seals to the prescribed depth without cutting, nicking, twisting, or

otherwise distorting or damaging the seal or concrete and with no more than 5 percent stretching of the seal. The sides of the joint and, if necessary, the sides of the compression seal shall be covered with a coating of lubricant. Butt joints shall be coated with liberal applications of lubricant.

3.1.3.2 Joints With Field-Molded Sealant

Joints shall not be sealed when the sealant material, ambient air, or concrete temperature is less than 40 degrees F. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C 919 shall be followed. Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

3.2 WATERSTOPS, INSTALLATION AND SPLICES

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures.

3.2.1 Copper And Stainless Steel

Splices in copper waterstops shall be lap joints made by brazing. Splices in stainless steel waterstops shall be welded using a TIG or MIG process utilizing a weld rod to match the stainless. All welds shall not be annealed to maintain physical properties. Carbon flame shall not be used in the annealing process. Damaged waterstops shall be repaired by removing damaged portions and patching. Patches shall overlap a minimum of 1 inch onto undamaged portion of the waterstop.

3.2.2 Flat Steel

Splices in flat steel waterstops shall be properly aligned, butt welded, and cleaned of excessive material.

3.2.3 Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.

3.2.3.1 Rubber Waterstop

Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified

for PVC.

3.2.3.2 Polyvinyl Chloride Waterstop

Splices shall be made by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. The correct temperature shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

3.2.3.3 Quality Assurance

Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

3.2.4 Non-Metallic Hydrophilic Waterstop Installation

Ends to be joined shall be miter cut with sharp knife or shears. The ends shall be adhered with cyanacryiate (super glue) adhesive. When joining hydrophilic type waterstop to PVC waterstop, the hydrophilic waterstop shall be positioned as shown on the drawings. A liberal amount of a single component hydrophilic sealant shall be applied to the junction to complete the transition.

3.2.5 Preformed Plastic Adhesive Installation

The installation of preformed plastic adhesive waterstops shall be a prime, peel, place and pour procedure. Joint surfaces shall be clean and dry before priming and just prior to placing the sealing strips. The end of each strip shall be spliced to the next strip with a 1 inch overlap; the overlap shall be pressed firmly to release trapped air. During damp or cold conditions the joint surface shall be flashed with a safe, direct flame to warm and dry the surface adequately; the sealing strips shall be dipped in warm water to soften the material to achieve maximum bond to the concrete surface.

3.3 CONSTRUCTION JOINTS

Construction joints are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

-- End of Section --

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

ACI 318	(2005) Building Code Requirements for Structural Concrete and Commentary

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4	(1998) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 185	(2002) Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 615/A 615M	(2006a) Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
ASTM A 706/A 706M	(2006a) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM C 1116	(2003) Fiber-Reinforced Concrete and Shotcrete

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 1MSP	(2001) Manual of Standard Practice

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Reinforcement; G

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

SD-03 Product Data

Manufacturer's product data including percentages of post-consumer recycled content and post-industrial recycled content.

Manufacturer's letter certifying that products specified as regionally manufactured materials were manufactured in a facility within 500 miles from the project site. Provide a written statement of the cost of each product.

Welding

A list of qualified welders names.

SD-07 Certificates

Reinforcing Steel

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 85 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

1.3 WELDING

Welders shall be qualified in accordance with AWS D1.4. Qualification test shall be performed at the worksite and the Contractor shall notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4.

1.4 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 DOWELS

Dowels shall conform to ASTM A 615/A 615M, Grade 60.

2.2 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 706/A 706M, grades and sizes as indicated.

2.3 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185.

2.4 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.5 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI 1MSP and shall be steel or precast concrete blocks.

Precast concrete blocks shall have wire ties and shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

2.6 SYNTHETIC FIBER REINFORCEMENT

Synthetic fiber shall be polypropylene with a denier less than 100 and a nominal fiber length of 2 inches.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318 at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318 and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6 inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in

slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

3.4 SYNTHETIC FIBER REINFORCED CONCRETE

Fiber reinforcement shall be added to the concrete mix in accordance with the applicable sections of ASTM C 1116 and the recommendations of the manufacturer, and in an amount of 0.1 percent by volume.

-- End of Section --

SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

ACI 117/117R	(1990; R 2002) Standard Tolerances for Concrete Construction and Materials & Commentary
ACI 211.1	(1991; R 2002) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 211.2	(1998; R 2004) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 214.3R	(1988; R 1997) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 305R	(1999) Hot Weather Concreting
ACI 318	(2005) Building Code Requirements for Structural Concrete and Commentary

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(2005) Burlap Cloth Made from Jute or Kenaf

ASTM INTERNATIONAL (ASTM)

ASTM C 1017/C 1017M	(2003) Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1059	(1999) Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C 1064/C 1064M	(2005) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(2005a) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

ASTM C 1107	(2005) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1260	(2005) Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C 136	(2005) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 143/C 143M	(2005a) Slump of Hydraulic Cement Concrete
ASTM C 150	(2005) Portland Cement
ASTM C 1567	(2004) Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C 171	(2003) Sheet Materials for Curing Concrete
ASTM C 172	(2004) Sampling Freshly Mixed Concrete
ASTM C 173/C 173M	(2001e1) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 192/C 192M	(2005) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(2004) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2001) Air-Entraining Admixtures for Concrete
ASTM C 309	(2003) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31/C 31M	(2003a) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(2003) Concrete Aggregates
ASTM C 330	(2005) Lightweight Aggregates for Structural Concrete
ASTM C 39/C 39M	(2005) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42/C 42M	(2004) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 494/C 494M	(2005a) Chemical Admixtures for Concrete
ASTM C 552	(2003) Cellular Glass Thermal Insulation
ASTM C 567	(2005) Determining Density of Structural Lightweight Concrete
ASTM C 578	(2005) Rigid, Cellular Polystyrene Thermal

Insulation

ASTM C 591	(2001) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 618	(2005) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 78	(2002) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 881/C 881M	(2002) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 937	(2002) Grout Fluidifier for Preplaced-Aggregate Concrete
ASTM C 94/C 94M	(2004a) Ready-Mixed Concrete
ASTM C 940	(1998a; R 2003) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM C 989	(2005) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM D 1751	(2004) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 75	(2003) Sampling Aggregates
ASTM E 96/E 96M	(2005) Water Vapor Transmission of Materials

NATIONAL READY MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA QC 3	(2002) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities
NRMCA TMMB 100	(2001) Truck Mixer, Agitator and Front Discharge Concrete Carrier Standards

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete

COE CRD-C 540	(2001) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 572	(1974) Specifications for Polyvinylchloride Waterstops
COE CRD-C 94	(1966) Specification for Surface Retarders

1.2 UNIT PRICE CONTRACT

1.3 LUMP SUM CONTRACT

Under this type of contract concrete items will be paid for by lump sum and will not be measured. The work covered by these items consists of furnishing all concrete materials, reinforcement, miscellaneous embedded materials, and equipment, and performing all labor for the forming, manufacture, transporting, placing, finishing, curing, and protection of concrete in these structures.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Manufacturer's product data for concrete including percentages of post-consumer recycled content and post-industrial recycled content.

Manufacturer's letter certifying that products specified as regionally manufactured materials were manufactured in a facility within 500 miles from the project site. Provide a written statement of the cost of each product.

Manufacturer's product data or MSDS for all field applied coatings indicating coating systems meet or exceed the VOC and chemical component limits of Green Seal requirements.

Manufacturer's product data or MSDS for all field applied adhesives and sealants indicating adhesives that meet or exceed VOC limits of SCAQMD Rule #1168 and sealants meet or exceed Bay Area Resources Board Reg. 8, Rule 51.

Mixture Proportions; G

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies

have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

Lightweight Aggregate Concrete

Written recommendations from lightweight aggregate supplier on batching and mixing cycles.

Curing Compound

Written confirmation that the curing compound to be used on slabs is compatible with adhesive to be used for access floor pedestals.

SD-06 Test Reports

Testing and Inspection for Contractor Quality Control; G

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, silica fume, aggregate, admixtures, surface retarder and curing compound proposed for use on this project.

1.5 FIELD TEST PANELS

Field test panels shall be constructed prior to beginning of work using the materials and procedures proposed for use on the job, to demonstrate the results to be attained. The quality and appearance of each panel shall be subject to the approval of the Architect, and, if not judged satisfactory, additional panels shall be constructed until approval is attained. Formed or finished surfaces in the completed structure shall match the quality and appearance of the approved field example.

1.5.1 Sample Wall Panels

One sample panel at least 4 feet by 5 feet and 6 inches thick shall be constructed to demonstrate Class B formed finish and a similar one for Class A formed finish if directed by the Architect. Each panel shall include a full length and full width joint line and shall have at least two voids each at least 12 inches by 12 inches by 3 inches deep either impressed in the concrete as placed or chipped in the hardened concrete. After the concrete is 7 days old, the voids shall be patched to demonstrate the effectiveness and the appearance of the Contractor's repair procedures.

1.5.2 Slab Panels

A slab panel at least 4 feet by 5 feet and 4 inches thick shall be constructed to demonstrate exposed slab finish and a similar panel for slab finish beneath raised access floor. Each panel shall have a full length joint line.

1.6 SPECIAL REQUIREMENTS

A pre-installation meeting with the Contractor's Quality Control personnel will be required at least 10 days prior to start of construction for the

slabs-on-grade and elevated slabs. The Contractor shall be responsible for calling the meeting; the Project Superintendent and active installation personnel shall be present.

1.7 GENERAL REQUIREMENTS

1.7.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

1.7.1.1 Floors

For the purpose of this Section the following terminology correlation between ACI 117/117R and this Section shall apply:

Floor Profile Quality Classification From ACI 117/117R	This Section
Conventional Bullfloated	Same
Conventional Straightedged	Same
Flat	Float Finish or Trowel Finish

Levelness tolerance shall not apply where design requires floors to be sloped to drains or sloped for other reasons.

1.7.2 Strength Requirements and w/c Ratio

1.7.2.1 Strength Requirements

Specified compressive strength (f'c) shall be as follows:

COMPRESSIVE STRENGTH	STRUCTURE OR PORTION OF STRUCTURE
4000 psi at 28 days	All structural concrete except as noted otherwise
3500 psi at 28 days	Mow strips
3000 psi at 28 days	Duct banks

Concrete slabs on-grade shall have a 28-day flexural strength of 570 psi. Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength for concrete made with Type I or II portland cement. Compressive strength shall be determined in accordance with ASTM C 39/C 39M. Flexural strength shall be determined in accordance with ASTM C 78.

a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (6 by 12 inch cylinders) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39/C 39M. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'c and no individual test result falls below the specified strength f'c by more than

500 psi. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 500 psi or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42/C 42M. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Structural Engineer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.

c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

d. Evaluation of Concrete Flexural Strength. Flexural strength specimens (beams) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 78. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified flexural strength and no individual test result falls below the specified flexural strength by more than 50 psi. A "test" is defined as the average of two companion beams. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the slab is considered potentially deficient.

1.7.3 Air Entrainment

Except as otherwise specified for lightweight concrete, all normal weight

concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 3/4 inch or smaller it shall be between 4.5 and 7.5 percent. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with ASTM C 231. Lightweight concrete in the floor parts of the structure shall be air-entrained with a total air content of 4.5 to 7.5 percent, except that if the nominal maximum size coarse aggregate is 3/8 inch or less, the air content shall be 5.5 to 8.5 percent. Air content for lightweight concrete shall be determined in accordance with ASTM C 173/C 173M.

1.7.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143/C 143M.

Structural Element	Slump Minimum	Slump Maximum
Walls, columns and beams	2 in.	6 in.
Foundation walls, substructure walls, footings, slabs	2 in.	6 in.
Any structural concrete approved for placement by pumping:		
At pump	4 in.	6 in.
At discharge of line	4 in.	6 in.

When use of a plasticizing admixture conforming to ASTM C 1017/C 1017M or when a Type F or G high range water reducing admixture conforming to ASTM C 494/C 494M is permitted to increase the slump of concrete, concrete shall have a slump of 2 to 5 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added. For troweled floors, slump of structural lightweight concrete with normal weight sand placed by pump shall not exceed 8 inches at the point of placement. For other slabs, slump of lightweight concrete shall not exceed 8 inches at point of placement.

1.7.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 90 degrees F. When the ambient temperature during placing is 40 degrees F or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 55 and 75 degrees F.

1.7.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

1.7.7 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

1.7.8 Lightweight Aggregate Structural Concrete

Lightweight aggregate structural concrete shall conform to the requirements specified for normal weight concrete except as specified herein. Specified compressive strength shall be at least 4000 at 28 days, as determined by test specimens that have been air dried at 50 percent relative humidity for the last 21 days. Air-dry unit weight shall be not over 113 pcf at 28 days as determined by ASTM C 567. However, fresh unit weight shall be used for acceptance during concreting, using a correlation factor between the two types of unit weight as determined during mixture design studies.

1.7.9 Technical Service for Specialized Concrete

The services of a factory trained technical representative shall be obtained to oversee proportioning, batching, mixing, placing, consolidating, and finishing of specialized structural concrete, such as lightweight concrete. The technical representative shall be on the job full time until the Contractor's Quality Control is satisfied that field controls indicate concrete of specified quality is furnished and that the Contractor's crews are capable of continued satisfactory work. The technical representative shall be available for consultation with, and advice to, Government forces.

1.8 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

1.8.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Except as specified for flexural strength concrete, mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39/C 39M. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in subparagraph Water-Cement Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where GGBF slag is used, the weight of the GGBF slag shall be included in the equations in ACI 211.1 for the term P, which is used to denote the weight

of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192/C 192M. They shall be tested at 7 and 28 days in accordance with ASTM C 39/C 39M. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

1.8.2 Proportioning Studies for Lightweight Aggregate Structural Concrete

Trial design batches, mixture proportioning studies, and testing requirements shall conform to the requirements specified in paragraph Proportioning Studies for Normal Weight Concrete, except as follows. Trial mixtures having proportions, consistencies and air content suitable for the work shall be made based on methodology described in ACI 211.2, using at least three different cement contents. Trial mixes shall be proportioned to produce air dry unit weight and concrete strengths specified in paragraph GENERAL REQUIREMENTS. Trial mixtures shall be proportioned for maximum permitted slump and air content. Test specimens and testing shall be as specified for normal weight concrete except that 28-day compressive strength shall be determined from test cylinders that have been air dried at 50 percent relative humidity for the last 21 days. Air dry unit weight shall be determined in accordance with ASTM C 567 and shall be designed to be at least 2.0 pcf less than the maximum specified air dry unit weight in paragraph GENERAL REQUIREMENTS. Curves shall be plotted using these results showing the relationship between cement factor and strength and air dry unit weight. Normal weight fine aggregate may be substituted for part or all of the lightweight fine aggregate, provided the concrete meets the strength and unit weight. A correlation shall also be developed showing the ratio between air dry unit weight and fresh concrete unit weight for each mix.

1.8.3 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength (f'cr) exceeding the specified compressive strength (f'c) by the amount indicated below. This required average compressive strength, f'cr, will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below f'cr during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'cr, the mixture shall be adjusted, as approved, to bring the daily average back up to f'cr. During production, the required f'cr shall be adjusted, as appropriate, based on the standard

deviation being attained on the job.

1.8.3.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths (f'c) within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'cr used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

f'cr = f'c + 1.34S where units are in psi

f'cr = f'c + 2.33S - 500 where units are in psi

Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

1.8.3.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength f'cr shall be determined as follows:

a. If the specified compressive strength f'c is 3,000 to 5,000 psi,

f'cr = f'c + 1,200 psi

1.9 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site

for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

1.10 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

1.10.1 Materials

The Contractor's independet testing laboratory may sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials may be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

1.10.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

1.10.3 Hardened Concrete

Tests on hardened concrete will be performed by the Contractor's independent testing laboratory when such tests are considered necessary.

1.10.4 Inspection

Concrete operations may be tested and inspected by the Contractor's independent testing laboratory as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement, portland blast-furnace slag cement, or portland cement in combination with pozzolan or ground granulated blast furnace slag and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

2.1.1 Portland Cement

ASTM C 150, Type I low alkali with a maximum 15 percent amount of

tricalcium aluminate, or Type II low alkali including false set requirements or Type V. White portland cement shall meet the above requirements except that it may be Type I, Type II or Type III low alkali. White Type III shall be used only in specific areas of the structure, when approved in writing.

2.1.2 High-Early-Strength Portland Cement

ASTM C 150, Type III with tricalcium aluminate limited to 5 percent. Type III cement shall be used only in isolated instances and only when approved in writing.

2.1.3 Pozzolan (Fly Ash)

Pozzolan shall conform to ASTM C 618, Class C or F, including low alkali multiple factor, drying shrinkage, uniformity,,and moderate sulfate resistance requirements in Table 3 of ASTM C 618. Requirement for maximum alkalies from Table 1A of ASTM C 618 shall apply. If pozzolan is used, it shall never be less than 15 percent nor more than 25 percent by weight of the total cementitious material. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.1.4 Ground Granulated Blast-Furnace (GGBF) Slag

ASTM C 989, Grade 120.

2.2 AGGREGATES

Fine and coarse aggregates shall "be tested and evaluated for alkali-aggregate reactivity in accordance with ASTM C 1260. The fine and coarse aggregates shall be evaluated separately and in combination, which matches the Contractor's proposed mix design proportioning. All results of the separate and combination testing shall have a measured expansion less than 0.10 (0.08) percent at 16 days after casting. Should the test data indicate an expansion of 0.10 (0.08) percent or greater, the aggregate(s) shall be rejected or additional testing using ASTM C 1260 and ASTM C 1567 shall be performed. The additional testing using ASTM C 1260 and ASTM C 1567 shall be performed using the low alkali portland cement in combination with ground granulated blast furnace (GGBF) slag, or Class F fly ash. GGBF slag shall be used in the range of 40 to 50 percent of the total cementitious material by mass. Class F fly ash shall be used in the range of 25 to 40 percent of the total cementitious material by mass."

2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.

2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S, size designation to vary with the thickness of the concrete element.

2.2.3 Lightweight Aggregate

Lightweight fine and coarse aggregate shall conform to the quality and gradation requirements of ASTM C 330, size 3/4" for coarse aggregate. Lightweight aggregate shall be prewetted in accordance with the

Manufacturer's instructions unless otherwise specified. For pumped concrete, prewetting shall be sufficient to ensure that slump loss through the pump line does not exceed 4 inches.

2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.3.1 Air-Entraining Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

2.3.2 Accelerating Admixture

ASTM C 494/C 494M, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

2.3.3 Water-Reducing or Retarding Admixture

ASTM C 494/C 494M, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

2.3.4 High-Range Water Reducer

ASTM C 494/C 494M, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.3.5 Surface Retarder

COE CRD-C 94.

2.3.6 Expanding Admixture

Aluminum powder type expanding admixture conforming to ASTM C 937.

2.3.7 Other Chemical Admixtures

Chemical admixtures for use in producing flowing concrete shall comply with ASTM C 1017/C 1017M, Type I or II. These admixtures shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.4 CURING MATERIALS

2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

2.4.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or

2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient or access flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, raised access floor pedestal adhesive or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

2.4.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

2.6 NONSHRINK GROUT

Nonshrink grout shall conform to ASTM C 1107 and shall be a commercial formulation suitable for the proposed application.

2.7 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to ASTM C 1059.

2.8 EPOXY RESIN

Epoxy resins for use in repairs shall conform to ASTM C 881/C 881M, Type V, Grade 2. Class as appropriate to the existing ambient and surface temperatures.

2.9 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel. Inserts for shelf angles and bolt hangers shall be of malleable iron or cast or wrought steel.

2.10 PERIMETER INSULATION

Perimeter insulation shall be polystyrene conforming to ASTM C 578, Type II; polyurethane conforming to ASTM C 591, Type II; or cellular glass conforming to ASTM C 552, Type I or IV. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.11 VAPOR BARRIER

Install vapor barrie as indicated on drawings. Vapor barrier shall be polyethylene sheeting with a minimum thickness of 6 mils or other equivalent material having a vapor permeance rating not exceeding 0.5 perms as determined in accordance with ASTM E 96/E 96M.

2.12 JOINT MATERIALS

2.12.1 Joint Fillers, Sealers, and Waterstops

Expansion joint fillers shall be preformed materials conforming to ASTM D 1751. Materials for waterstops shall be in accordance with Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS. Materials for and sealing of joints shall conform to the requirements of Section 07920 JOINT SEALANTS.

2.12.2 Contraction Joints in Slabs

Sawable type contraction joint inserts shall conform to COE CRD-C 540. Nonsawable joint inserts shall have sufficient stiffness to permit placement in plastic concrete without undue deviation from a straight line and shall conform to the physical requirements of COE CRD-C 540, with the exception of Section 3.4 "Resistance to Sawing". Plastic inserts shall be polyvinyl chloride conforming to the materials requirements of COE CRD-C 572.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section 03100 STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section 03200 CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.1.1 Foundations

3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

3.1.1.2 Preparation of Rock

Rock surfaces upon which concrete is to be placed shall be free from oil, standing or running water, ice, mud, drummy rock, coating, debris, and loose, semidetached or unsound fragments. Joints in rock shall be cleaned to a satisfactory depth, as determined by the Contracting Officer, and to firm rock on the sides. Immediately before the concrete is placed, rock surfaces shall be cleaned thoroughly by the use of air-water jets or sandblasting as specified below for Previously Placed Concrete. Rock

surfaces shall be kept continuously moist for at least 24 hours immediately prior to placing concrete thereon. All horizontal and approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar proportioned similar to that in the concrete mixture. Concrete shall be placed before the mortar stiffens.

3.1.1.3 Excavated Surfaces in Lieu of Forms

Concrete for footings may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section 02300 EARTHWORK. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances.

3.1.2 Previously Placed Concrete

3.1.2.1 Waste Disposal

The method used in disposing of waste water employed in cutting, washing, and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor, or affect exposed surfaces of the structures, or damage the environment of the project area. The method of disposal shall be subject to approval.

3.1.2.2 Preparation of Previously Placed Concrete

Concrete surfaces to which other concrete is to be bonded shall be abraded in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be thoroughly washed and shall be moist but without free water when concrete is placed.

3.1.3 Vapor Barrier

Vapor barrier shall be provided beneath the interior on-grade concrete floor slabs which do not receive methane protection. The greatest widths and lengths practicable shall be used to eliminate joints wherever possible. Joints shall be lapped a minimum of 12 inches. Torn, punctured, or damaged vapor barrier material shall be removed and new vapor barrier shall be provided prior to placing concrete. For minor repairs, patches may be made using laps of at least 12 inches. Lapped joints shall be sealed and edges patched with pressure-sensitive adhesive or tape not less than 2 inches wide and compatible with the membrane. Vapor barrier shall be placed directly on underlying subgrade, base course, or capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier. In this case, a thin layer of approximately 1/2 inch of fine graded material should be rolled or compacted over the fill before installation of the vapor barrier to reduce the possibility of puncture. Concrete placement shall be controlled so as to prevent damage to the vapor barrier.

3.1.4 Perimeter Insulation

Perimeter insulation shall be installed at locations indicated on the drawings. Adhesive shall be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

3.1.5 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Tack welding shall not be performed on or to embedded items unless approved by the Structural Engineer.

3.2 CONCRETE PRODUCTION

3.2.1 General Requirements

Concrete shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94/C 94M, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB 100. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete. Site-mixed concrete shall conform to the following subparagraphs.

3.3 LIGHTWEIGHT AGGREGATE CONCRETE

In addition to the requirements specified for normal weight concrete, lightweight aggregate concrete shall conform to the following. The batching and mixing cycle shall be as directed based on written recommendations from the aggregate supplier which the Contractor shall furnish. Unless otherwise directed, the mixer shall be charged with approximately 2/3 of the total mixing water and all of the aggregate. This shall be mixed for at least 1.5 minutes in a stationary mixer or 15 revolutions at mixing speed in a truck mixer. The remaining ingredients shall then be added and mixing continued as specified for normal weight concrete. Lightweight aggregate concrete shall not be vibrated to the extent that large particles of aggregate float to the surface. During finishing, lightweight aggregate concrete shall not be worked to the extent that mortar is driven down and lightweight coarse aggregate appears at the surface. Lightweight aggregate concrete to be pumped shall have a cement content of at least 564 lb/cu. yd.

3.4 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in truck mixers. Nonagitating equipment, other than pumps, shall not be used for transporting lightweight aggregate concrete.

3.5 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

3.5.1 Buckets

The interior hopper slope shall be not less than 58 degrees from the

horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 2 square feet. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 2 cubic yards shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

3.5.2 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required. Separate chutes and other similar equipment will not be permitted for conveying concrete unless approved by the Structural Enginer.

3.5.3 Belt Conveyors

Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means, such as discharge baffle or hopper , for preventing segregation of the concrete at the transfer points and the point of placing. Belt conveyors shall be constructed such that the idler spacing shall not exceed 36 inches. The belt speed shall be a minimum of 300 feet per minute and a maximum of 750 feet per minute. If concrete is to be placed through installed horizontal or sloping reinforcing bars, the conveyor shall discharge concrete into a pipe or elephant truck that is long enough to extend through the reinforcing bars.

3.5.4 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 4 inches. Aluminum pipe shall not be used.

3.6 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 60 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

3.6.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 48 inches thick, except that all slabs shall be placed in a single lift. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

3.6.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.025 inch, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1.5 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segration or flotation of coarse aggregate shall be prevented. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

3.6.3 Cold Weather Requirements

Special protection measures, approved by the structural engineer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 40 degrees F. The temperature of the concrete when placed shall be not less than 50 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice,

snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C 494/C 494M, Type C or E may be used, provided it contains no calcium chloride. Calcium chloride shall not be used.

3.6.4 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 85 degrees F, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064/C 1064M. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature Degrees
Greater than 60	90 F
40-60	85 F
Less than 40	80 F

3.6.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Excessive plastic shrinkage cracks that occur in exposed slabs shall be filled by injection of epoxy resin as directed by the Structural Engineer, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.6.6 Placing Concrete in Congested Areas

Special care shall be used to ensure complete filling of the forms, elimination of all voids, and complete consolidation of the concrete when placing concrete in areas congested with reinforcing bars, embedded items, waterstops and other tight spacing. An appropriate concrete mixture shall be used, and the nominal maximum size of aggregate (NMSA) shall meet the specified criteria when evaluated for the congested area. Vibrators with heads of a size appropriate for the clearances available shall be used, and the consolidation operation shall be closely supervised to ensure complete and thorough consolidation at all points. Where necessary, splices of

reinforcing bars shall be alternated to reduce congestion. Where two mats of closely spaced reinforcing are required, the bars in each mat shall be placed in matching alignment to reduce congestion.

3.6.7 Placing Flowable Concrete

If a plasticizing admixture conforming to ASTM C 1017/C 1017M is used or if a Type F or G high range water reducing admixture is permitted to increase the slump, the concrete shall meet all requirements of paragraph GENERAL REQUIREMENTS in PART 1. Extreme care shall be used in conveying and placing the concrete to avoid segregation. Consolidation and finishing shall meet all requirements of paragraphs Placing Concrete, Finishing Formed Surfaces, and Finishing Unformed Surfaces. No relaxation of requirements to accommodate flowable concrete will be permitted.

3.7 JOINTS

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 2 inches clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 30 pound asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints indicated on the drawings to be sealed shall be cleaned and sealed as indicated and in accordance with Section 07920 JOINT SEALANTS.

3.7.1 Construction Joints

Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the structural engineer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, a strip of 1 inch square-edge lumber, bevelled and oiled to

facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

3.7.2 Contraction Joints in Slabs on Grade

Contraction joints shall be located and detailed as shown on the drawings. Contraction Joints shall be produced by forming a weakened plane in the concrete slab by sawing a continuous slot with a concrete saw. Regardless of method used to produce the weakened plane, it shall be 1/4 the depth of the slab thickness and between 1/8 and 3/16 inch wide. For saw-cut joints, cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent ravelling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Reservoir for joint sealant shall be formed as previously specified.

3.7.3 Expansion Joints

Installation of expansion joints and sealing of these joints shall conform to the requirements of Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS and Section 07920 JOINT SEALANTS.

3.7.4 Waterstops

Waterstops shall be installed in conformance with the locations and details shown on the drawings using materials and procedures specified in Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

3.7.5 Dowels and Tie Bars

Dowels and tie bars shall be installed at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section 03200 CONCRETE REINFORCEMENT and herein. Conventional smooth "paving" dowels shall be installed in slabs using approved methods to hold the dowel in place during concreting within a maximum alignment tolerance of 1/8 inch in 12 inches. "Structural" type deformed bar dowels, or tie bars, shall be installed to meet the specified tolerances. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

3.8 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section 03100 STRUCTURAL CONCRETE FORMWORK. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class B finish. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any

location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/117R. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs on walls scheduled to remain exposed shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract and, for Class A and B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

3.8.1 Class B Finish

Class B finish is required for all walls required to remain exposed. Fins, ravelings, and loose material shall be removed, all surface defects over 1/2 inch in diameter or more than 1/2 inch deep, shall be repaired and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Defects more than 1/2 inch in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep. The Contractor shall prepare a sample panel for approval (as specified in PART 1) before commencing repair, showing that the surface texture and color match will be attained. Metal tools shall not be used to finish repairs in Class A surfaces.

3.8.2 Class C and Class D Finish

Class C finish is required for all walls not exposed to view unless indicated on the drawings. Fins, ravelings, and loose material shall be removed, and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 1/2 inch deep or more than 2 inches in diameter shall be repaired. Defects more than 2 inches in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

3.8.3 Architectural and Special Finishes

Architectural concrete finishes are specified in Section 03330 CAST-IN-PLACE ARCHITECTURAL CONCRETE. Special finishes shall conform to the requirements specified herein.

3.8.3.1 Smooth Finish

After other concrete construction is complete in each overall separate contiguous area of the structure, smooth finish shall be applied to the areas indicated on the drawings. A mortar mix consisting of one part portland cement and two parts well-graded sand passing a No. 30 sieve, with water added to give the consistency of thick paint, shall be used. Where the finished surface will not receive other applied surface, white cement shall be used to replace part of the job cement to produce an approved color, which shall be uniform throughout the surfaces of the structure.

After the surface has been thoroughly wetted and allowed to approach surface dryness, the mortar shall be vigorously applied to the area by clean burlap pads or by cork or wood-floating, to completely fill all surface voids. Excess grout shall be scraped off with a trowel. As soon as it can be accomplished without pulling the mortar from the voids, the area shall be rubbed with burlap pads having on their surface the same sand-cement mix specified above but without any mixing water, until all of the visible grout film is removed. The burlap pads used for this operation shall be stretched tightly around a board to prevent dishing the mortar in the voids. The finish of any area shall be completed in the same day, and the limits of a finished area shall be made at natural breaks in the surface. The surface shall be membrane cured or continuously moist cured for 48 hours commencing immediately after finishing operations in each area. The temperature of the air adjacent to the surface shall be not less than 50 degrees F for 24 hours prior to, and 48 hours after, the application. In hot, dry weather the smooth finish shall be applied in shaded areas or at night, and shall never be applied when there is significant hot, dry wind.

3.9 REPAIRS

3.9.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 4 inches shall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the No. 16 mesh sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use if required by the manufacturer. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured or membrane cured for at least 48 hours.

3.9.2 Repair of Major Defects

Major defects will be considered to be those more than 1/2 inch deep or, for Class B finishes, more than 1/2 inch in diameter and, for Class C and D finishes, more than 2 inches in diameter. Also included are any defects of any kind whose depth is over 4 inches or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

3.9.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 2 inches on all sides. All such defective areas greater than 12 square inches shall be outlined by saw cuts at least 1 inch deep. Defective areas less than 12 square inches shall be outlined

by a 1 inch deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured or membrane cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet. In lieu of this process, al alternate product and procedue may be submitted for approval and used in accordance with manufacturer's instructions.

3.9.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 6 inches deep and also have an average diameter at the surface more than 18 inches or that are otherwise so identified by the Contractor's quality control representative. Such defects shall be repaired as specified herein or directed, except that defects which affect the strength of the structure shall not be repaired and that portion of the structure shall be completely removed and replaced. Deep and large defects shall be repaired by procedures approved in advance including forming and placing special concrete using applied pressure during hardening. Preparation of the repair area shall be as specified for surface application of mortar. In addition, the top edge (surface) of the repair area shall be sloped at approximately 20 degrees from the horizontal, upward toward the side from which concrete will be placed. The special concrete shall be a concrete mixture with low water content and low slump, and shall be allowed to age 30 to 60 minutes before use. Concrete containing a specified expanding admixture may be used in lieu of the above mixture; the paste portion of such concrete mixture shall be designed to have an expansion between 2.0 and 4.0 percent when tested in accordance with ASTM C 940. A full width "chimney" shall be provided at the top of the form on the placing side to ensure filling to the top of the opening. A pressure cap shall be used on the concrete in the chimney with simultaneous tightening and revibrating the form during hardening to ensure a tight fit for the repair. The form shall be removed after 24 hours and immediately the chimney shall be carefully chipped away to avoid breaking concrete out of the repair; the

surface of the repair concrete shall be dressed as required.

3.10 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in PART 1, when tested as specified herein.

3.10.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 50 degrees F. In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted unless approved by the Structural Engineer. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any exposed slabs with surfaces which exhibit significant crazing as determined by the Structural Engineershall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

3.10.2 Rough Slab Finish

As a first finishing operation for unformed surfaces and as final finish for slabs to receive mortar setting beds, the surface shall receive a rough slab finish prepared as follows. Areas indicated on the drawings shall receive only a rough slab finish. The concrete shall be uniformly placed across the slab area, consolidated as previously specified, and then screeded with straightedge strikeoffs immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible. Side forms and screed rails shall be provided, rigidly supported, and set to exact line and grade. Allowable tolerances for finished surfaces apply only to the hardened concrete, not to forms or screed rails. Forms and screed rails shall be set true to line and grade.

3.10.3 Floated Finish

Slabs to receive more than a rough slab finish shall next be given a float finish. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 1/4 inch and the water sheen has disappeared, it shall be floated to a true and even plane

free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment. Sufficient pressure shall be used on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum. Lightweight concrete or concrete that exhibits stickiness shall be floated with a magnesium float. Care shall be taken to prevent over-finishing or incorporating water into the surface.

3.10.4 Troweled Finish

Areas as indicated on the drawings shall be given a trowel finish. After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. Additional trowelings shall be performed, either by hand or machine until the surface has been troweled 2 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

3.10.5 Non-Slip Finish

Non-slip floors shall be constructed in accordance with the following subparagraphs.

3.10.5.1 Broomed

Areas as indicated on the drawings shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a coarse fiber push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab. After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

3.10.5.2 Abrasive Aggregate

Areas as indicated on the drawings shall be given an abrasive aggregate finish. The concrete surface shall be given a float finish. Abrasive aggregate shall then immediately be uniformly sprinkled over the floated surface at a total rate of not less than 0.25 psf spread in two applications at right angles to each other. The surface shall then be troweled to a smooth, even finish that is uniform in texture and appearance and free from blemishes including trowels marks. Immediately after curing, cement paste and laitance covering the abrasive aggregate shall be removed by steel brushing, rubbing with abrasive stone, or sandblasting to expose the abrasive particles.

3.11 EXTERIOR SLAB AND RELATED ITEMS

3.11.1 Pits and Trenches

Pits and trenches shall be constructed as indicated on the drawings. Bottoms and walls shall be placed monolithically or waterstops and keys, shall be provided as approved.

3.12 CURING AND PROTECTION

3.12.1 General

Concrete shall be cured by an approved method for the period of time given below:

Concrete with Type III cement	3 days
All other concrete	7 days

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded. Except for plastic coated burlap, impervious sheeting alone shall not be used for curing.

3.12.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void if removed prior to end of curing period. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

3.12.3 Membrane Forming Curing Compounds

Membrane curing shall not be used on surfaces that are to receive any

subsequent treatment depending on adhesion or bonding to the concrete, including surfaces to which a smooth finish is to be applied or other concrete to be bonded. However, a styrene acrylate or chlorinated rubber compound meeting ASTM C 309, Class B requirements, may be used for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. All surfaces shall be thoroughly moistened with water. Curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. The curing compound shall be applied in a two-coat continuous operation by motorized power-spraying equipment recommended by the manufacturer, at a uniform coverage of not more than 400 square feet/gallon for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. Surfaces on which clear compound is used shall be shaded from direct rays of the sun for the first 3 days if recommended by the manufacturer. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

3.12.4 Impervious Sheeting

Except for plastic coated burlap, impervious sheeting alone shall not be used for curing. Impervious-sheet curing shall only be used on horizontal or nearly horizontal surfaces. Surfaces shall be thoroughly wetted and be completely covered with the sheeting. Sheeting shall be at least 18 inches wider than the concrete surface to be covered. Covering shall be laid with light-colored side up. Covering shall be lapped not less than 12 inches and securely weighted down or shall be lapped not less than 4 inches and taped to form a continuous cover with completely closed joints. The sheet shall be weighted to prevent displacement so that it remains in contact with the concrete during the specified length of curing. Coverings shall be folded down over exposed edges of slabs and secured by approved means. Sheets shall be immediately repaired or replaced if tears or holes appear during the curing period.

3.12.5 Ponding or Immersion

Concrete shall be continually immersed throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete.

3.12.6 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 32 degrees F the temperature of the concrete shall be maintained above 40 degrees F for the first seven days after placing. During the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 25 degrees F as determined by suitable temperature measuring devices furnished by the Contractor, as required, and

installed adjacent to the concrete surface and 2 inches inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor as directed.

3.13 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation with nonshrink grout. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed. Nonshrink grout shall be used for column bases.

3.13.1 Nonshrink Grout

Nonshrink grout shall be a ready-mixed material requiring only the addition of water. Water content shall be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

3.13.1.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified therein. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, the batch shall be mixed for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. The space between the top of the concrete or machinery-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for completely retaining the grout on all sides and on top and shall be removed after the grout has set. The placed grout shall be carefully worked by rodding or other means to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be retempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces receiving the grout, shall be maintained in accordance with manufacturer's instructions until after setting.

3.13.1.2 Treatment of Exposed Surfaces

For metal-oxidizing nonshrink grout, exposed surfaces shall be cut back 1 inch and immediately covered with a parge coat of mortar consisting of 1 part portland cement and 2-1/2 parts fine aggregate by weight, with sufficient water to make a plastic mixture. The parge coat shall have a smooth finish. For other mortars or grouts, exposed surfaces shall have a smooth-dense finish and be left untreated. Curing shall comply with paragraph CURING AND PROTECTION.

3.14 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Structural Engineer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with

ASTM C 1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site. The Government may inspect the laboratory, equipment, and test procedures prior to start of concreting operations and periodically thereafter for conformance with ASTM C 1077.

3.14.1 Grading and Corrective Action

3.14.1.1 Fine Aggregate

At least once per week when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with ASTM C 136 and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall immediately reported to the Contractor's quality control representative, concreting shall be stopped, and immediate steps taken to correct the grading.

3.14.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C 136 for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contractor's quality control representative. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and shall be reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

3.14.2 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests for aggregate quality required by ASTM C 33. In addition, after the start of concrete placement, the Contractor shall perform tests for aggregate quality at least every three months, and when the source of aggregate or aggregate quality changes. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

3.14.3 Scales, Batching and Recording

The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every three months. Such tests

shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, the Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

3.14.4 Batch-Plant Control

The measurement of concrete materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate weights and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic yard amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic yard for each class of concrete batched during each day's plant operation.

3.14.5 Concrete Mixture

a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with ASTM C 231 for normal weight concrete and ASTM C 173/C 173M for lightweight concrete. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph Air Entrainment. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible

for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the air content at the mixer controlled as directed.

b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good reproducibility. Whenever a point on either control chart reaches an action limit line, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted.

c. Slump Testing. In addition to slump tests which shall be made when test specimens are fabricated, periodic additional slump tests shall be made on randomly selected batches in accordance with ASTM C 143/C 143M for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Limits shall be set on separate control charts for slump for each type of mixture. The upper warning limit shall be set at 1/2 inch below the maximum allowable slump specified in paragraph Slump in PART 1 for each type of concrete and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 2 inches. Samples for slump shall be taken at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an adjustment shall immediately be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water

content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, the concreting operation shall immediately be halted, and the Contractor shall take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.

e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064/C 1064M. The temperature shall be reported along with the compressive strength data.

f. Strength Specimens. At least one set of test specimens shall be made, for compressive or flexural strength as appropriate, on each different concrete mixture placed during the day for each 500 cubic yards or portion thereof of that concrete mixture placed each day. Additional sets of test specimens shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A truly random (not haphazard) sampling plan shall be developed by the Contractor and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength per paragraph Strength Requirements in PART 1 shall consist of four specimens, two to be tested at 7 days and two at 28 days. Test specimens shall be molded and cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39/C 39M for test cylinders and ASTM C 78 for test beams. Results of all strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in paragraph Strength Requirements in PART 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in ACI 214.3R.

3.14.6 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.14.7 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of

placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

3.14.8 Vibrators

The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing. Any vibrator not meeting the requirements of paragraph Consolidation, shall be immediately removed from service and repaired or replaced.

3.14.9 Curing Inspection

a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.

b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.

c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the Contractor shall estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, shall compute the rate of coverage in square feet/gallon, and shall note whether or not coverage is uniform.

d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

e. Sheet Curing Inspection. At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.

f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period

for those areas shall be extended by 1 day.

3.14.10 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.14.11 Mixer Uniformity

a. Stationary Mixers. Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 75,000 cubic yards of concrete placed, whichever results in the shortest time interval, uniformity of concrete mixing shall be determined in accordance with ASTM C 94/C 94M.

b. Truck Mixers. Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94/C 94M. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.

c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

3.14.12 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

-- End of Section --

SECTION 03411

PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991; R 2002) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 211.2	(1998; R 2004) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 305R	(1999) Hot Weather Concreting
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting
ACI 318/318R	(2005) Building Code Requirements for Structural Concrete and Commentary
ACI 517.2R	(1987; R 1992) Accelerated Curing of Concrete at Atmospherinc Pressure

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

ACPA 01-102	(2000) Concrete Pipe Handbook
ACPA 01-110	(1984) Design Manual for Sulfide and Corrosion Prediction and Control
ACPA QPC	(2005; Ver 3.0) QCast Plant Certification Manual

ASTM INTERNATIONAL (ASTM)

ASTM A 36/A 36M	(2005) Carbon Structural Steel
ASTM A 82/A 82M	(2005a) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 153/A 153M	(2005) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 185/A 185M	(2006; E 2006) Steel Welded Wire Reinforcement, Plain, for Concrete

ASTM A 496/A 496M	(2005) Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497/A 497M	(2006; E 2006) Steel Welded Wire Reinforcement, Deformed, for Concrete
ASTM A 615/A 615M	(2005a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 706/A 706M	(2006a) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 775/A 775M	(2004a) Epoxy-Coated Reinforcing Steel Bars
ASTM A 884/A 884M	(2004) Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM C 31/C 31M	(2003a) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(2003) Concrete Aggregates
ASTM C 39/C 39M	(2004a) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 138/C 138M	(2001a) Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 143/C 143M	(2005) Slump of Hydraulic Cement Concrete
ASTM C 150	(2005) Portland Cement
ASTM C 171	(2003) Sheet Materials for Curing Concrete
ASTM C 173/C 173M	(2001e1) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 192/C 192M	(2005) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(2004) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2001) Air-Entraining Admixtures for Concrete
ASTM C 309	(2003) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 330	(2005) Lightweight Aggregates for Structural Concrete
ASTM C 443	(2005) Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 595	(2005) Blended Hydraulic Cements
ASTM C 877	(2002; E 2005) External Sealing Bands for Concrete Pipe, Manholes, and Precast Box

Sections

ASTM C 891	(1990; R 2003) Installation of Underground Precast Concrete Utility Structures
ASTM C 920	(2005) Elastomeric Joint Sealants
ASTM C 923	(2002) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C 989	(2005) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 990	(2003a) Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C 1064/C 1064M	(2005) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1107	(2005) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1244	(2005a; E 2006) Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
ASTM C 1478	(2006) Storm Drain Resilient Connectors Between Reinforced Concrete Storm Sewer Structures, Pipes and Laterals

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2006) Structural Welding Code - Steel
AWS D1.4/D1.4M	(2005) Structural Welding Code - Reinforcing Steel

NATIONAL PRECAST CONCRETE ASSOCIATION (NPCA)

NPCA QC Manual	(2005; R 2006) Quality Control Manual for Precast Plants

1.2 SUBMITTALS

All submittals are the responsibility of the precast concrete producer. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control Procedures

Quality control procedures established by the precast manufacturer in accordance with NPCA QC Manual and/or ACPA QPC.

SD-02 Shop Drawings

Standard Precast Units; G

Drawings for standard precast concrete units furnished by the precast concrete producer for approval by the Contractor's Quality Control Representative. These drawings shall demonstrate that the applicable industry design standards have been met. Include installation and construction information on shop drawings. Include details of steel reinforcement size and placement as well as supporting design calculations, if appropriate. Produce precast concrete units in accordance with the approved drawings.

Custom-Made Precast Units; G

Drawings for custom-made precast concrete units furnished by the precast concrete producer for approval by the Contractor's Quality Control Representative. Show on these drawings complete design, installation, and construction information in such detail as to enable the Contractor's Quality Control Representative to determine the adequacy of the proposed units for the intended purpose. Include details of steel reinforcement size and placement as well as supporting design calculations, if appropriate. Produce precast concrete units in accordance with the approved drawings.

SD-03 Product Data

Standard Precast Units

Cut sheets, for standard precast concrete units, showing conformance to project drawings and requirements, and to applicable industry design standards listed in this specification.

Proprietary Precast Units

Standard plans or informative literature, for proprietary precast concrete units. Make available supporting calculations and design details upon request. Provide sufficient information as to demonstrate that such products will perform the intended task.

Embedded Items

Product data sheets and proper installation instruction for anchors, lifting inserts and other devices. Clearly indicate the products dimensions and safe working load.

Accessories

Proper installation instructions and relevant product data for items including, but not limited to, sealants, gaskets, connectors, steps, cable racks and other items installed before or after delivery.

SD-05 Design Data

Design Calculations
Concrete Mix Proportions

Precast concrete unit design calculations, and concrete mix proportions.

SD-06 Test Reports

Test Reports

a. Copies of material certifications and/or laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolans, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

b. Copies of test reports showing that the mix has been successfully tested to produce concrete with the properties specified and will be suitable for the job conditions. Such tests may include compressive strength, flexural strength, plastic or hardened air content, freeze thaw durability, abrasion and absorption. Clearly detail in the specifications special tests for precast concrete or cast-in items.

c. Sufficient documentation, when the use of self-consolidating concrete (SCC) is proposed, showing a minimum of 30-days production track records demonstrating that SCC is appropriate for casting of the product.

d. Copies of in-plant QA/QC inspection reports, upon the request of the Contractor's Quality Control Representative.

SD-07 Certificates

Quality Control Procedures

Quality control procedures established in accordance with NPCA QC Manual and/or ACPA QPC.

1.3 GENERAL REQUIREMENTS

Furnish precast concrete units designed and fabricated by an experienced and acceptable precast concrete manufacturer who has been, for at least 3 years, regularly and continuously engaged in the manufacture of precast concrete work similar to that indicated on the drawings. Coordinate precast work with the work of other trades.

1.4 DESIGN

1.4.1 Standard Precast Units

Design standard precast concrete units to withstand indicated design load conditions in accordance with applicable industry design standards ACI 318/318R, ASTM, ACPA 01-102, Chapter 7-Design for Sulfide Control. Design must also consider stresses induced during handling, shipping and installation as to avoid product cracking or other handling damage. Indicate design loads for precast concrete units on the shop drawings.

1.4.2 Custom-Made Precast Units

Submit design calculations and drawings of custom-made precast units, prepared and sealed by a registered professional engineer, for approval

prior to fabrication. Include in the calculations the analysis of units for lifting stresses and the sizing of lifting devices.

1.4.3 Proprietary Precast Units

Products manufactured under franchise arrangements must conform to all the requirements specified by the franchiser. Items not included in the franchise specification, but included in this specification, must conform to the requirements in this specification.

1.4.4 Joints and Sealants

Provide joints and sealants between adjacent units of the type and configuration indicated on shop drawings meeting specified design and performance requirements.

1.4.5 Concrete Mix Design

1.4.5.1 Concrete Mix Proportions

Base selection of proportions for concrete on the methodology presented in ACI 211.1 for normal weight concrete and ACI 211.2 for lightweight concrete. Develop the concrete proportions using the same type and brand of cement, the same type and brand of pozzolan, the same type and gradation of aggregates, and the same type and brand of admixture that will be used in the manufacture of precast concrete units for the project. Do not use calcium chloride in precast concrete containing reinforcing steel or other embedded metal items. At a minimum of thirty days prior to precast concrete unit manufacturing, the precast concrete producer will submit a mix design for each strength and type of concrete that will be used. Furnish a complete list of materials, including quantity, type, brand and applicable data sheets for all mix design constituents as well as applicable reference specifications. The use of self-consolidating concrete is permitted, provided that mix design proportions and constituents meet the requirements of this specification.

1.4.5.2 Concrete Strength

Provide precast concrete units with a 28-day compressive strength (f'c) of 4000 psi.

1.4.5.3 Water-to-Cement Ratio

Furnish concrete, that will be exposed to freezing and thawing, containing entrained air and with water-cement ratios of 0.45 or less. Furnish concrete which will not be exposed to freezing, but which is required to be watertight, with a water-cement ratio of 0.48 or less if the concrete is exposed to fresh water, or 0.45 or less if exposed to brackish water. Furnish reinforced concrete exposed to deicer salts or brackish water with a water-cement ratio of 0.40 or less for corrosion protection.

1.4.5.4 Air Content

The air content of concrete that will be exposed to freezing conditions must be within the limits given below.

NOMINAL MAXIMUM AGGREGATE SIZE	AIR CONTENT % MODERATE EXPOSURE
3/8 inch	4.5 to 7.5
1/2 inch	4.0 to 7.0
3/4 inch	3.5 to 6.5
1.0 inch	3.0 to 6.0
1.5 inch	3.0 to 6.0

1.4.5.5 Corrosion Control for Sanitary Sewer Systems

Follow design recommendations outlined in Chapter 7 of ACPA 01-102 or the ACPA 01-110 when hydrogen sulfide is indicated as a potential problem.

1.5 QUALITY ASSURANCE

Demonstrate adherence to the standards set forth in NPCA QC Manual and/or ACPA QPC. Meet requirements written in the subparagraphs below.

1.5.1 Qualifications, Quality Control and Inspection

1.5.1.1 Qualifications

Select a precast concrete producer that has been in the business of producing precast concrete units similar to those specified for a minimum of 3 years. The precast concrete producer must maintain a permanent quality control department or retain an independent testing agency on a continuing basis.

1.5.1.2 Quality Control Procedures

Show that the following QC tests are performed as required and in accordance with the ASTM standards indicated.

a. Slump: Perform a slump test for each 150 cu yd of concrete produced, or once a day, whichever comes first. Perform slump tests in accordance with ASTM C 143/C 143M.

b. Temperature: Measure the temperature of fresh concrete when slump or air content tests are made and when compressive test specimens are made in accordance with ASTM C 1064/C 1064M.

c. Compressive Strength: Make at least four compressive strength specimens for each 150 cubic yards of concrete of each mix in accordance with the following Standards: ASTM C 31/C 31M, ASTM C 192/C 192M, ASTM C 39/C 39M.

d. Air Content: Perform tests for air content on air-entrained, wet-cast concrete for each 150 cu yd of concrete, but not less often than once each day when air-entrained concrete is used. Determine the air content in accordance with either ASTM C 231 or ASTM C 173/C 173M for normal weight aggregates and ASTM C 173/C 173M for lightweight aggregates.

e. Unit Weight: Perform tests for unit weight a minimum of once per week to verify the yield of batch mixes. Perform unit weight tests for each 100 cu yd of lightweight concrete in accordance with ASTM C 138/C 138M.

Submit test reports as specified in the Submittals paragraph and documentation to demonstrate compliance with the above subparagraphs.

1.5.1.3 Inspection

The Contractor's Quality Control Representative may inspect the plant when the units covered by this specification are being manufactured. The precast concrete producer shall give notice 14 days prior to the time the units will be available for plant inspection. Neither the exercise nor waiver of inspection at the plant will affect the Contractor's right to enforce conractual provisions after units are transported or erected.

The Contractor's Quality Control Representative may place an inspector in the plant when the units covered by this specification are being manufactured. The burden of payment for plant inspection will be clearly detailed in the specification. The precast concrete producer shall give notice 14 days prior to the time the units will be available for plant inspection. Neither the exercise nor waiver of inspection at the plant will affect the Government's right to enforce contractual provisions after units are transported or erected.

1.6 HANDLING, STORAGE AND DELIVERY

1.6.1 Handling

Handle, transport, and store products in a manner to minimize damage. Lifting devices or holes shall be consistent with industry standards. Perform lifting with methods or devices intended for this purpose as indicated on shop drawings.

1.6.2 Storage

Store units off the ground or in a manner that will minimize potential damage.

1.6.3 Delivery

Deliver precast units to the site in accordance with the delivery schedule to avoid excessive build-up of units in storage at the site. Upon delivery to the jobsite, all precast concrete units will be inspected by the Contractor's Quality Control Representative for quality.

PART 2 PRODUCTS

2.1 MATERIALS

Except as otherwise specified in the following paragraphs, conform material to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and Section 03200 CONCRETE REINFORCEMENT.

2.1.1 Cement

Furnish cement conforming to ASTM C 150, Type I, II, III or V. Furnish blended cements that conform to ASTM C 595.

2.1.2 Ground Granulated Blast-Furnace Slag

Ground granulated blast furnace slag is used as an admixture conforming to ASTM C 989, Grade 120 with between 25 to 50 percent maximum cement

replacement by weight.

2.1.3 Water

Furnish water potable or free of deleterious substances in amounts harmful to concrete or embedded metals.

2.1.4 Aggregates

2.1.4.1 Selection

Furnish aggregates conforming to ASTM C 33. Provide aggregates not containing any substance, which may be deleteriously reactive with the alkalies in the cement.

2.1.4.2 Aggregates for Lightweight Concrete

ASTM C 330

2.1.5 Admixtures

2.1.5.1 Air-Entraining

ASTM C 260

2.1.5.2 Accelerating, Retarding, Water Reducing

ASTM C 494/ASTM C 494M

2.1.5.3 Pigments

Non-fading and lime-resistant

2.1.6 Reinforcement

2.1.6.1 Reinforcing Bars

a. Deformed Billet-steel: ASTM A 615/A 615M
b. Deformed Low-alloy steel: ASTM A 706/A 706M

2.1.6.2 Reinforcing Wire

a. Plain Wire: ASTM A 82/A 82M
b. Deformed Wire: ASTM A 496/A 496M

2.1.6.3 Welded Wire Fabric

a. Plain Wire: ASTM A 185/A 185M
b. Deformed Wire: ASTM A 497/A 497M

2.1.6.4 Epoxy Coated Reinforcement

a. Reinforcing Bars: ASTM A 775/A 775M
b. Wires and Fabric: ASTM A 884/A 884M

2.1.7 Inserts and Embedded Metal

All items embedded in concrete shall be of the type required for the intended task, and meet the following standards.

a. Structural Steel Plates, Angles, etc.: ASTM A 36/A 36M
b. Hot-dipped Galvanized: ASTM A 153/A 153M
c. Proprietary Items: In accordance with manufacturers published literature

2.1.8 Accessories

a. Rubber Gaskets for Circular Concrete Sewer Pipe and Culvert Pipe: ASTM C 443.

b. External Sealing Bands for Noncircular Sewer, Storm Drain and Culvert Pipe: ASTM C 877.

c. Preformed Flexible Joint Sealants for Concrete Pipe, Manholes, and Manufactured Box Sections: ASTM C 990.

d. Elastomeric Joint Sealants: ASTM C 920

2.1.9 Pipe Entry Connectors

Pipe entry connectors shall conform to ASTM C 923 or ASTM C 1478.

2.1.10 Grout

Nonshrink Grout shall conform to ASTM C 1107. Cementitious grout shall be a mixture of portland cement, sand, and water. Proportion one part cement to approximately 2.5 parts sand, with the amount of water based on placement method. Provide air entrainment for grout exposed to the weather.

PART 3 EXECUTION

3.1 FABRICATION AND PLACEMENT

Perform fabrication in accordance with NPCA QC Manual and/or ACPA QPC unless specified otherwise.

3.1.1 Forms

Use forms, for manufacturing precast concrete products, of the type and design consistent with industry standards and practices. They should be capable of consistently providing uniform products and dimensions. Construct forms so that the forces and vibrations to which the forms will be subjected can cause no product damage. Clean forms of concrete build-up after each use. Apply form release agents according to the manufacturers recommendations and do not allow to build up on the form casting surfaces.

3.1.2 Reinforcement

Follow applicable ASTM Standard or ACI 318/318R for placement and splicing. Fabricate cages of reinforcement either by tying the bars, wires or welded wire fabric into rigid assemblies or by welding, where permissible, in accordance with AWS D1.4/D1.4M. Position reinforcing as specified by the design and so that the concrete cover conforms to requirements. The tolerance on concrete cover shall be one-third of that specified but not more than 1/2 inch. Provide concrete cover not less than 1/2 inch. Take positive means to assure that the reinforcement does not move significantly during the casting operations.

3.1.3 Embedded Items

Position embedded items at locations specified in the design documents. Perform welding in accordance with AWS D1.1/D1.1M when necessary. Hold rigidly in place inserts, plates, weldments, lifting devices and other items to be imbedded in precast concrete products so that they do not move significantly during casting operations.

3.2 CONCRETE

3.2.1 Concrete Mixing

Mixing operations shall produce batch-to-batch uniformity of strength, consistency, and appearance.

3.2.2 Concrete Placing

Deposit concrete into forms as near to its final location as practical. Keep the free fall of the concrete to a maximum of 3 feet. Consolidate concrete in such a manner that segregation of the concrete is minimized and honeycombed areas are kept to a minimum. Use vibrators to consolidate concrete with frequencies and amplitudes sufficient to produce well consolidated concrete.

3.2.2.1 Cold Weather Concreting

Perform cold weather concreting in accordance with ACI 306.1.

a. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather.

b. Free from frost all concrete materials and all reinforcement, forms, fillers, and ground with which concrete is to come in contact.

c. Do not use frozen materials or materials containing ice.

d. In cold weather the temperature of concrete at the time of placing shall not be below 45 degrees F. Discard concrete that freezes before its compressive strength reaches 500 psi.

3.2.2.2 Hot Weather Concreting

Recommendations for hot weather concreting are given in detail in ACI 305R. During hot weather, give proper attention to constituents, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation that could impair required strength or serviceability of the member or structure. The temperature of concrete at the time of placing shall not exceed 90 degrees F.

3.2.3 Concrete Curing

Commence curing immediately following the initial set and completion of surface finishing.

3.2.3.1 Curing by Moisture Retention

Prevent moisture evaporation from exposed surfaces until adequate strength for stripping is reached by one of the following methods:

a. Cover with polyethylene sheets a minimum of 6 mils thick per ASTM C 171.

b. Cover with burlap or other absorptive material and keep continually moist.

c. Use of a membrane-curing compound applied at a rate not to exceed 200 square ft/gallon, or per manufacturers' recommendations according to ASTM C 309.

3.2.3.2 Curing with Heat and Moisture

Do not subject concrete to steam or hot air until after the concrete has attained its initial set. Apply steam, if used, within a suitable enclosure, which permits free circulation of the steam in accordance with ACI 517.2R. If hot air is used for curing, take precautions to prevent moisture loss from the concrete. The temperature of the concrete shall not be permitted to exceed 150 degrees F. These requirements do not apply to products cured with steam under pressure in an autoclave.

3.2.4 Surface Finish

Finish unformed surfaces of wet-cast precast concrete products as specified. If no finishing procedure is specified, finish such surfaces using a strike-off to level the concrete with the top of the form.

3.2.4.1 Formed Non-Architectural Surfaces

Cast surfaces against approved forms following industry practices in cleaning forms, designing concrete mixes, placing and curing concrete. Normal color variations, form joint marks, small surface holes caused by air bubbles, and minor chips and spalls will be accepted but no major imperfections, honeycombs or other major defects will be permitted.

3.2.4.2 Unformed Surfaces

Finish unformed surfaces with a vibrating screed, or by hand with a float. Normal color variations, minor indentations, minor chips and spalls will be accepted but no major imperfections, honeycombs, or other major defects shall be permitted.

3.2.4.3 Special Finishes

Troweled, broom or other finishes shall be according to the requirements of project documents and performed per industry standards or supplier specifications. Submit finishes for approval when required by the project documents. The sample finishes shall be approved prior to the start of production.

3.2.5 Stripping Products from Forms

Do not remove products from the forms until the concrete reaches the compressive strength for stripping required by the design. If no such requirement exists, products may be removed from the forms after the final set of concrete provided that stripping damage is minimal.

3.2.6 Patching and Repair

No repair is required to formed surfaces that are relatively free of air

voids and honeycombed areas, unless the surfaces are required by the design to be finished.

3.2.6.1 Repairing Minor Defects

Defects that will not impair the functional use or expected life of a precast concrete product may be repaired by any method that does not impair the product.

3.2.6.2 Repairing Honeycombed Areas

When honeycombed areas are to be repaired, remove all loose material and cut back the areas into essentially horizontal or vertical planes to a depth at which coarse aggregate particles break under chipping rather than being dislodged. Use proprietary repair materials in accordance with the manufacturer's instructions. If a proprietary repair material is not used, saturate the area with water. Immediately prior to repair, the area should be damp, but free of excess water. Apply a cement-sand grout or an approved bonding agent to the chipped surfaces, followed immediately by consolidating an appropriate repair material into the cavity.

3.2.6.3 Repairing Major Defects

Evaluate, by qualified personnel, defects in precast concrete products which impair the functional use or the expected life of products to determine if repairs are feasible and, if so, to establish the repair procedure.

3.2.7 Shipping Products

Do not ship products until they are at least 5 days old, unless it can be shown that the concrete strength has reached at least 75% of the specified 28-day strength, or that damage will not result, impairing the performance of the product.

3.3 INSTALLATION

3.3.1 Site Access

It is the Contractor's responsibility to provide adequate access to the site to facilitate hauling, storage and proper handling of the precast concrete products.

3.3.2 General Requirements

a. Install precast concrete products to the lines and grades shown in the contract documents or otherwise specified.

b. Lift products by suitable lifting devices at points provided by the precast concrete producer.

c. Install products per the precast concrete producer's instructions. In the absence of such instructions, install underground utility structures in accordance with ASTM C 891. Install pipe and manhole sections in accordance with the procedures outlined by the American Concrete Pipe Association.

d. Field modifications to the product will relieve the precast producer of liability even if such modifications result in the failure

of the product.

3.3.3 Water Tightness

Where water tightness is a necessary performance characteristic of the precast concrete product's end use, watertight joints, connectors and inserts should be used to ensure the integrity of the entire system.

3.4 FIELD QUALITY CONTROL

3.4.1 Site Tests

When water tightness testing is required for an underground product, use one of the following methods:

3.4.2 Vacuum Testing

Prior to backfill vacuum test system according to ASTM C 1244.

3.4.3 Water Testing

Perform water testing according to the contract documents and precast concrete producer's recommendations.

-- End of Section --

SECTION 03450

PLANT-PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991; R 2002) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 214R	(2002) Evaluation of Strength Test Results of Concrete
ACI 301	(2005) Specifications for Structural Concrete
ACI 304R	(2000) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	(1999) Hot Weather Concreting
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting
ACI SP-66	(2004) ACI Detailing Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2006) Structural Welding Code - Steel
AWS D1.4	(1998) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 153/A 153M	(2005) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 167	(2004) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 185	(2002) Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 27/A 27M	(2005) Steel Castings, Carbon, for General Application
ASTM A 283/A 283M	(2003) Low and Intermediate Tensile

	Strength Carbon Steel Plates
ASTM A 36/A 36M	(2005) Carbon Structural Steel
ASTM A 47	(1999) Ferritic Malleable Iron Castings
ASTM A 496	(2002) Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497	(2002) Steel Welded Wire Reinforcement, Deformed, for Concrete
ASTM A 615/A 615M	(2005a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 706/A 706M	(2005a) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM C 143	(1998) Slump of Hydraulic Cement Concrete
ASTM C 150	(2005) Portland Cement
ASTM C 172	(2004) Sampling Freshly Mixed Concrete
ASTM C 260	(2001) Air-Entraining Admixtures for Concrete
ASTM C 31/C 31M	(2003a) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(2003) Concrete Aggregates
ASTM C 39	(1993a) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 494	(1992) Chemical Admixtures for Concrete
ASTM C 94	(1994) Ready-Mixed Concrete

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI MNL-117	(1996) Quality Control for Plants and Production of Architectural Precast Concrete Products

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Precast concrete wall panel

SD-03 Product Data

Manufacturer's product data including percentages of

post-consumer recycled content and post-industrial recycled content.

Manufacturer's letter certifying that products specified as regionally manufactured materials were manufactured in a facility within 500 miles from the project site. Provide a written statement of the cost of each product.

Manufacturer's product data or MSDS for all field applied adhesives used within the building interior highlighting VOC content, expressed in g/L, indicating that adhesives meet or exceed the VOC limits of SCAQMD Rule # 1168.

Manufacturer's product data or MSDS for all field applied sealants used within the building interior highlighting VOC content, expressed in g/L, indicating that sealants meet or exceed Bay Area Resources Board Reg. 8, Rule 51.

Cast-in embedded items and connectors

Connection devices

SD-04 Samples

Concrete wall panel surface finishing

SD-05 Design Data

Precast concrete wall panel design calculations; G

Contractor-furnished mix design; G

Concrete mix design for repair of surface defects; G

Precast concrete wall panel connection and embedment design calculations; G

SD-06 Test Reports

Strength tests; G

Submit testing results in accordance with PCI MNL-117 and as required in paragraph entitled "Sampling and Testing."

SD-08 Manufacturer's Instructions

Installation of precast concrete wall panel

Cleaning of wall panel

Include precast concrete wall panel manufacturer's written recommendations for installation and cleaning.

1.3 MODIFICATION OF REFERENCES

In the referenced ACI and PCI publications, consider the advisory provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to the "Building Official," the "Structural Engineer,"

and the "Architect/Engineer" to mean the Contracting Officer.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver packaged materials, except for wall panels, to the project site in the original, unbroken packages or containers, each bearing a label clearly identifying manufacturer's name, brand name, weight or volume, and other pertinent information. Store packaged materials, and materials in containers, in a weathertight and dry place until ready for use.

1.5 PLANT INSPECTION

1.5.1 PCI Quality Certifications

1.5.1.1 Product Quality Control

Plants shall be certified by the PCI Plant Certification Program for Category A1 work, or Architectural Precast Association (APA) certification.

1.6 QUALITY ASSURANCE

1.6.1 Wall Panel Drawings

a. Wall panel dimensions, cross-section, and edge details; location, size, and type of reinforcement, including reinforcement necessary for safe handling and erection of panels. Comply with ACI SP-66.

b. Layout, dimensions, and identification of each panel, corresponding to installation sequence.

c. Setting drawings, instructions, and directions for installation of concrete inserts.

d. Location and details of anchorage devices and lifting devices embedded in panels, and connection details to building framing system.

1.6.2 Design Calculations

Submit design calculations prepared and sealed by a registered professional engineer demonstrating compliance with indicated loading conditions.

1.6.3 Connection and Embedment Design Calculations

Submit design calculations prepared and sealed by a professional engineer demonstrating compliance with the indicating connection and embedment details.

1.6.4 Mix Designs

Submit a mix design for each strength and type of concrete. Include a complete list of materials including type; brand; source and amount of cement, fly ash, pozzolan, ground slag, and admixtures; and applicable reference specifications.

1.6.5 Concrete Wall Panel Surface Finish Sample

Submit a concrete wall panel sample 12 inches by 12 inches by approximately 1 1/2 inches in thickness, to illustrate quality, color, and texture of

both exposed-to-view surface finish and finish of panel surfaces that will be concealed by other construction.

1.6.6 Required Records

Maintain all concrete mix records in accordance with PCI Guidelines.

PART 2 PRODUCTS

2.1 CONCRETE

2.1.1 Contractor-Furnished Mix Design

ACI 211.1 and ACI 301. Concrete shall have a 28-day minimum compressive strength of 5000 psi. Air content of plastic concrete shall be between 4 and 6 percent air by volume.

2.1.2 Exposed-to-View Facing Mixture

Provide aggregates for exposed-to-view facing mixture; white, gray, or buff portland cement or a blend of two or more portland cements; air-entraining admixture; and water. Provide exact proportions of facing mixture to produce concrete having the specified properties and capable of obtaining the approved surface color and finish.

2.1.3 Backing Mixture

Provide the approved mix design.

2.2 MATERIALS

2.2.1 Fine Aggregates

ASTM C 33. The optional method of reducing the No. 50 and No. 100 sieve aggregates does not apply. The restriction to use only fine aggregates that do not contain any materials that are deleteriously reactive with alkalies in cement does apply.

2.2.2 Coarse Aggregate

ASTM C 33, Size No. 57, Class 5S. The restriction to use only coarse aggregates that do not contain any materials that are deleteriously reactive with alkalies in cement does apply. Aggregate shall not contain slag or crushed concrete.

2.2.3 Exposed Aggregate

In addition to the above, facing mixture aggregate, and aggregate for homogeneous panels with exposed aggregate finish, shall be crushed stone of size and color to produce exposed surfaces to match the color and texture of the sample on file with the Contracting Officer.

2.2.4 Cement

ASTM C 150, Type III.

2.2.5 Admixtures

ASTM C 260 for air-entraining admixtures. Other admixtures: ASTM C 494.

2.2.6 Water

Fresh, clean, and potable.

2.2.7 Hardware

Connectors shall be zinc-coated hot-dipped galvanized. Reinforcing shall be plain non-galvanized.

2.2.7.1 Reinforcing Bars

ACI 301 unless otherwise specified. ASTM A 706/A 706M, Grade 60 or ASTM A 615/A 615M, 60.

2.2.7.2 Welded Wire Fabric

ASTM A 185 or ASTM A 497.

2.2.7.3 Supports for Concrete Reinforcement

Include bolsters, chairs, spacers, and other devices necessary for proper spacing, supporting, and fastening in place.

a. Supports: ASTM A 615/A 615M, wire-type reinforcing bars and welded wire fabric.

b. Legs of supports in contact with formwork: Stainless steel, ASTM A 167, Type 302 or Type 304.

2.3 Cast-In Embedded Items and Connectors

Structural embedded anchorage and connections to panels shall be designed to withstand gravity loads, live loads, dynamic loads, any volume change stresses inherent in the structure, and loads indicated.

2.3.1 Inserts

2.3.1.1 Threaded-Type Concrete Inserts

ASTM A 47, Grade 32510 or 35018, or may be medium strength cast steel conforming to ASTM A 27/A 27M, Grade U-60-30. Provide galvanized ferrous casting having enlarged base with two nailing lugs minimum length less than the thickness of panel less 3/4 inch, and internally threaded to receive 3/4 inch diameter machine bolt. Ferrous castings shall be ferritic malleable iron. Provide inserts hot-dip galvanized after fabrication in accordance with ASTM A 153/A 153M.

2.3.1.2 Wedge-Type Concrete Inserts

Provide galvanized, box-type ferrous castings with integral anchor loop at back of box to accept 3/4 inch diameter bolts having special wedge-shaped head. Provide ferrous castings ASTM A 47, Grade 32510 or 35018, ferritic malleable iron or ASTM A 27/A 27M, Grade U-60-30, medium-strength cast steel. Provide inserts hot-dip galvanized after fabrication in accordance with ASTM A 153/A 153M.

2.3.1.3 Slotted-Type Concrete Inserts

Provide pressed steel plate, welded construction, box type with slot to receive 3/4 inch diameter square head bolt, and provide lateral adjustment of bolt. Length of insert body, less anchorage lugs, shall be 4 1/2 inches minimum. Provide insert with knockout cover. Steel plate shall be 1/8 inch minimum thickness, ASTM A 283/A 283M, Grade C. Provide inserts hot-dip galvanized after fabrication in accordance with ASTM A 153/A 153M.

2.3.2 Embedded Plates

ASTM A 36/A 36M, galvanized ferrous metal plate connectors for attachment to the structural framing using manufacturer standard construction procedures. Headed studs shall use 60,000 psi steel with construction conforming to AWS D1.1/D1.1M, Type B. Deformed bar anchors shall conform to ASTM A 496. Provide embedded anchors galvanized after fabrication in accordance with ASTM A 153/A 153M.

2.3.3 Connection Devices

2.3.3.1 Clip Angles

ASTM A 36/A 36M steel, galvanized after fabrication in accordance with ASTM A 153/A 153M.

2.3.3.2 Ferrous Casting Clamps

ASTM A 47, Grade 32510 or Grade 35018 malleable iron or cast steel, or ASTM A 27/A 27M, Grade U-60-30, cast steel casting, hot-dip galvanized in accordance with ASTM A 153/A 153M.

2.3.3.3 Threaded Fasteners

Provide galvanized Grade 5 machine bolts, washers and, when required, nuts.

2.3.4 Form Materials

Provide forms and form-facing materials of wood, metal, plastic, or other approved material to produce concrete having the specified finish. Construct forms mortar-tight and of sufficient strength to withstand all pressures due to concrete placing operations and temperature changes within the specified fabrication tolerances.

2.4 PANEL FABRICATION

2.4.1 Formwork and Fabrication Tolerances

Provide metal or wood forms. Brace and stiffen against deformation. Provide form liners where required to produce indicated finish. Provide dimensional tolerances as follows:

Overall panel dimensions:

10 feet or less	Plus or minus 1/8 inch
10 to 20 feet	Plus 1/8 inch, minus 3/16 inch
20 feet or more	Plus or minus 1/4 inch, plus or minus 1/16 inch for each additional 10 feet

Overall panel dimensions:
Thickness: Plus 1/4 inch, minus 1/8 inch

Angular deviation of sides:
Plus or minus one percent, 1/8 inch maximum

Deviation from square (difference in length of two diagonals):
Plus or minus 1/2 inch or plus or minus 1/8 inch per 6 feet

Size and location of openings within one unit:
Plus or minus 1/4 inch

Local smoothness (deviation from a true plane):
Plus or minus 1/4 inch in 10 feet

Bowing (convex or concave):
Length of bow/360, with a maximum of 1 inch

Position of reinforcement: Within 1/4 inch of indicated position

Position of anchorage devices: Plus or minus 1 inch

Position of pick-up devices: Plus or minus 3 inches

2.4.2 Reinforcement

ACI 301. Place reinforcing bars and welded wire fabric. Secure in position with tie wires, bar supports, and spacers.

2.4.3 Preparation for Placing Concrete

Remove hardened concrete, excess form parting compound, standing water, ice, snow, or other deleterious substances from form interiors and reinforcement before concrete placement. Secure reinforcement and embedded items.

2.4.4 Concrete Mixing and Conveying

2.4.4.1 Batch Plant, Mixer, Mixing, and Measuring of Materials

ASTM C 94.

2.4.4.2 Conveying

Prevent segregation and loss of materials.

2.4.5 Concrete Placing

ACI 304R. Deposit concrete in the forms continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the precast concrete wall panel. Place concrete at a constant temperature of between 50 and 90 degrees F throughout fabrication of each panel. Make temperature of forms or molds the same as or close to the concrete temperature. For hot or cold weather, use methods recommended by ACI 305R and ACI 306.1. Vibrate and consolidate concrete to prevent segregation and to produce a high-density concrete free of honeycomb and rock pockets. When specified, the exposed-to-view facing mixture shall be a minimum

thickness of 3/4 inches. Place backing mixture before facing mixture attains initial set.

2.4.6 Identification Markings

Permanently mark each panel to indicate pick-up points, location, orientation in the building, and date of casting. Identification markings shall correlate with approved detail drawings. Do not locate in exposed-to-view finished surfaces.

2.4.7 Finishing

2.4.7.1 Unformed Concealed Surfaces (Standard Float Finish)

Level surface with a straightedge, and strike off. After surface water has disappeared, float surface.

2.4.7.2 Smooth, Exposed-to-View Surfaces

Provide a standard smooth finish to all exposed-to-view surfaces of panels, unless otherwise indicated. Provide a concrete surface having the texture imparted by a steel form or other approved smooth surfaces form-facing material.

2.4.8 Curing

Cure units until the compressive strength is high enough to ensure that stripping does not have an effect on the performance or appearance of the final product.

2.4.9 Repair of Surface Defects

Cut out defective areas to solid concrete. Patch the surface in accordance with PCI requirements submitted by the Subcontractor and approved by the Contractor. Where exposed to view, the patches, when dry, shall be indistinguishable from the surrounding surfaces.

2.4.9.1 Smooth, Concealed Surfaces

Acceptable defective area shall be limited to holes left by rods and other temporary inserts, and to honeycomb or rock pockets of 1/4 inch diameter maximum. Remove fins and other projections on the surfaces.

2.4.9.2 Exposed-to-View Surfaces

The combined area of acceptable defective areas shall not exceed 0.2 percent of the exposed-to-view surface area and shall be limited to holes of 1/4 inch diameter maximum.

PART 3 EXECUTION

3.1 INSTALLATION

Verify that all parts of the supporting structure are complete and ready to receive the panels and that site conditions are conducive to proper installation. Install precast concrete wall panels and accessories in accordance with approve detail drawings and descriptive data, and as specified below.

3.1.1 Building Framing System

Provide supporting members, including anchorage items attached to or embedded in building structural elements, prior to placement of panels.

3.1.2 Placing Panels

Panels shall attain the specified 28-day compressive design strength prior to placement. Provide temporary supports and bracing, as required, to maintain panel position and alignment during attachment to the building framing system. Secure adjustable connections after panels have been properly positioned. All welded connections shall conform to the requirements of AWS D1.1/D1.1M and AWS D1.4.

3.1.3 Erection Tolerances

Locate panels to accommodate adjacent products, proper joint width, and alignment with adjacent precast members. Noncumulative dimensional tolerances for erection of panels shall comply with PCI MNL-117 and are as follows:

a. Face width of joint

Panel dimension normal to joint

10 feet or under: Plus or minus 1/4 in

10 feet to 20 feet: Plus or minus 1/4 inch

Each additional 10 feet: Plus or minus 1/16 inch

b. Joint taper (panel edges not parallel): 0.2 percent or 1/16 inch total, whichever is larger, but not greater than 3/8 inch

c. Panel alignment

Jog in alignment of edge: 1/4 inch

Offset in face of panel (exterior face unless otherwise noted):1/4 inch

d. Variation from theoretical position, any location: Plus or minus 1/2 inch

e. Deviation from plumb: 0.2 percent, 3/8 inch maximum

f. Maximum warpage after erection: One corner out of plane of other three, 0.5 percent of distance from nearer adjacent corner, or1/8 inch

g. Differential bowing or camber of adjacent panels: 1/4 inch maximum

3.1.4 Joints

Joint widths between panels shall be as specified unless otherwise indicated. Provide joints with sealants in accordance with Section 07920 JOINT SEALANTS.

3.1.5 Protection

Protect exposed-to-view facing from staining and other damage. Do not allow laitance to penetrate, stain, or harden on exposed surfaces.

3.2 CLEANING

Clean exposed-to-view surfaces of panels thoroughly with detergent and water; use a brush to remove foreign matter. Remove stains that remain after washing in accordance with recommendations of the panel manufacturer. Surfaces shall be clean and uniform in color.

3.3 SAMPLING AND TESTING

3.3.1 Product Quality Control

PCI MNL-117 for PCI enrolled plants. Where panels are manufactured by specialists in plants not currently enrolled in the PCI "Quality Control Program," provide a product quality control system in accordance with PCI MNL-117 and perform concrete and aggregate quality control testing using an approved, independent commercial testing laboratory. Submit test results to the Contracting Officer.

3.3.1.1 Aggregate Tests

ASTM C 33. Perform one test for each aggregate size, including determination of the specific gravity.

3.3.1.2 Strength Tests

ASTM C 172. Provide ASTM C 39 and ASTM C 31/C 31M compression tests. Perform ASTM C 143 slump tests. Mold six cylinders each day or for every 20 cubic yards of concrete placed, whichever is greater. Perform strength tests using two cylinders at 7 days and two at 28 days. Cure four cylinders in the same manner as the panels and place at the point where the poorest curing conditions are offered. Moist cure two cylinders and test at 28 days.

3.3.1.3 Changes in Proportions

If, the compressive strength falls below that specified, adjust the mix proportions and water content and make necessary changes in the temperature, moisture, and curing procedures to secure the specified strength. Notify the Contracting Officer of all changes.

3.3.1.4 Strength Test Results

Evaluate compression test results at 28 days in accordance with ACI 214R using a coefficient of variation of 20 percent. Evaluate the strength of concrete by averaging the test results (two specimens) of standard cylinders tested at 28 days. Not more than 20 percent of the individual tests shall have an average compressive strength less than the specified ultimate compressive strength.

3.3.2 Rejection

Panels in place may be rejected using PCI acceptable criteria for any one of the following product defects or installation deficiencies remaining after repairs and cleaning have been accomplished. "Visible" means visible

to a person with normal eyesight when viewed from a distance of 20 feet in broad daylight.

a. Nonconformance to specified tolerances.

b. Air voids (bugholes or blowholes) larger than3/8 inch diameter.

c. Visible casting lines.

d. Visible from joints.

e. Visible irregularities.

f. Visible stains on panel surfaces.

g. Visible differences between panel and approved sample.

h. Visible nonuniformity of textures or color.

i. Visible areas of backup concrete bleeding through the facing concrete.

j. Visible foreign material embedded in the face.

k. Visible repairs.

l. Visible reinforcement shadow lines.

m. Visible cracks.

3.3.3 Field Quality Control

Perform field inspection of panel connections. The Contracting Officer shall be notified in writing of defective welds, bolts, nuts and washers within 7 working days of the date of inspection. All defective connections or welds shall be removed and re-welded or repaired as required by the Contracting Officer.

3.3.3.1 Welded Connection Visual Inspection

AWS D1.1/D1.1M, furnish the services of AWS-certified welding inspector for erection inspections. Welding inspector shall visually inspect all welds and identify all defective welds.

-- End of Section --

SECTION 04200

MASONRY

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

ACI 318	(2005) Building Code Requirements for Structural Concrete and Commentary
ACI 530/530.1	(2002) Building Code Requirements for Masonry Structures and Specifications for Masonry Structures and Commentaries
ACI SP-66	(2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A 153/A 153M	(2005) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 615/A 615M	(2006a) Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
ASTM A 641/A 641M	(2003) Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A 82	(2005) Steel Wire, Plain, for Concrete Reinforcement
ASTM C 1019	(2005) Sampling and Testing Grout
ASTM C 129	(2003) Nonloadbearing Concrete Masonry Units
ASTM C 140	(2005) Sampling and Testing Concrete Masonry Units and Related Units
ASTM C 144	(2004) Aggregate for Masonry Mortar
ASTM C 150	(2005) Portland Cement
ASTM C 207	(2005) Hydrated Lime for Masonry Purposes
ASTM C 270	(2005a) Mortar for Unit Masonry
ASTM C 476	(2002) Grout for Masonry

ASTM C 494/C 494M	(2005a) Chemical Admixtures for Concrete
ASTM C 641	(1998e1) Staining Materials in Lightweight Concrete Aggregates
ASTM C 780	(2005) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 90	(2005a) Loadbearing Concrete Masonry Units
ASTM C 91	(2005) Masonry Cement
ASTM C 94/C 94M	(2004a) Ready-Mixed Concrete
ASTM D 2000	(2005) Rubber Products in Automotive Applications
ASTM D 2240	(2005) Rubber Property - Durometer Hardness
ASTM D 2287	(1996; R 2001) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM E 119	(2000a) Fire Tests of Building Construction and Materials

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2003) International Building Code

U.S. ARMY CORPS OF ENGINEERS (USACE)

SPiRiT	(2002)Sustainable Project Rating Tool (SPiRiT), Version 1.4.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Structural Masonry

Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; lintels; and wall openings. Bar splice locations shall be shown. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. The minimum scale for wall elevations shall be 1/4 inch per foot. Reinforcement bending details shall conform to the requirements of ACI SP-66.

SD-03 Product Data

Local/Regional Materials (SPiRiT)

Documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate dollar value of local/regional materials included in project.

Concrete Masonry Units (CMU) (SPiRiT)
Cement (SPiRiT)
Water-Repellant Admixture
Mortar Accessories

Manufacturer's descriptive data. Documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate dollar value of recycled content products included in project.

Cold Weather Installation

Cold weather construction procedures.

Documentation certifying products are from salvaged/recovered sources. Indicate relative dollar value of salvaged content products to total dollar value of products included in project.

Anchors, Ties, and Bar Positioners

Expansion-Joint Materials

Joint Reinforcement

SD-05 Design Data

Unit Strength Method

Calculations and certifications of masonry unit and mortar strength.

SD-06 Test Reports

Field Testing of Mortar
Field Testing of Grout
Fire-rated CMU

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

Special Inspection

Copies of masonry inspector reports.

SD-07 Certificates

Control Joint Keys
Anchors, Ties, and Bar Positioners

Expansion-Joint Materials
Joint Reinforcement
Reinforcing Steel Bars and Rods
Precast Concrete Items
Admixtures for Masonry Mortar

Certificates of compliance stating that the materials meet the specified requirements.

SD-08 Manufacturer's Instructions

Masonry Cement

When masonry cement is used, submit the manufacturer's printed instructions on proportions of water and aggregates and on mixing to obtain the type of mortar required.

SD-10 Operation and Maintenance Data

Take-Back Program

Documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and/or reuse.

1.3 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material. Store and prepare materials in already disturbed areas to minimize project site disturbance and size of project site.

1.3.1 Masonry Units

Concrete masonry units shall be covered or protected from inclement weather. Store Type II, concrete masonry units at the site for a minimum of 28 days for air cured units, 10 days for atmospheric steam or water cured units, and 3 days for units cured with steam at a pressure of 120 to 150 psi and at a temperature of 350 to 365 degrees F for at least 5 hours. Protect moisture controlled units (Type I) from rain and ground water.Cover and protect moisture-controlled concrete masonry units and cementitious materials from precipitation. Conform to all handling and storage requirements of ASTM C 90. Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.3.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.3.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner

that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

1.4 STRUCTURAL MASONRY

1.4.1 Special Inspection

A qualified masonry inspector approved by the Contracting Officer shall perform inspection of the load bearing structural masonry work. Minimum qualifications for the masonry inspector shall be 5 years of reinforced masonry inspection experience or acceptance by a State, municipality, or other governmental body having a program of examining and certifying inspectors for reinforced masonry construction. The masonry inspector shall be present during preparation of sampling and placing of masonry units, placement of reinforcement (including placement of dowels in footings and foundation walls), inspection of grout space, immediately prior to closing of cleanouts, and during grouting operations. The masonry inspector shall assure Contractor compliance with the drawings and specifications. The masonry inspector shall keep a complete record of all inspections and shall submit daily written reports to the Quality Control Supervisory Representative reporting the quality of masonry construction.

1.4.2 Unit Strength Method

Compute compressive strength of masonry system "Unit Strength Method," ACI 530/530.1. Submit calculations and certifications of unit and mortar strength.

1.4.3 Seismic Requirement

In addition to design requirements of ICC IBC, additional seismic reinforcement shall be provided, as indicated on the drawings.

1.5 QUALITY ASSURANCE

1.5.1 Testing

Masonry strength shall be determined in accordance with ACI 530/530.1; submit test reports on three prisms as specified in ACI 530/530.1. The cost of testing shall be paid by the Contractor.

1.5.2 Spare Vibrator

Maintain at least one spare vibrator on site at all times.

1.5.3 Bracing and Scaffolding

Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by local code.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources. See Section 01335 SUSTAINABLE DESIGN AND DEVELOPMENT for cumulative total local material requirements. Masonry

materials may be locally available.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.

2.2 CONCRETE MASONRY UNITS (CMU)

Cement shall be of one brand. Units shall contain a minimum of 10 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content. See Section 01335 SUSTAINABLE DESIGN AND DEVELOPMENT for cumulative total recycled content requirements. Units may contain post-consumer or post-industrial recycled content. Units shall be of modular dimensions and air, water, or steam cured. Exposed surfaces of units shall be smooth and of uniform texture.

a. Hollow Load-Bearing Units: ASTM C 90, made with lightweight aggregate. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.

b. Hollow Non-Load-Bearing Units: ASTM C 129, made with lightweight aggregate. Load-bearing units may be provided in lieu of non-load-bearing units.

2.2.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

2.2.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

2.2.3 Fire-Rated CMU

Concrete masonry units used in fire-rated construction shown on the drawings shall be of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated on the aggregate requiring the greater minimum equivalent thickness to produce the required fire rating. Construction shall conform to ASTM E 119.

TABLE I

FIRE-RATED CONCRETE MASONRY UNITS

See note (a) below

Aggregate Type	Minimum equivalent thickness inches for fire rating of: 4 hours	3 hours	2 hours
Pumice	4.7	4.0	3.0
Expanded slag	5.0	4.2	3.3
Expanded clay, shale, or slate	5.7	4.8	3.7
Limestone, scoria, cinders or unexpanded slag	5.9	5.0	4.0
Calcareous gravel	6.2	5.3	4.2
Siliceous gravel	6.7	5.7	4.5

a. Minimum equivalent thickness shall equal net volume as determined in conformance with ASTM C 140 divided by the product of the actual length and height of the face shell of the unit in inches. Where walls are to receive plaster or be faced with brick, or otherwise form an assembly; the thickness of plaster or brick or other material in the assembly will be included in determining the equivalent thickness.

2.3 PRECAST CONCRETE ITEMS

Lintels and splashblocks shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be 3000 psi minimum conforming to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE using 1/2 inch to No. 4 nominal-size coarse aggregate, and minimum reinforcement shall be the reinforcement required for handling of the units. Clearance of 3/4 inch shall be maintained between reinforcement and faces of units. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 120 psi for at least 5 hours, the items, after casting, shall be either damp-cured for 24 hours or steam-cured and shall then be aged under cover for 28 days or longer. Cast-concrete members weighing over 80 pounds shall have built-in loops of galvanized wire or other approved provisions for lifting and anchoring. Units shall have beds and joints at right angles to the face, with sharp true arises and shall be cast with drip grooves on the underside where units overhang walls. Exposed-to-view surfaces shall be free of surface voids, spalls, cracks, and chipped or broken edges. Precast units exposed-to-view shall be of uniform appearance and color. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

2.3.1 Lintels

Precast lintels, unless otherwise shown, shall be of a thickness equal to the wall and reinforced with two No. 4 bars for the full length. Top of lintels shall be labeled "TOP" or otherwise identified and each lintel shall be clearly marked to show location in the structure. In reinforced masonry, lintels shall conform to ACI 318 for flexural and shear strength and shall have at least 8 inches bearing at each end. Concrete shall have a minimum 28 day compressive strength of 3000 psi using 1/2 inch to No. 4 nominal-size coarse aggregate. Reinforcement shall conform to ASTM A 615/A 615M Grade 60. Limit lintel deflection due to dead plus live load to the lesser of L/600 or 0.3 inches. Provide top and bottom bars for lintels over 36 inches in length.

2.3.2 Splash Blocks

Splash blocks shall be as detailed. Reinforcement shall be the manufacturer's standard.

2.4 MORTAR FOR STRUCTURAL MASONRY

ASTM C 270, Type S. Strength (f'm) as indicated. Test in accordance with ASTM C 780. Use Type I portland cement. Do not use admixtures containing chlorides. When structural reinforcement is incorporated, maximum air-content shall be 12 percent in cement-lime mortar and 18 percent in masonry cement mortar.

2.5 MASONRY MORTAR

Mortar Type S shall conform to the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate. Type S mortar shall be used for all masonry. Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.5.1 Admixtures for Masonry Mortar

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C.

2.5.2 Hydrated Lime and Alternates

Hydrated lime shall conform to ASTM C 207, Type S. Lime alternates which have a current ICBO, ICBO UBC, Evaluation Report number whose findings state it may be used as an alternate to lime for Type M, S, N, and O mortars will be deemed acceptable provided the user follows the manufacturer's proportions and mixing instructions as set forth in ICBO report.

2.5.3 Cement

Portland cement shall conform to ASTM C 150, Type I. Masonry cement shall conform to ASTM C 91, Type S. Containers shall bear complete instructions for proportioning and mixing to obtain the required types of mortar.

Incorporate to the maximum extent, without conflicting with other requirements of this section, up to 40 percent fly ash, up to 70 percent slag, up to 10 percent censopheres, and up to 10 percent silica fume. Additives shall conform to the requirements in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.5.4 Sand and Water

Sand shall conform to ASTM C 144. Water shall be clean, potable, and free from substances which could adversely affect the mortar.

2.6 GROUT AND READY-MIXED GROUT

Grout shall conform to ASTM C 476, fine. Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 11 inches. Minimum grout strength shall be 2000 psi in 28 days, as tested by ASTM C 1019. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements. Ready-Mixed grout shall conform to ASTM C 94/C 94M.

2.6.1 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.7 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153/A 153M, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A 82. Wire ties or anchors in exterior walls shall conform to ASTM A 641/A 641M. Joint reinforcement in interior walls, and in exterior or interior walls exposed to moist environment shall conform to ASTM A 641/A 641M; coordinate with paragraph JOINT REINFORCEMENT below. Anchors and ties shall be sized to provide a minimum of 5/8 inch mortar cover from either face.

2.7.1 Wall Ties

Wall ties shall be rectangular-shaped or Z-shaped fabricated of 3/16 inch diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 4 inches wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 3/16 inch diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 1/2 inch eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 1/16 inch. The pintle and eye elements shall be formed so that both can be in the same plane.

2.7.2 Dovetail Anchors

Dovetail anchors shall be of the flexible wire type, 3/16 inch diameter zinc-coated steel wire, triangular shaped, and attached to a 12 gauge or heavier steel dovetail section. Cells within vertical planes of these anchors shall be filled solid with grout for full height of walls or partitions, or solid units may be used. Dovetail slots are specified in

Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.7.3 Adjustable Anchors

Adjustable anchors shall be 3/16 inch diameter steel wire, triangular-shaped. Anchors attached to steel shall be 5/16 inch diameter steel bars placed to provide 1/16 inch play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

2.7.4 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.8 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153/A 153M, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 5/8 inch cover from either face. The distance between crosswires shall not exceed 16 inches. Joint reinforcement for straight runs shall be furnished in flat sections not less than 10 feet long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features.

2.9 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615/A 615M, Grade 60.

2.10 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 5/8 inch thick and 3/8 inch thick flanges, with a tolerance of plus or minus 1/16 inch. The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 30 degrees F after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

2.11 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07920 JOINT

SEALANTS.

PART 3 EXECUTION

3.1 PREPARATION

Prior to start of work, Contractor's quality control representative shall verify the applicable onditions as set forth in ACI 530/530.1, inspection.

3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent or the ambient air temperature exceeds 90 degrees F and the wind velocity is more than 8 mph. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F or temperature of masonry units is below 40 degrees F, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection. Conform to ACI 530/530.1 for hot and cold weather masonry erection.

3.1.2.1 Protection

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F.

b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing.

c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.

d. Air Temperature 20 Degrees F and below. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F. Temperature of units when laid shall not be less than 20 degrees F.

3.1.2.2 Completed Masonry and Masonry Not Being Worked On

a. Mean daily air temperature 40 to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.

b. Mean daily air temperature 32 to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.

c. Mean Daily Air Temperature 25 to 20 degrees F. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.

d. Mean Daily Temperature 20 degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.1.3 Stains

Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

3.1.4 Loads

Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed. Provide temporary bracing as required.

3.1.5 Surfaces

Surfaces on which masonry is to be placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

3.2 LAYING MASONRY UNITS

Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Masonry units shall be laid in running bond pattern. Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 1/2 inch into cavities and chases or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below.

3.2.1 Forms and Shores

Provide bracing and scaffolding as required. Design bracing to resist wind pressure as required by local codes. Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

3.2.2 Reinforced Concrete Masonry Units Walls

Where vertical reinforcement occurs, fill cores solid with grout. Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be filled. Embed the adjacent webs in mortar to prevent leakage of grout. Remove mortar fins protruding from joints before placing grout. Minimum clear dimensions of vertical cores shall be 2 by 3 inches. Position reinforcing accurately as indicated before placing grout. As masonry work progresses, secure vertical reinforcing in place at vertical intervals not to exceed 160 bar diameters. Use puddling rod or vibrator to consolidate the grout. Minimum clear distance between masonry and vertical reinforcement shall be not less than 1/2 inch. Unless indicated or specified otherwise, form splices by lapping bars not less than 48 bar diameters and wire tying them together.

3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

3.2.4 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

TABLE II

TOLERANCES

Variation from the plumb in the lines and surfaces of columns, walls and arises	
In adjacent masonry units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch

TOLERANCES

In 40 feet or more	1/2 inch
Variations from the plumb for external corners, expansion joints, and other conspicuous lines	
In 20 feet	1/4 inch
In 40 feet or more	1/2 inch
Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	
In 20 feet	1/4 inch
In 40 feet or more	1/2 inch
Variation from level for bed joints and top surfaces of bearing walls	
In 10 feet	1/4 inch
In 40 feet or more	1/2 inch
Variations from horizontal lines	
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch
Variations in cross sectional dimensions of columns and in thickness of walls	
Minus	1/4 inch
Plus	1/2 inch

3.2.5 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.6 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose

and excess mortar. Mortar joints shall be finished as follows:

3.2.6.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.

3.2.6.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.6.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

3.2.7 Joint Widths

Joint widths shall be as follows:

3.2.7.1 Concrete Masonry Units

Concrete masonry units shall have 3/8 inch joints.

3.2.8 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Toothing may be resorted to only when used for repair or when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

3.2.9 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

3.2.10 Partitions

Partitions shall be continuous from floor to underside of floor or roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 4 inches above the ceiling level. An isolation joint shall be placed in the intersection between partitions and structural or exterior walls as shown. Cells within vertical plane of ties shall be filled solid with grout for full height of

partition or solid masonry units may be used. Interior partitions shall be tied together with joint reinforcement. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

3.3 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes or premix mortar. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

3.4 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

3.4.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.4.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.5 JOINT REINFORCEMENT INSTALLATION

Joint reinforcement shall be installed at 16 inches on center or as indicated. Reinforcement shall be lapped not less than 6 inches. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 5/8 inch cover to either face of the unit.

3.6 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on

each side of openings shall be filled solid with grout for full height of openings. Lintels and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

3.6.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

3.6.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

3.6.3 Grout Holes and Cleanouts

3.6.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 16 inches on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings shall not be less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

3.6.3.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 32 inches where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.6.4 Grouting Equipment

3.6.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed of outside the masonry.

3.6.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

3.6.5 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

3.6.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

3.6.5.2 High-Lift Method

Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift

grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2) Multiwythe Masonry (3)	Hollow-unit Masonry
1	Fine	Low Lift	3/4	1-1/2 x 2
5	Fine	Low Lift	2	2 x 3
8	Fine	High Lift	2	2 x 3
12	Fine	High Lift	2-1/2	2-1/2 x 3
24	Fine	High Lift	3	3 x 3
1	Coarse	Low Lift	1-1/2	1-1/2 x 3
5	Coarse	Low Lift	2	2-1/2 x 3
8	Coarse	High Lift	2	3 x 3
12	Coarse	High Lift	2-1/2	3 x 3
24	Coarse	High Lift	3	3 x 4

Notes:

(1) The actual grout space or cell dimension must be larger than the sum of the following items:
a) The required minimum dimensions of total clear areas given in the table above;
b) The width of any mortar projections within the space;
c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.

(2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.

(3) For grouting spaces between masonry wythes.

(4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.7 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

3.8 CONTROL JOINTS

Control joints shall be provided at a maximum spacing of 25 feetalong walls and within 10 feet of corners unless indicated otherwise on the drawings, and shall be constructed by using special control-joint units in accordance with the details shown on the drawings. Sash jamb units shall have a 3/4 by 3/4 inch groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. Exposed interior control joints shall be raked to a depth of 1/4 inch. Concealed control joints shall be flush cut.

3.9 LINTELS

3.9.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 1/2 inch above the bottom inside surface of the lintel unit.

3.9.2 Precast Concrete and Steel Lintels

Precast concrete and steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel and precast lintels shall have a minimum bearing length of 8 inches unless otherwise indicated on the drawings.

3.10 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.10.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 16 inches on centers vertically and 24 inches on center horizontally.

3.10.2 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 16 inches on centers vertically, and if applicable, not over 24 inches on centers horizontally.

3.11 SPLASH BLOCKS

Splash blocks shall be located as shown.

3.12 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and

stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

3.12.1 Concrete Masonry Unit Surfaces

Exposed concrete masonry unit surfaces shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.13 BEARING PLATES

Bearing plates for beams, joists, joist girders and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Bedding mortar and non-shrink grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.14 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Cover the top of unfinished walls . Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.15 WASTE MANAGEMENT

Manage waste according to the Waste Management Plan and as follows. Minimize water used to wash mixing equipment. Use trigger operated spray nozzles for water hoses.

3.15.1 Separate and Recycle Waste

Place materials defined as hazardous or toxic waste in designated containers. Fold up metal banding, flatten, and place in designated area for recycling. Collect wood packing shims and pallets and place in designated area. Use leftover mixed mortar as retaining wall footing ballast where lower strength mortar meets the requirements for bulk fill. Separate masonry waste and place in designated area for use as structural fill. Separate selected masonry waste and excess for landscape uses, either whole or crushed as ground cover.

3.15.2 Take-Back Program

Collect information from manufacturer for take-back program options. Set aside masonry units, full and partial to be returned to manufacturer for recycling into new product. When such a service is not available, local recyclers shall be sought after to reclaim the materials.

3.16 TEST REPORTS

3.16.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each 5000 square feet of CMU. The specimens shall be prepared and tested for compressive strength in accordance with ASTM C 780.

3.16.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per each placement day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 2000 psi at 28 days.

-- End of Section --