PHASE 1

QUINDARO – RIVERSIDE LEVEES AND STRUCTURES

PHASE I

DIVISION 1 – GENERAL REQUIREMENTS

01100	General
01312A	Quality Control System (QCS)
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SECTION 01100

GENERAL

PART 1 GENERAL

1.1 INQUIRIES

Pursuant to SECTION 00100 paragraph titled "Instructions to Offerors--Competitive Acquisition", any inquiries regarding this Invitation, before bids are opened, should be addressed to the District Engineer, Kansas City District, Corps of Engineers, 700 Federal Building, Kansas City, Missouri 64106, ATTN: Mr. Bob Dimmit. Inquiries for which oral explanation or advice on the plans and specifications will suffice may be referred to Mr. Dimmit by calling Area Code 816-983-3468. Telephone calls concerning the mailing of plans and specifications should be made to Contracting Division at Area Code 816-983-3975. Collect telephone calls will not be accepted. (KCDO APR 84)

1.2 OPEN BURNING

On-site burning in general will be allowed under the following conditions:

a. The Contractor shall obtain approval of the local fire marshals;

b. The Contractor shall use a smoke curtain and below ground pit;

c. The Contractor shall include on-site open burning in his Plan of Operations, and shall submit it for the approval of the Contracting Officer;

d. The Contractor shall obtain a burn permit from the Missouri Department of Natural Resources' Regional Office; and

e. The Contractor shall have applied for and been granted a permit to burn with restrictions from the local Government.

Failure of the Contractor to meet these conditions in a timely manner will not constitute a basis for claims against the Government. The Contractor may use other processes to remove the materials, such as chipping or off-site disposal, if this method is cost-comparable to the on-site burning method.

All on-site burning will require the use of an Air Curtain Destructor. An Air Curtain Destructor is an air pollution control device designed to increase burning efficiency, thereby reducing air contaminant emissions during open burning.

A burning permit is a permit that must be applied for and granted in order to burn with restrictions from the local and State Governments. The Contractor must send permit applications to the local and State Regional Offices that have jurisdiction.

A completed application submitted to the Missouri Department of Natural Resources' Regional Office which has jurisdiction over this area will contain the following:

a. The name, address and telephone number of the person submitting the application;

b. The type of business or activity involved;

c. A description of the proposed equipment and operating practices, the type, quantity and composition of trade wastes and vegetation to be burned, and expected composition and amount of air contaminants to be released to the atmosphere, if known;

d. The schedule of burning operations;

e. The location where the open burning will be performed;

f. Reasons why no method other than open burning is feasible; and

g. Evidence that the fire control authority and other local agencies that have jurisdiction over the area have approved the proposed open burning.

For more information, call or write:

Missouri Department of Natural Resources
Kansas City Regional Office
500 N.E. Colbern Road
Lee's Summit, MO 64086-4710
(816) 622-7000 office
(816) 622-7044 fax

1.3 SUPERINTENDENCE OF SUBCONTRACTORS

(a) The Contractor shall be required to furnish the following:

(1) If more than 50% and less than 70% of the value of the contract work is subcontracted, one superintendent shall be provided at the site and on the Contractor's payroll to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

(2) If 70% or more of the value of the work is subcontracted, the Contractor shall be required to furnish two such superintendents to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

(b) If the Contracting Officer, at any time after 50% of the subcontracted work has been completed, finds that satisfactory progress is being made, he may waive all or part of the above requirement for additional superintendence subject to the right of the Contracting Officer to reinstate such requirement if at any time during the progress of the remaining work he finds that satisfactory progress is not being made.

1.4 IDENTIFICATION OF EMPLOYEES

The Contractor shall be responsible for furnishing to each employee and for requiring each employee engaged on the work to display identification as may be approved and directed by the Contracting Office. All prescribed identification shall immediately be delivered to the Contracting Officer, for cancellation upon the release of any employee. When required by the Contracting Officer the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project.

1.5 APPLICATION OF WAGE RATES

The inclusion of the Davis-Bacon Act General Wage Decision or the Service Contract Act Wage Determination in the solicitation is a statutory requirement. It is not a representation by the U.S. Army Corps of Engineers that any specific work task can be performed by any specific trade. Which work tasks can be performed by what trades depends on and is determined by the prevailing area practice for the local area where the contract is being performed. It is the sole responsibility of the bidder to determine and comply with the prevailing area practice. Inquiries regarding a prevailing area practice should be directed to the Corps of Engineers, Contractor Industrial Relations Specialist (telephone number 816-983-3723) or to the Department of Labor Regional Wage and Hour Division.

Application of wage rates and fringe benefits: For the application of the wage rates and fringe benefits contained in the Decision of the Secretary of Labor; attached to and a part of this contract, all work shall be considered Heavy Construction.

1.6 PAYMENTS TO SUBCONTRACTORS

The Contractor's attention is directed to CONTRACT CLAUSE titled "Payment Under Fixed-Price Construction Contracts." In addition to the requirements set forth in the referenced paragraph, the Government will reimburse the Contractor, upon request, for amount of premiums paid by the subcontractors for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor furnishes evidence of full payment to the surety.

1.7 PAYMENTS TO CONTRACTOR (KCD MAY 90 - FORMERLY FAR 52.2/9101(a))

The following is an example of a Contractor's release of claims clauses required to comply with the provisions of paragraph (h) of the CONTRACT CLAUSE titled "Payments Under Fixed-Price Construction Contracts":

RELEASE OF CLAIMS

The undersigned Contractor under contract dated _____, 2000, between the United States of America and said Contractor for the _____ located at _____, in accordance with paragraph (h) of the CONTRACT CLAUSE titled "Payments Under Fixed-Price Construction Contracts" of said contract, hereby releases the United States, its officers, agents, and employees from any and all claims arising under or by

virtue of said contract or any modification or change thereof except with respect to those claims, if any, listed below:

(Here itemize claims and amounts due.)

1.8 PARTNERING

The Government intends to encourage the foundation of a cohesive partnership with the Contractor and its subcontractor. This partnership will be structured to draw on the strengths of each organization to identify and achieve mutual goals with the intent to complete the Contract within budget, on schedule and in accordance with plans and specifications. This partnership will be bilateral in makeup, and participation will be totally voluntary. Any cost associated with implementing this partnership will be agreed to by the Contractor and the Government, and will be shared equally with no change in Contract price. To implement this partnership initiative, it is anticipated that thirty (30) days after Notice to Proceed, a team building workshop will be conducted. Follow-up workshops will be held periodically throughout the duration of the Contract as agreed to by the Contractor and the Government.

1.9 PROSPECTIVE CONTRACTOR RESPONSIBILITY

Each bidder shall furnish, within 3 calendar days after receipt of request therefor, data which will show the bidder's ability to perform the work or services required by this Invitation for Bids. Such data shall include as a minimum: Bank certification of financial capability, or a financial statement not over 60 days old, which will be treated as confidential (if over 60 days old, a certificate shall be attached thereto stating that the financial condition is substantially the same or, if not the same, the changes that have taken place); names of commercial and financial reporting agencies from whom credit reports may be obtained; trade creditors; name and address of bonding company; business and construction experience; past record of performance of Government contracts; and construction plant and equipment available for this job, with resume of work in progress or other data that will assure that the bidder is in a position to perform the work within the time specified.

In addition, if the bid exceeds $1,000,000, the bidder shall furnish upon request, a certified statement listing:

(a) Each contract awarded to him within the preceding three-month period exceeding $1,000,000 in value with brief description of the contract.

(b) Each contract awarded to him within the preceding three-year period not already physically completed and exceeding $5,000,000 in value with brief description of the contract.

(c) If the prospective Contractor is a joint venture, each joint venture member will be required to submit the above defined certification. There shall also be furnished any other available information which will serve to substantiate the bidder's qualifications as a responsible prospective Contractor. (KCD APR 84)

1.10 PERFORMANCE OF WORK BY CONTRACTOR

Bidder's attention is directed to SPECIAL CLAUSE titled "Performance of work by Contractor". The successful bidder will be required to furnish the Contracting Officer a description of the work which he will perform with his own organization (e.g., earthwork, paving, etc.), the percentage of the total work this represents, and the estimated cost thereof. Such description of work to be performed by the Contractor's own organization shall be furnished to the Contracting Officer within 10 days after award of the contract.

1.11 LABORATORY AND TESTING FACILITIES

The Contractor shall provide and maintain all measuring and testing devices, laboratory equipment, instruments, transportation, and supplies necessary to accomplish the required testing. All measuring and testing devices shall be calibrated at established intervals against certified standards. The Contractor's measuring and testing equipment shall be made available for use by the Government for verification of their accuracy and condition as well as for any inspection or test desired pursuant to the CONTRACT CLAUSE titled "Inspection of Construction." The location of the laboratory shall be convenient to the site such that test results are available prior to proceeding with the next sequential phase of the work. (KCD)

1.12 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

(a) This provision specifies the procedure for determination of time extensions for unusually severe weather in accordance with the CONTRACT CLAUSE titled "Default: (Fixed Price Construction)." In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

(1) The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

(2) The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

(b) The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY

WORK DAYS BASED ON (5) DAY WORK WEEK

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(16)	(11)	(6)	(7)	(7)	(8)	(6)	(5)	(6)	(5)	(3)	(9)

(c) Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph b, above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the CONTRACT CLAUSE titled "Default (Fixed Price Construction)." (ER 415-1-15)

1.13 REQUIRED INSURANCE SCHEDULE

In accordance with CONTRACT CLAUSE titled "Insurance - Work On A Government Installation," the Contractor shall procure and maintain during the entire period of his performance under this contract the following minimum insurance.

Type	Amount
Workmen's Compensation State Statute	coverage complying with applicable
Employers' Liability	minimum amount of $100,000.00
General Liability on Comprehensive Form of Policy	minimum limits of $500,000 per occurrence for bodily injury which includes, but is not limited to, insurance for all work required herein
Comprehensive Automobile Liability	minimum limits of $200,000 per person and $500,000 per occurrence for bodily injury, and $20,000 per occurrence for property damage

(End of clause)

1.14 CONTRACTOR-FURNISHED EQUIPMENT DATA

At or before 30 days prior to final inspection and acceptance of the work, the Contractor shall submit the data mentioned in the following subclauses.

(1) Equipment List. An itemized equipment list showing unit retail value and nameplate data including serial number, model number, size, manufacturer, etc., for all Contractor-furnished items of mechanical equipment, electrical equipment, and fire protection systems installed under this contract.

(2) Guarantees. A list of all equipment items which are specified to be guaranteed accompanied by a copy of each specific guarantee therefor. For each specific guaranteed item, a name, address, and telephone number shall be shown on the list for subcontractor who installed equipment, equipment supplier or distributor and equipment manufacturer. The completion date of the guarantee period shall correspond to the applicable specification requirements for each guaranteed item.

(3) Warranty Service Calls. The Contractor shall furnish to the Contracting Officer the names of local service representatives and/or Contractors that are available for warranty service calls and who will respond to a call within the time periods as follows: 4 hours for heating, air-conditioning, refrigeration, air supply and distribution, and critical electrical service systems and food service equipment, and 24 hours for all other systems. The names, addresses, and telephone numbers for day, night, weekend, and holiday service responses shall be furnished to the Contracting Officer and also posted at a conspicuous location in each mechanical and electrical room or close to the unit.

1.15 DATE OF SAFETY AND HEALTH REQUIREMENTS MANUAL (EM 385-1-1)

(a) The date of the U.S. Army Corps of Engineers Safety and Health Requirements Manual in effect at the time of this solicitation is 3 September 1996. See Section 00700, Contract Clause titled "Accident Prevention." (KCD 18 DEC 1992)

(b) Section 06.I of EM 385-1-1 is deleted. Job hazard analysis for confined space entry procedures is still required, as per 01.A.09 of EM 385-1-1. OSHA Standards 29 CFR 1910.146 or 29 CFR 1926 shall apply.

1.16 RECORDING AND PRESERVING HISTORICAL AND ARCHAEOLOGICAL FINDS

All items having any apparent historical or archaeological interest which are discovered in the course of any construction activities shall be carefully preserved. The Contractor shall leave the archaeological find undisturbed and shall immediately report the find to the Contracting Officer so that the proper authorities may be notified (see also Specification Section 01354, paragraph 3.2.2).

1.17 COMPLIANCE WITH OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)

The Contractor shall comply with OSHA standards as well as the Corps of Engineers Safety and Health Requirements Manual (EM 385-1-1) dated September 1996. The OSHA standards are subject to change and such changes may affect the Contractor in his performance under the contract. It is the Contractor's responsibility to know such changes and effective dates of changes. (KCD APR 84)

1.18 CONSTRUCTION EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE

Whenever a modification or equitable adjustment of contract price is required, the Contractor's cost proposal for equipment ownership and operating expenses shall be as set forth in SPECIAL CLAUSE titled "Equipment Ownership and Operating Expense Schedule." A copy of EP

1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" dated June 1999 can be ordered from the Government Printing Office (GPO) by calling Telephone No. 202-512-1800.

1.19 SHOP DRAWINGS

The Contractor's attention is directed to clause "Specifications and Drawings for Construction" of the Contract Clauses.

1.20 SUBMITTALS

(a) Submittal Procedures. See Division One SECTION: SUBMITTAL PROCEDURES.

(b) Shop Drawings shall be submitted in ample time to secure approval prior to the time the items covered thereby are to be delivered to the site. ENG Form 4025 and 4026 shall be used for the transmittal of shop drawings. Unless otherwise specified, shop drawings shall be submitted not less than 30 days before commencement of fabrication of fabricated items and not less than 15 days before delivery of standard stock manufactured items. Where materials are stock with the manufacturer, catalog data, including specifications and full descriptive matter, may be submitted as shop drawings. When catalog includes nonapplicable data, the applicable data shall be clearly designated and identified by item number, item name, and name of manufacturer. Shop drawings submitted (including initial and final submittals) shall be reproductions on high quality paper with clear and legible print. Drawings shall generally be bordered a minimum of one inch and trimmed to neat lines and unless otherwise specified, the minimum scale shall be 3/8-inch to the foot. Shop drawings quality will be subject to approval. Each shop drawing, including catalog data, shall be identified with a title block including the name of Contractor, contract number, name and location of project, and name of item of work or structure to which the shop drawing applies. Material fabricated or delivered to the site before approved shop drawings have been returned to the Contractor will be subject to rejection. NO CONSTRUCTION OR INSTALLATION SHALL BE DONE FOR ANY ITEM REQUIRING SHOP DRAWINGS, UNTIL ALL SHOP DRAWINGS FOR THAT ITEM HAVE BEEN APPROVED.

(c) As-Built Shop Drawings: Upon completion of the work under this contract, the Contractor shall furnish five complete sets of prints or one complete set of reproducibles of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the equipment is completed and accepted. The quality of the reproducibles and prints is subject to approval.

(d) As-Built Drawings: The Contractor shall maintain three separate sets of red-lined, full scale, as-built construction drawings marked up to fully indicate as-built conditions. These drawings shall be maintained in a current condition at all times until completion of the work, and shall be available for review by Government personnel at all times. All variations from the contract drawings, for whatever reason, including those occasioned by modifications, optional materials, and the required coordination between trades, shall be indicated. These variations shall be shown in the same general detail utilized in the contract drawings. In addition, the Contractor shall indicate on the As-Built Drawings, the brand-name,

description, location, and quantity of any and all materials used which contain asbestos. The Contractor shall also be responsible for updating the Government-furnished CADD files to reflect the current as-built conditions throughout the duration of the project. The updated CADD design files shall be maintained in the Intergraph Microstation format consistent with the graphic standards established in the CADD contract drawings provided by the Government. The Contractor will be provided a copy of the Tri-Service CADD standards to facilitate his efforts in the maintenance of design files. The updated CADD files shall be reviewed by the Government on a monthly basis during the progress payment evaluation. The Contractor shall be prepared to demonstrate the status of the updated CADD files in his on-site office. The as-built utility drawings shall show locations and elevations of all underground new utilities and existing utilities encountered, including dimensions from permanent structures and/or survey locations. The submittal requirements for as-built utility drawings shall be shown as separate activities on the Contractor-prepared network analysis. Upon completion of the work, the marked-up drawings and the updated CADD files shall be furnished to the Contracting Officer on 8 mm tape or CD. In multiphased construction where portions of a system are to be turned over to the user prior to completion of the project, the marked-up drawings for that portion shall be furnished to the Contracting Officer at that time.(MRD ltr 30 Oct 70 and KCD 8 Apr 91)

(e) CADD Files: The Government will provide to the Contractor, within 30 calendar days after Notice of Award, copies of the CADD computer files of the contract drawings for the production of as-built drawings. These files will be in Intergraph Microstation format. The Government provides no warranty, expressed or implied, of the CADD computer files. The Contractor shall assume all responsibility to verify the CADD drawing files. The Contractor will not utilize the CADD drawing computer files to resolve dimensional or other discrepancies. The Government will not guarantee the measurable accuracy of the CADD drawing computer files.

(f) Purchase Orders: Each purchase order issued by the Contractor or his subcontractors for materials and equipment to be incorporated into the project, shall be maintained on file at the Contractor's field office for inspection and review by Government representatives. Each purchase order shall (1) be clearly identified with applicable DA contract number, (2) carry an identifying number, (3) be in sufficient detail to identify the material being purchased, (4) indicate a definite delivery date, and (5) display the DMS priority rating. At the option of the Contractor, the copies of the purchase orders may or may not indicate the price of the articles purchased. (MRD Ltr 22 Oct 74)

1.21 SPECIAL REFERENCES

(a) Shop Drawings. Bidder's attention is directed to SPECIAL CLAUSE titled "Shop Drawings." The basic requirements for Shop Drawings are set forth in the CONTRACT CLAUSES and SPECIAL CLAUSES.

(b) Approved Equal. Bidder's attention is directed to SPECIAL CLAUSE titled "Approved Equal."

(c) Payment to Subcontractors. Bidder's attention is directed to SPECIAL

CLAUSE titled "Payments to Subcontractors."

1.22 DIFFERENCES IN DRAWINGS

In addition to the provisions of CONTRACT CLAUSE paragraph "Specifications and Drawings for Construction," the structural drawings shall govern in cases where they differ from the architectural drawings.

1.23 LAYOUT OF WORK (1965 APR OCE)

(a) The Government will establish the following base lines and benchmarks at the site of the work:

(Furnish no more than the following:

Dams - 3 base lines for the dam
- 1 base line for each principal structure
- 1 or 2 bench marks on each bank of stream

Levees and Local

Protection Work - 1 base line at centerline or levee or floodwall
- 1 base line for each principal structure
- bench marks at approximately 1 mile intervals and at each structure

Relocation Projects - alignment survey base lines
- bench marks at wide intervals and at each principal structure

Other Work - as necessary to lay out the work.)

(b) From the base lines and bench marks established by the Government, the Contractor shall complete the layout of the work and shall be responsible for all measurements that may be required for the execution of the work to the location and limit marks prescribed in the specifications or on the contract drawings, subject to such modifications as the Contracting Officer may require to meet changed conditions or as a result of necessary modifications to the contract work.

(c) The Contractor shall furnish, at his own expense, such stakes, templates, platforms, equipment, tools and material, and all labor as may be required in laying out any part of the work from the base lines and benchmarks established by the Government. It shall be the responsibility of the Contractor to maintain and preserve all stakes and other marks established by the Contracting Officer until authorized to remove them, and if such marks are destroyed, by the Contractor or through his negligence prior to their authorized removal they may be replaced by the Contracting Officer, at his discretion, and the expense of replacement will be deducted from any amounts due or to become due the Contractor. The Contracting Officer may require that work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit checking of the work.

(d) Records of Contractor-performed survey activities shall be kept in complete, accurate, and legible field notes. The format shall conform to established standards for such records. Prior to any surveys, the Contractor shall submit the field note format for approval.

(e) The layout of work shall be under the direction of a competent survey party chief who has the following minimum qualifications: (1) high school graduate; (2) 7 years survey experience; (3) 4 years experience on construction related survey activities, and (4) 1 year experience as survey party chief.

1.24 PLANTS AVAILABLE

Each bidder shall, upon request of the Contracting Officer, furnish a list of the plants available to the bidder and proposed for use on the work.

1.25 DAMAGE TO WORK (1966 MAR OCE)

The responsibility for damage to any part of the permanent work shall be as set forth in the CONTRACT CLAUSE titled "Permits and Responsibilities." However, if, in the judgment of the Contracting Officer, any part of the permanent work performed by the Contractor is damaged by flood or earthquake, which damage is not due to the failure of the Contractor to take reasonable precautions or to exercise sound engineering and construction practices in the conduct of the work, the Contractor will make the repairs as ordered by the Contracting Officer and full compensation for such repairs will be made at the applicable contract unit or lump sum prices as fixed and established in the contract. If, in the opinion of the Contracting Officer, there are no contract unit or lump sum prices applicable to any part of such work an equitable adjustment pursuant to CONTRACT CLAUSE titled, "Changes," of the contract, will be made as full compensation for the repairs of that part of the permanent work for which there are no applicable contract unit or lump sum prices. Except as herein provided, damage to all work (including temporary construction), utilities, materials, equipment and plant shall be repaired to the satisfaction of the Contracting Officer at the Contractor's expense, regardless of the cause of such damage.

1.26 WORK ADJACENT TO ROADS AND HIGHWAYS

Where the construction work is on or adjacent to, or involves hauling over public or private roads, streets, or highways, all herein referred to as "roads," the said roads shall, except as otherwise specified or directed, be kept open for traffic at all times during the construction period. Further, the Contractor shall, during said construction, provide, erect and maintain warning signs, lanterns or torches or other safety devices and, when necessary, provide flagmen for protection of traffic to the satisfaction of the Contracting Officer and local authorities. The Contractor shall keep the right-of-way of the roads free of debris that might be caused to accumulate thereon by his operations, and upon completion of the work, shall clean up the said roads and repair any damage to the roads occasioned by his operations under this contract to the satisfaction of the Contracting Officer and local authorities having

jurisdiction. The drainage from the roads shall not be obstructed by the construction work. The Contractor shall be responsible for obtaining and paying for all permits required for operation on all roads.

1.27 APPROVED EQUAL

The drawings and the TECHNICAL PROVISIONS of these specifications may, in some instances, refer to certain items of equipment, material, or article by trade name. References of this type shall not be construed as limiting competition, but shall be regarded as establishing a standard of quality. In this respect, the Contractor's attention is directed to CONTRACT CLAUSE titled "Material and Workmanship."

1.28 SCHEDULE OF WORK

The Contractor's attention is directed to CONTRACT CLAUSE titled "Schedule for Construction Contracts," wherein if, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer.

1.29 PROTECTION OF UTILITY LINES

(a) It shall be the Contractor's responsibility to protect all existing utility lines from damage during excavation for utilities systems. Any damage resulting to existing utility systems shall be repaired by the Contractor, to the satisfaction of the contracting officer, at no additional cost to the Government.

1.30 CLOSEOUT OF CONTRACTS (KCD JULY 1990)

The closing out of various features of the contract shall be done before or on the Government contract construction completion date. The Contractor's specific submittals and items required for closeout include, but are not limited to, Operation and Maintenance Manuals (O&M), training, spare parts, equipment list, guarantees, as-built shop drawings and contract drawings.

The Contractor shall review the contract documents and prepare a plan for closeout no later than 90 days after the notice to proceed date for approval by the Contracting Officer Representative (COR). The closeout plan shall also include the Specification Volume No., specification reference section and building name on each closeout item. A summary of the type of closeout information required for each of the items shall be prepared by the Contractor for the closeout plan. The closeout data base shall be updated as required by the Contracting Officer to ensure adequate tracking of the items noted.

The following is a general list of the various types of closeout materials and the data required for each. (* indicates data required on initial submittal)

(a) O&M Manuals:

Descriptions*, Specification Paragraph*, Date Due*, No. Copies Due*, Date

Submit Action Code, Resubmit Date, Approved, Date to User

(b) Training Requirements:

Description*, Specification Paragraph*, Length Required*, Date Scheduled, Plan Submitted, Plan Approved, Date Training Held

(c) Spare Parts Required:

Description*, Specification Paragraph*, Quantity Required*, Date Turned Over to User

(d) Salvaged Material:

Description*, Specification-Plan Requirement*, Quantity*, Turn In Document Received

(e) Government-Furnished Equipment:

Description*, Specification-Plan Requirement*, GFCI-GFGI*, Number Required*, Date Equipment Data Required*, Date Equipment Required*, Turnover Document Provided

(f) Utilities Provided or Relocated by Others:

Description*, Relocate or Provide*, Specification-Plan Note*, Date Required*

1.31 MODIFICATIONS PRIOR TO DATE SET FOR OPENING BIDS

The right is reserved, as the interest of the Government may require, to revise or amend the specifications or drawings or both prior to the date set for opening bids. Such revisions and amendments, if any, will be announced by an amendment or amendments to this Invitation for Bids. If the revisions and amendments are of a nature which requires material changes in quantities or prices bid or both, the date set for opening bids may be postponed by such number of days as in the opinion of the issuing officer will enable bidders to revise their bids. In such cases, the amendment will include an announcement of the new date for opening bids. (KCD APR 84)

1.32 UNEXPECTED HAZARDOUS SUBSTANCES

In the event that suspected hazardous substances are revealed during construction activities, all such construction activities in the immediate area shall be immediately suspended. Hazardous substances for purposes of this specification only, shall be defined as CERCLA hazardous substances, infectious or radioactive wastes, asbestos or oil. The Contractor shall leave the materials undisturbed and shall immediately report the find to the Contracting Officer's Representative (COR) so that proper authorities can be notified. The Contractor shall not resume construction activities in the vicinity of the suspected hazardous substances until written clearance is received from the COR. Identification and removal of any such materials will be conducted in accordance with all Federal, state and local environmental laws and regulations according to the CONTRACT CLAUSE titled

"Differing Site Conditions."

1.33 SURVEY MARKERS

Reference is made to CONTRACT CLAUSE titled "Permits and Responsibilities", Chapter 60 of the Missouri Revised Statutes 1969, and rules titled "Maintenance of the Original US Public Land Survey Corners" adopted by the Division of Geology and Land Survey, Missouri Department of Natural Resources. The Contractor shall be responsible for removing and relocating survey markers. Relocation shall be performed by a professional registered Land Surveyor.

1.34 DEMOLITION

Disposal of demolition waste shall be in accordance with all applicable Federal, State and local regulations, including "Chapter 260, RSMO" of the "Missouri Department of Natural Resources."

1.35 EXCAVATION NOTIFICATION

Prior to any excavation on either public or private properties, Missouri law requires that you notify all owners and operators of underground facilities in your dig site. Missouri One Call System (MOCS) can help you comply with the law; "Chapter 319, RSMO" of the "Missouri Department of Natural Resources," by calling this one toll-free number 1-800-344-7483.

1.36 MISSOURI SALES AND USE TAX (JUL 1997)

In accordance with FAR Clause 52.229, notice is given that the contract price excludes the Missouri sales tax and compensating (use) tax on all sales of tangible personal property and materials purchased by the Contractor or subcontractors for the construction of projects, including repairing or remodeling facilities, for the United States. In accordance with Section 144.062, RSMo., the Contracting Officer will issue and furnish to the Contractor an exemption certificate (example copy appears at the end of this section) for this project with the Notice to Proceed. The Contractor and the subcontractors will use the exemption certificate for this project in the purchase of supplies, materials and furnishings for incorporation in the project. The Contractor and the subcontractors shall furnish a copy of such certificate to all suppliers/materialmen from whom such purchases are made, and the suppliers shall execute invoices covering the same bearing the number of such certificate. (KCD OC)

1.37 MATERIALS SOURCES

Riprap, bedding, and coarse aggregates for cast-in-place concrete meeting the requirements of these specifications can be produced from the approved sources listed below.

(1)Coarse aggregate for concrete and stone protection materials for riprap and bedding:

QUARRIES	**COUNTY**	**STATE**	**APPROVED LEDGE**

LaFarge (Menefee) - Dresden Quarry Sec. 23, T.46N, R22W Sedalia, MO 816-826-0328	Pettis	MO	Burlington LS
Fischer Quarries Sec 17, T46, R21 Hughesville, MO 660-829-5555, 800-352-1517	Pettis	MO	Burlington LS
Hilty Quarries - Snyder Quarry Sec. 16, T39N, R25W Clinton, MO 816-855-8135	St. Clair	MO	Burlington
Hilty Quarries - Tightwad Quarry Sec. 3 & 34, T41N, R24W Clinton, MO 816-855-8135	Benton	MO	Burlington
Hilty Quarries - Warsaw North Quarry Sec. 15, T41N, R23W Clinton, MO 816-855-8135	Benton	MO	Burlington
Hilty Quarries - Warsaw South Quarry Sec. 4 T39N, R22W Clinton, MO 816-855-8135	Benton	MO	Burlington
Ash Grove Aggregates - Wheatland Quarry Sec. 2, T37N, R23W Butler, MO 816-679-4128	Hickory	MO	Burlington
AgRock Quarries SW1/4 Sec. 20, T37N, R22W Wheatland, MO	Hickory	MO	Burlington
Franklin Quarry Sec 34, T53N, R20W	Saline	MO	Burlington
Malan Quarry (Milan) Sec 5, T52N, R21W	Saline	MO	Burlington
Howard Quarry Sec 5, T52N, R21W	Saline	MO	Burlington

(2) Stone protection materials for riprap and bedding:

QUARRIES	**COUNTY**	**STATE**	**APPROVED LEDGE**
Damon Pursell Rock Ridge Quarry SW1/4 Sec 23 & NW1/4 Sec 26 T48N, R33W	Jackson	MO	Winterset LS lower 17' Bethany Falls LS

Liberty, MO 816-792-1031, 816-926-0300			
APAC-Limpus Quarries (Metro/City Wide) Sec. 24, T50N, R32W Sugar Creek, MO 816-380-5170, 816-257-2222	Jackson	MO	Lower 16 feet of Bethany Falls LS and lower 17' Winterset LS
Hunt Midwest Mining/Randolf Quarry SW1/4 Sec. 2, T50N, R32W Kansas City, MO 816-455-3876	Clay	MO	Upper 13.6 feet Winterset LS and lower 16 feet Bethany Falls LS
Missouri Rock, Inc/Orrick Quarry NW1/4 Sec. 14, T51N, R29W Independence, MO 816-781-6459	Ray	MO	Lower 8 feet of Bethany Falls LS and Lower 8 feet of Winterset LS

Listing of a source is not to be construed as approval of all material from the source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels when such materials are unsuitable as determined by the Contracting Officer. A winter quarrying prohibition is in effect for this contract. Riprap and bedding material production for this contract shall not be permitted from November 15 to March 21.

Materials may be furnished from any of the above listed sources or at the option of the Contractor may be furnished from any other source designated by the Contractor and approved by the Contracting Officer, subject to the conditions stated below.

After the award of contract, the Contractor shall designate in writing only one source or combination of sources from which he proposes to furnish each material. If the Contractor proposes to furnish material from a source or from sources not listed above, he may designate only a single source or single combination of sources for the material for testing by and at the expense of the Government. If a source of material so designated by the Contractor is not approved for use by the Contracting Officer, the Contractor may not submit for approval other sources but shall furnish the material from an approved source listed above at no additional cost to the Government. . The Contractor will be entitled to no additional compensation or extension of time due to any requirements for sampling and testing.

When the Contractor desires to use aggregates from a source not listed, suitable samples for quality evaluation consisting of not less than 1500 pounds of each size coarse aggregate shall be taken under the supervision of the Contracting Officer in accordance with CRD-C 100. These samples shall be delivered to an approved laboratory selected by the Government within 15 days after notice to proceed. Sampling and shipping of samples shall be at the expense of the Contractor. A minimum of 90 days will be required to complete evaluation of the proposed aggregates.

When the Contractor proposes to furnish riprap, or bedding from a source not listed, the Government will make such tests and other investigations as necessary to determine whether or not the rock materials meeting the requirements of this project can be produced from the proposed sources. The tests to which the rock materials may be subjected include specific gravity, absorption, Los Angeles abrasion, soundness in magnesium sulfate, petrographic analysis, freezing and thawing, alkali or carbonate-aggregate reaction, and organic impurities. Other tests may be performed as are necessary to demonstrate that rock products or concrete of acceptable quality can be produced from the proposed materials.

Approximately one sample per 1-1/2 feet of face and from each bed 8 inches or greater in the entire vertical face of the ledge to be quarried shall be taken by the Contractor in the presence of a Government representative. The samples shall be approximately 8- to 14-inch cubes and shall be marked in order, starting with number one at the top of the quarry face. Samples shall be delivered to a laboratory selected by the Government, 60 days in advance of the time the materials will be needed in the work. These samples will be subjected to freezing and thawing tests under Corps of Engineers specification CRD C-144 and to the specific gravity and absorption tests under Corps of Engineers specification CRD C-107. Since the performance of these samples in the test will be affected by the presence of moisture, the extent of "drying out" and the amount of incipient fractures in the rock due to blasting shock, every effort shall b made to obtain samples for a quarry face that are truly representative of actual job production. At least 60 percent of the quarry face as represented by individual samples shall show individual losses of less than 25 percent, and the average loss of all samples shall be less than 25 percent.

The geologic rock unit of other sources submitted for stone protection shall have, as a minimum, a suitable 5 year service record on similar sized slope protection material exposed to shoreline conditions in a similar climatic region. The Contracting Officer will determine what is suitable for an adequate service record. Service record documentation shall include date used, where used, identification of ledges used, names of previous users, gradation produced, quantities produced since last tested, and result of most recent tests identified hereinafter. In addition to an acceptable 5-year service record, as determined by the Contracting Officer, the Contracting Officer has the option to elect to have representative samples taken and tested.

1.38 UNIT LUMP SUM AND UNIT PRICING

This project is a cost share project between the U.S. Government and its Sponsors. To break out the shared cost this contract will require the Contractor to provide an electronic measurement and payment schedule based on the bid schedule items. The schedule shall provide a work breakdown structure using both detail feature codes and descriptions using ASTM El 557-97 UNIFORMAT II. The work breakdown structure shall cover all the items of a task and cost which are put together as one element in a project. The Contractor will be required to provide a copy of the software used by the Contractor for measurement and payment billing to the COR. A copy of Contractor's program shall also provide Cost Accounting Reports.

Reports shall include labor hours and cost, material cost, equipment cost and total cost. All items must be Fair Market Price. Fair Market Price is a method of estimating a task by labor, materials and equipment using a minimum of three cost surveys by the Contractor if it is identified as an unbalanced cost by the COR. The fair market price must be tempered by judgmentally incorporating particular job conditions. Also a cost is reasonable if, in its nature and amount, it does not exceed that which would be incurred by a prudent person well equipped in the conduct of competitive business. The COR shall establish what is reasonable using the United States Army Corps of Engineers estimating program called Micro Computer-Aided Cost Estimating Systems (MCACES). MCACES is used for the preparation of detailed construction cost estimates.

Subcontractors data shall also be provided to provide unit cost data.

All information shall be keep confidential by the U.S. Government and marked "For Offical Use Only". Level 1 Major Group Element and Level 2 Group Element are considered nonprietary. All detail information will be considered proprietary information from the Level 3 Individual Elements and deeper levels of detail.

The bid schedule unit or lump sum pricing and measurement units given as bid items on the bid schedule shall be used for Construction Administration. Payments or Modifications to the Construction Contract will be based on the appropriate bid schedule item. The unit or lump sum pricing and measurement units, if any, found in the specifications are for Construction Administrative use to insure proper procedures and standards.

1.39 SPECIFICATIONS OF PHASES I AND II.

If there is a difference in the specifications between Phase I and II, the more stringent requirement between the specification will apply. This will only be implemented by the COR if a ruling or judgement must be made.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

* * * * * *

EXAMPLE

STATE OF MISSOURI

PROJECT EXEMPTION CERTIFICATE FOR EXEMPT ENTITY CONSTRUCTION

UNITED STATES OF AMERICA

NAME OF EXEMPT ENTITY _____

ADDRESS _____

CITY _____ STATE ____ ZIP _____

TAX IDENTIFICATION NUMBER (None required) _____

PROJECT IDENTIFICATION NUMBER _____

PLEASE PROVIDE THE PROJECT LOCATION AND A BRIEF DESCRIPTION BELOW: _____

_____

_____

CONTRACT DATE _____

CERTIFICATE EXPIRATION DATE _____

Contractors are required to provide a copy of this project exemption certificate to their vendors.

This project exemption certificate does not allow contractors to purchase machinery, equipment, or tools used in fulfilling this contract, tax exempt.

Suppliers accepting this project exemption certificate are required to render to the contractor invoices bearing the name of the exempt entity and the project identification number.

An exempt entity that fails to revise the expiration date on this certificate as necessary to complete any work required by the contract will be liable for any sales tax determined due as a result of an audit of the contractor.

The Contractor shall provide this project exemption to all subcontractors purchasing construction materials for this project.

_____

SIGNATURE OF AUTHORIZED AGENT

EXHIBIT A

-- End of Section --

SECTION 01312A

QUALITY CONTROL SYSTEM (QCS)
08/01

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. 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
Submittal Monitoring
Scheduling
Import/Export of Data

1.1.1 Correspondence 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.

1.1.2 Other Factors

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01320A, PROJECT SCHEDULE, Section 01330, SUBMITTAL PROCEDURES, and Section 01451A, CONTRACTOR 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.

1.2 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.

1.3 SYSTEM REQUIREMENTS

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

Hardware

IBM-compatible PC with 200 MHz Pentium or higher processor

32+ MB RAM

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

3 1/2 inch high-density floppy drive

Compact disk (CD) Reader

Color monitor

Laser printer compatible with HP LaserJet III or better, with minimum 4 MB installed memory.

Connection to the Internet, minimum 28 BPS

Software

MS Windows 95 or newer version operating system (MS Windows NT 4.0 or newer is recommended)

Word Processing software compatible with MS Word 97 or newer

Internet browser

The Contractor's computer system shall be protected by virus protection software that is regularly upgraded with all issued manufacturer's updates throughout the life of the contract.

Electronic mail (E-mail) compatible with MS Outlook

1.4 RELATED INFORMATION

1.4.1 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.

1.4.2 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.

1.5 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.

1.6 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:

1.6.1 Administration

1.6.1.1 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.

1.6.1.2 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.

1.6.1.3 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".

1.6.1.4 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.

1.6.1.5 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.

1.6.2 Finances

1.6.2.1 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.

1.6.2.2 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.

1.6.3 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 01451A, CONTRACTOR 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.

1.6.3.1 Daily Contractor Quality Control (CQC) Reports.

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 01451A, CONTRACTOR 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.

1.6.3.2 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.

1.6.3.3 Three-Phase Control Meetings

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

1.6.3.4 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 200.

1.6.3.5 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.

1.6.3.6 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.

1.6.4 Submittal Management

The Government will provide the initial submittal register, ENG Form 4288, 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, ENG Form 4288, 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.

1.6.5 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 01320A PROJECT SCHEDULE). The updated schedule data shall be included with each pay request submitted by the Contractor.

1.6.6 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.

1.7 IMPLEMENTATION

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.

1.8 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:

1.8.1 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.

1.8.2 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.

1.8.3 File Names

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

1.9 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.

1.10 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.

-- End of Section --

SECTION 01320A

PROJECT SCHEDULE
08/01

PART 1 GENERAL

1.1 REFERENCES

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

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11	(1995) Progress, Schedules, and Network Analysis Systems

1.2 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 construction shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers 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 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.

3.3.2.3 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. HVAC commissioning dates.

k. Controls testing plan.

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.

3.3.2.4 Government Activities

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

3.3.2.5 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.

3.3.2.6 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.

3.3.2.7 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.

3.3.2.8 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.

3.3.2.9 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.

3.3.2.10 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 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.

3.3.2.11 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 3.5 disks, formatted to hold 1.44 MB of data, under the MS-DOS Version 5. or 6.x, 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 or person responsible for the schedule, and the MS-DOS 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
09/01

PART 1 GENERAL

1.1 SUBMITTAL IDENTIFICATION (SD)

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

SD-01 Data

SD-04 Drawings

SD-06 Instructions

SD-07 Schedules

SD-08 Statements

SD-09 Reports

SD-13 Certificates

SD-14 Samples

SD-18 Records

SD-19 Operation and Maintenance Manuals

1.2 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.2.1 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."

1.2.2 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.

1.3 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.

1.4 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. **Caution:** The Contractor is cautioned that for each Contractor's resubmittal required beyond the initial submittal and one resubmittal for corrections required by the Contracting Officer, the Contracting Officer will assess Administrative Deduction in the amount of $500.00 from the progress payments due the Contractor. 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.

1.5 WITHHOLDING OF PAYMENT

Payment for materials will not be made if required approvals have not been obtained.

1.6 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.

1.7 SUBMITTAL REGISTER

At the end of this section is a submittal register showing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. The Contractor shall maintain a submittal register for the project in accordance with Section 01312A QUALITY CONTROL SYSTEM (QCS).

1.8 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 30 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.

1.9 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 will be furnished to the Contractor. 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.

1.10 SUBMITTAL PROCEDURES

Submittals shall be made as follows:

1.10.1 Procedures

<u>One complete set of all submittals shall go to the Resident Engineer.</u>

The Contractor shall submit for approval five (5) copies of all submittals. Items not to be submitted in quintuplicate, such as samples and test cylinders, shall be submitted accompanied by five (5) copies of ENG Form 4025. Items to be sent to EC-DS or EC-GL shall be addressed as follows:

US Army Engineer District, Kansas City
Federal Building, 601 East 12th Street, EC-DS
Kansas City, Missouri 64106-2896

AE designs:

- The AE will review submittals requiring an engineering review for designs they completed. Submittals designated for the resident engineer's (Construction) office will not go to the AE even though the AE completed the design.

- To track and expedite, submittals with an AE designation will go directly to the AE with a copy of the transmittal cover (only) to EC-DS for login. AE responses/actions go directly to the Resident Engineer's office with a copy to EC-DS for tracking.

Other District Designs:

- Submittals designated for Resident Engineer will go to the Resident Engineer only. To track and expedite, submittals with an other District Designs designation will go directly to the District with a copy of the transmittal cover (only) to EC-DS for login. Other District design responses/actions go directly to the Resident Engineer's office with a copy to EC-DS for tracking.

KCD Designs:

- Submittals designated for Resident Engineer will go to the Resident Engineer only. Submittals with an engineering review, will go to KCD through EC-DS for login and distribution to the reviewers.

1.10.2 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.

1.11 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."

1.12 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 one copy of the submittal will be returned to the Contractor.

1.13 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.

1.14 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: _____

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE *(Read instructions on the reverse side prior to initiating this form)*	DATE	TRANSMITTAL NO.

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This section will be initiated by the contractor)*

TO:	FROM:	CONTRACT NO.	CHECK ONE: ☐ THIS IS A NEW TRANSMITTAL ☐ THIS IS A RESUBMITTAL OF TRANSMITTAL
SPECIFICATION SEC. NO. *(Cover only one section with each transmittal)*	PROJECT TITLE AND LOCATION		CHECK ONE: THIS TRANSMITTAL IS FOR ☐ FIO ☐ GOV'T. APPROVAL

ITEM NO. *a.*	DESCRIPTION OF ITEM SUBMITTED *(Type size, model number/etc.)* .	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. *(See instruction no. 8)* *c.*	NO. OF COPIES *d.*	CONTRACT REFERENCE DOCUMENT SPEC. PARA. NO. *e.*	DRAWING SHEET NO. *f.*	FOR CONTRACTOR USE CODE *g.*	VARIATION *(See instruction No. 6)* .	FOR CE USE CODE *i.*

REMARKS	I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as other wise stated. NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED *(List by Item No.)*	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE

INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.

2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.

3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288-R for each entry on this form.

4. Submittals requiring expeditious handling will be submitted on a separate form.

5. Separate transmittal form will be used for submittals under separate sections of the specifications.

6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".

7. Form is self-transmittal, letter of transmittal is not required.

8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.

9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

A -- Approved as submitted.

B -- Approved, except as noted on drawings.

C -- Approved, except as noted on drawings. Refer to attached sheet resubmission required.

D -- Will be returned by separate correspondence.

E -- Disapproved (See attached).

F -- Receipt acknowledged.

FX -- Receipt acknowledged, does not comply as noted with contract requirements.

G -- Other *(Specify)*

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

SUBMITTAL REGISTER
(ER 415 1-10)

CONTRACT NO.

TITLE AND LOCATION
Flood Control Project

CONTRACTOR

SPECIFICATION SECTION
01355

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.7	Environmental Protection Plan	X											X	RE									

SUBMITTAL REGISTER
(ER 415 1-10)

CONTRACT NO.

TITLE AND LOCATION
Flood Control Project

CONTRACTOR

SPECIFICATION SECTION
01500

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.2	Site Plan		X										X	RE									

SUBMITTAL REGISTER
(ER 415 1-10)

CONTRACT NO.

TITLE AND LOCATION
Flood Control Project

CONTRACTOR

SPECIFICATION SECTION
01780A

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.2.1	As-Built Drawings												X	RE									
			1.2.2	As-Built Record of Equipment and												X	RE									
				Materials																						
			1.3.1	Warranty Management Plan												X	RE									
			1.1	Warranty Tags												X	RE									
			1.1	Final Cleaning												X	RE									

SUBMITTAL REGISTER
(ER 415 1-10)

CONTRACT NO.

TITLE AND LOCATION
Flood Control Project

CONTRACTOR

SPECIFICATION SECTION
01800

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.2	Contingency Plan	X											X	RE									

SUBMITTAL REGISTER
(ER 415 1-10)

CONTRACT NO.

TITLE AND LOCATION
Flood Control Project

CONTRACTOR

SPECIFICATION SECTION
02101

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.3	Sanitary Lagoon--Plan of Operations	X											X	GA									
			1.3	Sandblasting Facility--Plan of Operations	X											X	GA									
			1.3	Q2 Stoplog Gap--Plan of Operations	X											X	GA									
			1.3	Permits									X		X											

SUBMITTAL REGISTER
(ER 415 1-10)

CONTRACT NO.

TITLE AND LOCATION
Flood Control Project

CONTRACTOR

SPECIFICATION SECTION
02102

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.2	Plan of Operations	X											X	RE									
			1.2	Disposal Plan(s)	X											X	RE									
			1.2	Disposition	X											X	RE									

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02104

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.3	Plan of Operations	X											X	RE									
			1.3	SURVEY PLAN OF OPERATIONS	X											X	RE									

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SPECIFICATION SECTION
02170

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.3	Designs	X											X	EC									
			1.3	Plan of Operations					X							X	EC									
			1.3	Architecture-Engineer Qualifications					X							X	EC									

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SPECIFICATION SECTION
02228

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.2	Plan of Operations	X											X	RE									
			1.2	Aggregate Sources					X						X											
			1.2	Test Methods					X							X	EC									
			1.2	Field Test Reports						X						X	EC									
			1.2	Survey Data						X					X											
			1.2	Weigh Bills						X					X											

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SPECIFICATION SECTION
02316

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			3.5.3	Field Density Tests						X					X											
			3.5.2	Testing of Backfill Materials						X						X	RE									

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SPECIFICATION SECTION
02318

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.3	Installation Methods and Procedures	X										X											
			1.3	Grouting Specialist Qualifications	X										X											
			1.3	Mixture Proportioning	X											X	RE									
			1.3	Curing and Protection	X											X	RE									
			1.3	Cold-Weather Placing	X										X											
			1.3	Hot-Weather Placing	X										X											
			1.3	Quality and Gradation of Aggregates						X						X	RE									
			1.3	Tests and Inspections						X						X	RE									
			1.3	Cementitious Materials							X					X	RE									
			1.3	Air-Entraining Admixture							X					X	RE									
			1.3	Other Chemical Admixtures							X					X	RE									
			1.3	Nonshrink Grout							X					X	RE									
			1.3	Aggregates							X					X	RE									
			1.3	Non-structural flowable backfill							X					X	RE									

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02331

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			1.3	Shoring, Sheeting, and Bracing					X							X										
			1.3	Excavation					X							X										
			1.3	Borrow Areas					X							X										
			1.3	Plan of Operations					X							X										
			1.3	Testing Laboratory					X							X										
			1.3	Embankment and Backfill Materials					X							X										
			1.3	Nuclear Density Testing Equipment					X							X										
				Operator																						
			1.3	Survey Records						X						X										
			1.3	Test Results									X			X										
			1.3	Inspection and Test Results							X					X	RE									

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ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			3.2.2	Layout		X										X	EC									
			1.4	Erosion Control Details		X										X	EC									
			3.2.4	Obstructions Below Ground		X										X	RE									
			1.4	Erosion Control Blanket	X											X	EC									
			1.4	Equipment	X										X											
			1.4	Erosion Control Blanket						X						X	RE									
			1.4	Erosion Control Blanket							X					X	RE									
			1.4	Construction Work Sequence							X					X	EC									
			1.7	Installer's Qualification							X					X	RE									
			1.4	Materials								X				X	RE									
			3.6	Maintenance Record										X	X											
			3.6.1.1	Maintenance Instructions										X	X											

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02380

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			2.2.2	Riprap	X											X	EC									
			2.1	Bedding Material	X											X	EC									
			2.2.1.1	Gradation Test						X						X	RE									
			1.4	Stone							X				X											
			2.1	Bedding Material							X				X											
			1.4	Laboratory							X					X	RE									
			1.4	Weigh Scale Certification							X				X											
			1.4	Certified Weight Scale Tickets							X				X											

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02431

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.3	Concrete Pipe and Pipe Jacking		X									X											
				Construction																						
			3.6.1	Equipment	X										X											
			1.3	Controlled Low Strength Material	X										X											
			3.8	Tests						X					X											
			3.4	Drilling Operations						X					X											
			3.4	Pressure Washing and Pressure						X					X											
				Testing Operations																						
			3.4	Cement and controlled low strength						X					X											
				material Grouting Operations																						
			1.3	Qualifications							X				X		FIO									
			1.3	Grouting Equipment							X					X	RE									
			1.3	Grout Application							X					X	RE									
			1.3	Concrete Pipe and Pipe Jacking							X				X											
				Construction																						
			1.3	Samples of Impervious Stratum							X				X											
			3.8	Tests							X				X											
			1.3	Portland Cement							X					X	RE									
			2.3	Joints							X					X	RE									
			1.3	Backfill							X				X											
			1.3	Concrete Pipe and Pipe Jacking							X				X											
				Specialist																						

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02456

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.4	Pile Driving Equipment	X											X	GL									
			1.4	Pile Testing Subcontractor	X											X	EC									
			1.4	Pile Driving Records	X											X	RE									
			1.4	Delivery, Storage and Handling	X											X	GL									
			1.4	Pile Tests	X											X	GL									
			1.4	Pile Splices		X										X	EC									
			1.4	Pile Placement		X										X	GL									
			1.4	Mill Inspection						X						X	EC									
			1.4	Pile Driving Tests						X						X	GL									
			1.4	Pile Load Tests						X						X	GL									
			1.4	Pile Driving Records									X			X	GL									

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SPECIFICATION SECTION
02464

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			2.1	Layout, Design Drawings, and	X											X	RE									
				Calculations																						
			2.1	Metal Sheet Piling		X										X	RE									
			2.1	Metal Sheet Piling		X										X	RE									
			2.1	APPURTENANT METAL		X										X	RE									
				MATERIALS																						
			3.1.1	Pile Driving Equipment				X								X	RE									
			3.1.5	Pulling and Redriving					X							X	RE									
			2.3.1	Materials Tests					X						X											
			2.1	Welder Qualifications							X					X	RE									
			3.1.2.2	Driving									X		X											

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02630

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			3.3	Placing Pipe	X											X	RE									
			2.3.3	Frame and Cover for Gratings	X											X	RE									
			2.1	Pipe for Culverts and Storm Drains								X				X	RE									
			3.8	Pipeline Testing							X					X	RE									
			2.5	Hydrostatic Test on Watertight Joints							X					X	RE									
			3.7.5	Determination of Density							X					X	RE									

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02700

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.3	Testing Laboratory, para. 1.6.1					X							X	RE									
			1.3	Equipment, para. 2.3					X							X	KC									
			1.3	Mixing Plant, para. 2.4					X							X	KC									
			1.3	Composition of Mixture, para.'s 2.2						X						X	KC									
				thru 2.2.3.1																						
			1.3	Coarse Aggregate, para. 1.4.2.1.a						X						X	KC									
			1.3	Fine Aggregate, para. 1.4.2.1.b						X						X	KC									
			1.3	Mineral Filler, para. 1.4.2.1.c						X						X	KC									
			1.3	Aggregate Gradation, para. 1.4.2.2.a						X						X	KC									
			1.3	Crushed Particle Test, para. 1.4.2.2.b						X						X	KC									
			1.3	Specific Gravity Test, para. 1.4.2.2.c						X						X	KC									
			1.3	Bituminous Material, para. 1.5							X					X	KC									

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02721

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.6	Equipment	X										X											
			1.3	Material Source					X							X	RE									
			1.4	Sampling and Testing						X						X	RE									

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02722

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.3	Equipment	X																					
			1.3	Material Source					X							X	RE									
			1.5	Sampling and Testing						X						X	RE									

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02731

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			1.4	Equipment	X										X											
			1.5	Sampling and Testing						X						X										
			1.3	Density Test						X						X										
			1.3	weight certificates						X						X										
			3.9	DENSITY TESTS						X						X										

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			1.3	Tests						X						X	RE									

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SPECIFICATION SECTION
02754

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.7	Equipment	X																					
			3.4	Paving				X																		
			2.11	Mixture Proportions					X							X										

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SPECIFICATION SECTION
02821

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.2	Chain Link Fence							X					X	RE									

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ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.2	Equipment	X											X	RE									
			2.7	Surface Erosion Control Material	X											X	RE									
			1.2	Chemical Treatment Material	X											X	RE									
			1.2	Equipment				X								X	RE									
			1.4.1	Delivery					X							X	RE									
			3.2.1	Finished Grade and Topsoil					X							X	RE									
			2.2	Topsoil					X							X	RE									
			3.1.3	Equipment Calibration						X						X	RE									
			1.2	Soil Test						X						X	RE									
			2.1	Seed							X					X	RE									
			2.2	Topsoil							X					X	RE									
			2.3.1	pH Adjuster							X					X	RE									
			2.3.2	Fertilizer							X					X	RE									
			2.3.3	Organic Material							X					X	RE									
			2.3.4	Soil Conditioner							X					X	RE									
			1.2	Wood Fiber Mulch/Tackifier							X					X	GA									
			2.6	Pesticide							X					X	RE									
			1.2	Leguminous Inoculant							X					X	RE									
			1.4.1.1	Delivered Topsoil								X				X	RE									
			2.3	Soil Amendments								X				X	RE									
			1.2	Wood Fiber Mulch/Tackifier								X				X	RE									
			3.5	Quantity Check									X			X	RE									
			3.9	Seed Establishment Period									X			X	PM-									
			3.9.3.3	Maintenance Record									X			X	RE									
			3.6	Application of Pesticide									X			X	RE									

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02950

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.3	Plant Material Inspection Certificates							X					X	PR									
			1.10.5	Fertilizer							X					X										
			1.3	Ground Cloth							X					X	RE									
			1.3	Mycorrhizal Inoculant							X					X	RE									

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SPECIFICATION SECTION
03101

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			2.1	Materials	X										X											
			1.4	Shop Drawings		X									X											
			1.4	Shop Drawings					X						X											
			3.3	Inspection						X					X											
			3.2.1	Formwork Not Supporting the Weight						X						X	RE									
				of Concrete																						

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SPECIFICATION SECTION
03150

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			2.1	Preformed Expansion Joint Filler	X											X	RE									
			2.3	Sealant	X											X	RE									
			2.4	Waterstops	X											X	RE									
			2.4	Waterstops		X										X	RE									
			2.1	Preformed Expansion Joint Filler			X									X	RE									
			2.3	Sealant			X									X	RE									
			2.4	Waterstops			X									X	RE									
			2.1	Preformed Expansion Joint Filler							X					X	RE									
			2.3	Sealant							X					X	RE									
			2.4	Waterstops							X					X	RE									
			1.2	Preformed Compression Seals and								X				X	RE									
				Lubricants																						
			2.3.3	Field-Molded Type								X				X	RE									
			2.4.2	Non-metallic Materials								X				X	RE									

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SPECIFICATION SECTION
03200

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.2	Concrete Reinforcement System		X										X	ED									
			1.3	Welding					X						X											
			2.3	Reinforcing Steel							X				X											

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SPECIFICATION SECTION
03301

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			2.2	Concrete Mixture Proportioning					X							X	EC									
			3.1.2	Batch Plant					X							X	EC									
			3.1.3	Concrete Mixers					X							X	EC									
			3.1.1	Capacity					X							X	RE									
			3.1.4	Conveying Equipment					X						X											
			3.1.1	Placing Equipment					X						X											
			3.7.1	Testing Technicians					X						X											
			3.7.1	Concrete Transportation Construction					X						X											
				Inspector (CTCI)																						
			3.2.4	Construction Joint Treatment					X							X	EC									
			3.5	Curing and Protection					X							X	EC									
			1.3	Cold-Weather Placing					X							X	EC									
			1.3	Hot-Weather Placing					X							X	EC									
			1.3	Aggregate Quality						X						X	EC									
			1.3	Uniformity of Concrete Mixing						X						X	EC									
			3.7	Tests and Inspections						X						X	EC									
			2.1.1	Cementitious Materials							X					X	EC									
			2.1.4.1	Impervious-Sheet Curing Materials							X					X	EC									
			2.1.3.1	Air-Entraining Admixture							X					X	EC									
			2.1.3.4	Other Chemical Admixtures							X					X	EC									
			2.1.4.2	Membrane-Forming Curing							X					X	EC									
				Compound																						
			2.1.7	Epoxy Resin							X					X	EC									
			2.1.6	Nonshrink Grout							X					X	EC									
			1.4.1.1	Aggregates								X				X	EC									

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05055

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.4	Detail Drawings		X										X										
			2.1.1	materials list		X										X										
			2.2.2.1	Welding Procedures for Structural					X							X										
				Steel																						
			2.2.2.3	Welding of Aluminum					X							X										
			2.3.4	Structural Steel Welding Repairs					X							X										
			2.3	Tests, Inspections, and Verifications						X					X											
			1.3	Test Reports for Fracture Critical						X																
				Members (FCMO)																						
			1.5	Qualification of Welders and Welding							X				X											
				Operators																						
			2.2.2.4	Application Qualification for Steel							X					X										
				Studs																						
			2.2.2.3	Welding of Aluminum							X					X										
			1.3	Materials Disposition Records									X		X											

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SPECIFICATION SECTION
05120

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.3	Structural Steel System		X										X	RE									
			3.2.1	Structural Connections		X										X										
			3.2	Erection					X							X	RE									
			1.3	Mill Test Reports							X					X	RE									
			1.3	Welder Qualifications							X					X	RE									
			3.1	Fabrication							X					X	RE									
			2.5	High Strength Bolts and Nuts								X				X	RE									
			2.6	Carbon Steel Bolts and Nuts								X				X	RE									
			2.7	Nuts Dimensional Style								X				X	RE									
			2.8	Washers								X				X	RE									

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SPECIFICATION SECTION
05502

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.5	Lists of Materials, para 1.5	X											X	RE									
			1.5	Shop Drawings, para 1.5		X										X	EC									
			2.2.4	Recess Frames		X										X	EC									
			1.5	Manufacturer Design Calculations					X							X	EC									
			1.5	Certification, para 1.5							X					X	RE									

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05615

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			1.5	Sequencing and Scheduling	X											X	RE									
			2.3.1	Detail Drawings		X										X	RE									
			2.1	Materials				X							X											
			2.3.4	Welding					X							X	RE									
			2.4	Tests, Inspections, and Verifications						X					X											
			1.3	Materials Disposition Records									X		X											

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05650

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			2.7	Wood Ties	X											X	RE									
			2.5.1	New Jointed Rail	X											X	RE									
			1.2	Relay Rail	X											X	RE									
			1.2	Joint Bars	X											X	RE									
			1.2	Compromise Joint Bars	X											X	RE									
			2.8	Miscellaneous Track Materials	X											X	RE									
			1.2	Components or Products	X											X	RE									
			1.2	Materials and Equipment				X								X	RE									
			3.7	Thermite Welding Procedures					X							X	RE									
			3.6	Electric Arc Welding					X																	
			3.9	Sampling and Testing						X						X	RE									
			2.7	Wood Ties						X						X	RE									
			1.3.2	Geotextiles						X						X	RE									
			1.2	Ultrasonic Test						X						X	RE									
			2.7	Wood Ties							X					X	RE									
			2.1	Ballast							X					X	RE									
			2.2	Subballast							X					X	RE									
			1.2	Materials and Equipment							X					X	RE									
			2.3	Geotextile								X				X	RE									
			3.9.4	Geotextile								X				X	RE									
			3.9.1	Ballast and Subballast Samples								X				X	RE									
			1.2	Record of Field Weld									X			X	RE									
			1.2	Table VII									X			X	RE									
			1.2	Waybills and Delivery Tickets									X			X	RE									

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05700

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			2.1	Metal Sheet Piling		X										X	RE									
			3.1.1	Pile Driving Equipment				X								X	RE									
			3.1.5	Pulling and Redriving					X							X	RE									
			2.3.2	Interlocked Joint Strength in Tension						X						X	RE									
				Test																						
			2.3.1	Materials Tests						X					X											
			3.1.2.2	Driving									X		X											

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SPECIFICATION SECTION
06710

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.3	Plan of Operations					X							X	GL									
			1.3	Conformance With Specification					X							X	GL									
				Certification																						
			1.3	Vinyl Sheet Piling Sample								X				X	GL									

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09965

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			1.4	Accident Prevention Plan					X							X	RE									
			1.4	Waste Classification, Handling, and					X							X	RE									
				Disposal Plan																						
			1.4	Visible Emissions					X							X	RE									
			1.4	Special Paint Formulas								X				X	RE									
			1.4	Specification and Proprietary Paints								X				X	RE									
			1.4	Thinners								X				X	RE									
			1.4	Inspections and Operations									X			X	RE									

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SPECIFICATION SECTION
13121

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.2.2	Qualifications					X							X	RE									
			1.5	Moving Plan					X							X	RE									
			1.5	Accident Prevention Plan					X							X										

SUBMITTAL REGISTER
(ER 415 1-10)

CONTRACT NO.

TITLE AND LOCATION
Flood Control Project

CONTRACTOR

SPECIFICATION SECTION
16375

ACTIVITY NO. a.	TRANS-MITTAL NO. b.	ITEM NO. c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL: DATA f.	DRAWINGS g.	INSTRUCTIONS h.	SCHEDULES i.	STATEMENTS j.	REPORTS k.	CERTIFICATES l.	SAMPLES m.	RECORDS n.	O&M MANUALS o.	CLASSIFICATION: INFORMATION ONLY p.	GOVERNMENT APPROVED q.	REVIEWER r.	CONTRACTOR SCHEDULE DATES: SUBMIT s.	APPROVAL NEEDED BY t.	MATERIAL NEEDED BY u.	CONTRACTOR ACTION: CODE v.	DATE w.	SUBMIT TO GOVERN-MENT x.	GOVERNMENT ACTION: CODE y.	DATE z.	REMARKS aa.
			1.3	Fault Current and Protective Devices	X											X										
				Coordination Studies																						
			1.3	Manufacturer's Catalog Data	X											X	RE									
			1.3	Material, Equipment, and Fixture	X											X	RE									
				Lists																						
			1.3	Installation Procedures	X											X	RE									
			1.3	Electrical Distribution System		X										X	RE									
			1.3	As-Built Drawings		X										X	RE									
			1.3	Factory Test						X						X	RE									
			1.3	Field Testing						X						X	RE									
			1.3	Test Reports						X						X	RE									
			1.3	Cable Installation Reports						X						X	RE									
			1.3	Materials and Equipment							X					X	RE									
			1.3	Cable Installer Qualifications							X					X	RE									

SECTION 01355

ENVIRONMENTAL PROTECTION
10/00

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 basic designation only.

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

33 CFR 328	Definitions
40 CFR 68	Chemical Accident Prevention Provisions
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
49 CFR 171 - 178	Hazardous Materials Regulations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(1996) U.S. Army Corps on Engineers Safety and Health Requirements Manual
WETLAND MANUAL	Corps of Engineers Wetlands Delineation Manual Technical Report Y-87-1

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 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.

1.2.5 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.

1.2.6 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.

1.2.7 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.

1.2.8 Waters of the United States

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

1.2.9 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 "GA" designation; submittals not having a "GA" designation are for information only. When used, a designation following the "GA" 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 Data

Environmental Protection Plan; GA-RE, PM-PR .

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 and PM-PR (Schuettpelz). 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 and PM-PR (Schuettpelz) 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. A Storm Water Pollution Prevention Plan (SWPPP) may be substituted for this plan. The erosion and sediment control must satisfy all requirements of the Missouri Department of Natural Resources for and NPDES land disturbance permit.

f. Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, 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 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, the Contracting Officer, and PM-PR (Ziegler).

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 specific requirements.

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 SPECIAL ENVIRONMENTAL REQUIREMENTS

The Contractor shall comply with the special environmental requirements included at the end of this section.

1.10 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 PM-PR (Schuettpelz), 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, after consultation with PM-PR, determines that the proposed alternate method will have an adverse environmental impact.

1.11 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 USED)

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 shall be kept to a minimum. The Contractor shall construct or install temporary and permanent erosion and sediment control best management practices (BMPs) as indicated on the drawings. 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. 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 designated on the drawings or 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, removal of cofferdams, tailrace excavation, and tunnel closure 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 Missouri 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 Missouri rules.

3.4.4 Burning

See SECTION: GENERAL for open burning requirements.

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 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. 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. 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.

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.

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 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. The area shall be backfilled to the original grade, top-soiled and seeded/sodded.

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 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 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.

3.8 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.

3.9 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.

3.10 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.

3.11 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.

3.12 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.

3.13 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 01451A

CONTRACTOR QUALITY CONTROL
07/01

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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(2001) 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	(2000b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

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 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 20 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 construction operations, both onsite and offsite, including work by subcontractors, 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. 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 will be approved by the Contracting Officer.)

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

g. Procedures for tracking 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 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 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.

3.2.3 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 Preconstruction Conference, before start of 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. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, 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 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, show 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 Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of 2 years construction experience on construction similar to this contract, or a construction person with a minimum of 5 years in related work. This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned as System Manager but may have duties as project superintendent in addition to quality control. An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

3.4.3 Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management For Contractors". If the Contractor needs this training, it will be provided by the Government.

3.4.4 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

Submittals, if needed, shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

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 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 48 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 of $3,500 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:

USACE Research and Development Center
ATTN: Joe Tom, CEERD-SC-E
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

For other deliveries: Same as above.

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 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

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:

a. Contractor/subcontractor and their area of responsibility.

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

c. 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.

d. 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.

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

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

g. Offsite surveillance activities, including actions taken.

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

i. Instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

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.

3.10 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
02/97

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

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. Contractor and subcontractor personnel shall wear identifying markings on hard hats clearly identifying the company for whom the employee works.

1.1.3 Employee Parking

Contractor employees shall park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site.

1.2 SUBMITTALS

SD-04 Drawings

Site Plan ; GA-RE

The Contractor shall propare and submit a Site Plan including all information identified in paragraph 1.1.1 of this specification section.

1.3 AVAILABILITY AND USE OF UTILITY SERVICES

1.3.1 Utility Services

The Contractor shall make all arrangements for the connection of utilities to site facilities. No Government-owned utilities are available nor will be furnished during the execution of this contract action. The Contractor shall ensure that all connections to local utilities are accomplished according to Federal, State, and local regulations and codes. Payment for the connection, use of, and disconnection of the utilities is the sole responsibility of the Contractor.

1.3.2 Meters and Temporary Connections

The Contractor shall comply with all Federal, State, and local codes, and utility company regulations regarding the installation, maintenance, and use of utility meters.

1.3.3 Sanitation

The Contractor shall provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer.

1.3.4 Telephone

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

1.4 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

1.4.1 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.

1.4.2 Project and Safety Signs

The requirements for the signs, their content, and location shall be as shown on the drawings. The signs shall be erected within 15 days after receipt of the notice to proceed. The data required by the safety sign shall be corrected daily, with light colored metallic or non-metallic numerals. Upon completion of the project, the signs shall be removed from the site.

1.5 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction, the Contractor shall provide access and temporary 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 shall investigate and shall remain in compliance with the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

1.5.1 Haul Roads

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Haul roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided. The Contractor shall provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Lighting shall be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations. Upon completion of the work, haul roads designated by the Contracting Officer shall be removed.

1.5.2 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.

1.6 CONTRACTOR'S TEMPORARY FACILITIES

1.6.1 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.

1.6.2 Storage Area

The Contractor shall construct a temporary 6 foot high chain link fence around trailers and materials. The fence shall include plastic strip inserts, colored green, 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. 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.

1.6.3 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site. Fencing of materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or

equipment stored in this area. Utilities will not be provided to this area by the Government.

1.6.4 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.

1.6.5 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.

1.6.6 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, to include three separate phone lines for the sole use of Government personnel, shall be borne by the Contractor, including long distance charges up to a maximum of $75.00 per month.

1.6.7 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 appropriate law enforcement agency requesting periodic security checks of

the temporary project field office.

1.7 GOVERNMENT FIELD OFFICE

1.7 GOVERNMENT FIELD OFFICE

The Contractor shall furnish a temporary office facility a minimum of 24 feet by 44 feet and 1056 square feet of floor space that will accommodate and support the equipment and requirements below. It shall be located where directed and shall be reserved for Government personnel only. The temporary government office facility, including the parking area shall have an 8-foot security fence with triple barbed wire and outdoor security lighting. Parking shall include ten (10) off-street parking spaces adjacent to the temporary office. Cooled bottled drinking water facilities, adequate diffused, fluorescent lighting, local commercial telephone service, air conditioning, heating equipment, and a toilet room with water closet and lavatory with sewage facilities shall be furnished and maintained by the Contractor. All windows shall have operable windows and blinds. The office facility shall be divided to include a minimum of two (2) private office areas, one (1) private conference room and a common area that will accommodate four (4) additional workstations. Private offices and conference room shall include entry doors. Conference room shall be sized and equipped to provide a conference table and chairs to accommodate ten (10) people. Each office, conference room and workstation shall have electrical outlets, a dedicated phone line and computer connection. Offices and workstations shall include a desk, chair, ten feet of shelving located where directed, and one legal size filing cabinet with four drawers. Four additional 4-drawer file cabinets shall also be included in the common area. A plan table will be provided behind each desk as a work surface for full size drawings. The common area will include a telephone connection and power to support the required fax and copy machine. Other equipment that shall be provided includes the following:

- Three (3), 3ft x 4ft white marker boards to be installed where directed;
- Eight (8) coat hooks to be installed where directed;
- Three plan racks;
- Four (4) separate telephone lines, three (3) for voice and one for fax;
- One (1) ISDN data circuit (128k).
- Seven telephone instruments each capable of using the three voice telephone lines;
- Five (5) Dell OptiPlex GX240, Pentium 4, 1.7 GHz, 256K Cache, with PCI riser personal computers or equal with the following minimum capabilities:
  - 4-PCI slots;
  - 512MB, Non ECC, PC133 SDRAM;
  - Tower case;
  - 3.5 inch, 1.44MG floppy drive;
  - 40GB, EIDE, 7200 RPM, ATA/100 hard drive;
  - 48X internal EIDE CD-ROM;
  - DVD-CDRW combo drive with decoder for Windows 2000;
  - On-board enhance IDE/IO adapter 2F/4H, 2-Hi Speed Serial/1 BI-dir EPP Par. Port;
  - 32MB, ATI, Rage Ultra 128, Video Card;
  - Integrated Sound Blaster Compatible AC97 Sound Card;
  - Harman/Kardon 19.5 speakers or equal;
  - 104 enhanced keyboard;
  - MS Windows 2000 Professional on CD-ROM and installed on CPU's;
  - MS Office Pro 2000 on CD-ROM and installed on CPU's;
  - 3-button PS/2 mouse and mouse pad;
  - 10/100, Network Interface Card (NIC)
  - 19" .26mm 1289x1024 flat screen computer monitor;

o On-site warranty for the duration of the contract;
o FCC Certified, Novell certified, Windows NT certified, Year 2000 compliant;
· One Dell OptiPlex GX240, Pentium 4 personal computer for use as a 'server' with the following capability:
o 4-PCI slots;
o 512MB, Non ECC, PC133 SDRAM;
o Tower case;
o 3.5 inch, 1.44MG floppy drive;
o 40GB, EIDE, 7200 RPM, ATA/100 hard drive;
o 48X internal EIDE CD-ROM;
o On-board enhance IDE/IO adapter 2F/4H, 2-Hi Speed Serial/1 BI-dir EPP Par. Port;
o 32MB, ATI, Rage Ultra 128, Video Card;
o 104 enhanced keyboard;
o 3-button PS/2 mouse and mouse pad;
o 10/100, Network Interface Card (NIC)
o 17" .26mm 1289x1024 computer monitor;
o On-site warranty for the duration of the contract;
o FCC Certified, Novell certified, Windows NT certified, Year 2000 compliant;
o MS Windows 2000 Professional on CD-ROM and installed on CPU's;
o Internal tape drive with Windows 2000 Pro compatible backup software.
· APC Batter Backup device with PowerChute software for server that will provide 15 minutes of backup power in the event of a power failure;
· ISDN router;
· 16-port switch sufficient for print sharing and file sharing;
· An established LAN within the Government facility to have a minimum of ten drops at locations designated by the Government;
· One laser printer with NIC, HP laser jet 8000N or equivalent capable of making 11 inch x 17 inch documents;
· One HP 1220c with NIC color printer capable;
· One copy of the NAS scheduling software that the Contractor intends to use to manage the project;
· One plain paper FAX machine;
· One copier with the following capabilities: Document feeder, Collating, Magnification & reduction, Duplex copies, Sorting, Stapling, 11inch x 17inch copies;
· Monitored (reporting) security alarm system;
· Six handheld cellular telephones, Motorola Model I700+ or equal with service for the duration of the project. Service shall be digital cellular iDEN technology with integrated digital push to talk 2-way radio coverage within Missouri and Kansas.
· One (1) Digital camera, Sony model DSC-P5, 3.34 megapixel with 32Mb Memory Stick, Model MSA-32A and two (2) Sony Memory stick Floppy Disk Adapters, Model MSAC-FD2MA.

Maintenance service contract for the computers, printer, router, hub, fax machine and copier shall be provided for the duration of the contract. Toner for the printer and copier shall be provided for the duration of the project. Building entrance doors shall be equipped with a substantial lock with seven (7) keys. Janitorial service shall be provided that includes trash removal, sweeping twice weekly, mopping and dusting weekly, window washing monthly, toilet tissue, hand towels, liquid hand soap. The contractor will not be liable for Government long-distance telephone calls. The Contractor shall provide janitorial service, heating, air conditioning, local telephone service, electricity, water, sewerage, office equipment maintenance and monitored security system at no additional cost to the Government for the duration of the project. The facility will be set up and

completely operational with all items listed above functional within thirty days after the Notice to Proceed. The entire facility including all furniture, office equipment, camera, computers, printers, copier and communications equipment will remain the property of the Contractor and shall be removed from the site after completion of the work.

1.8 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.

1.9 TEMPORARY PROJECT SECURUTY 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 security fencing at the work site. The security fencing shall be 10-feet high and consist of 9-gage chain link fencing fabric. The fence shall be topped with a minimum of three strands of barbed wire or coiled razor wire to discourage after-hours entry of unauthorized individuals. The fencing shall be constructed at the location approved by the Contracting Officer. The fencing shall completely surround the Resident Engineer's Office as well as a gravel-surfaced parking facility of sufficient size to adequately accommodate 10 vehicles. The 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.

1.10 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.

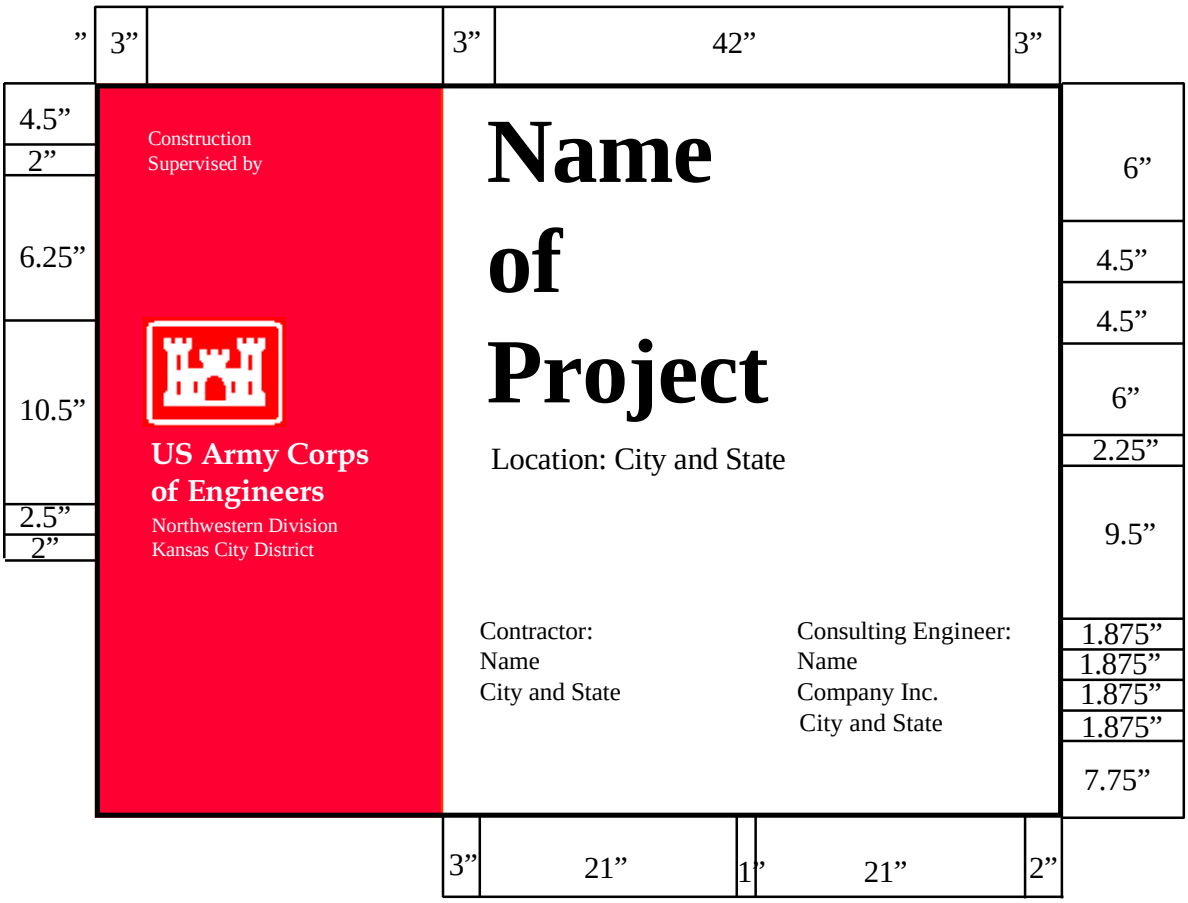
1.11 RESTORATION OF STORAGE AREA

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.

-- End of Section --

The graphic format for this 4'x 6' sign panel follows the legend guidelines and layout as specified below. The large 4'x 4' section of panel on the right is to be white with black legend. The 2'x 4' section of the sign on the left with with the full Corps signature (reverse version) is to be screen printed Communications Red on the White background.

This sign is to be placed with the Safety Performance Sign (See Fig. 2).



Legend Group 1: One to two-line description of Corps relationship to project
Color White
Typeface 1.25" Helvehca Regular
Maximum line lenth: 19"

Legend Group 2: Division\ District Name Placed below 10.5" Reverse Signature (6" Castle).
Color: White
Typeface: 1.25" Helvetica Regular

Legend Group 3: One- to three-line project title legend describes the work beging done under this contract.
Color: Black
Typeface: 3" Helvetica Bold
Maximum line length: 42"

Legend Group 4: One- to two-line identification of project or facility (civil works) or name of sponsoring department (military).
Color: Black
Typeface: 1.5" Helveticia Regular
Maximum line length: 42"

Cross-align the first line of Legend Group 4 with the first line of the Corps Signature (US Army Corps) as shown.

Legend Groups 5a-b: One- to five-line identification of prime contractors including: type (arcthitect, general contractor, etc.), corporate or firm name, city, state. Use of Legend Group 5 is optional.
Color: Black
Typeface: 1.25" Helvetica Regular
Maximum line length: 21"

All typography is flush left and rag right, upper and lower case with initial capitals only as shown. Letter- and word-spacing to follow Corps standards

Sign Type	Legend Size	Panel Size	Post Size	Specification Code	Mounting Height	Color Bkg/Lgd
CID-01	Various	4' x 6'	4" x 4"	HDO-3	48"	WH-RD/BK

CONSTRUCTION SIGN (CORPS OF ENGINEERS DESIGN)
(Use with Fig 2)

Fig. 1

SAFETY PERFORMANCE SIGN

Each contractor's safety record is to be posted on Corps managed or supervised construction projects and mounted with the construction project identification sign.

The graphic format, color, size and typefaces used on the sign are to be reproduced exactly as specified below. The title with First Aid logo in the top section of the sign and the performance record captions are standard for all signs of the type. Legend Groups 2 and 3 below identify the project and the contractor and are to be placed on the sign as shown.

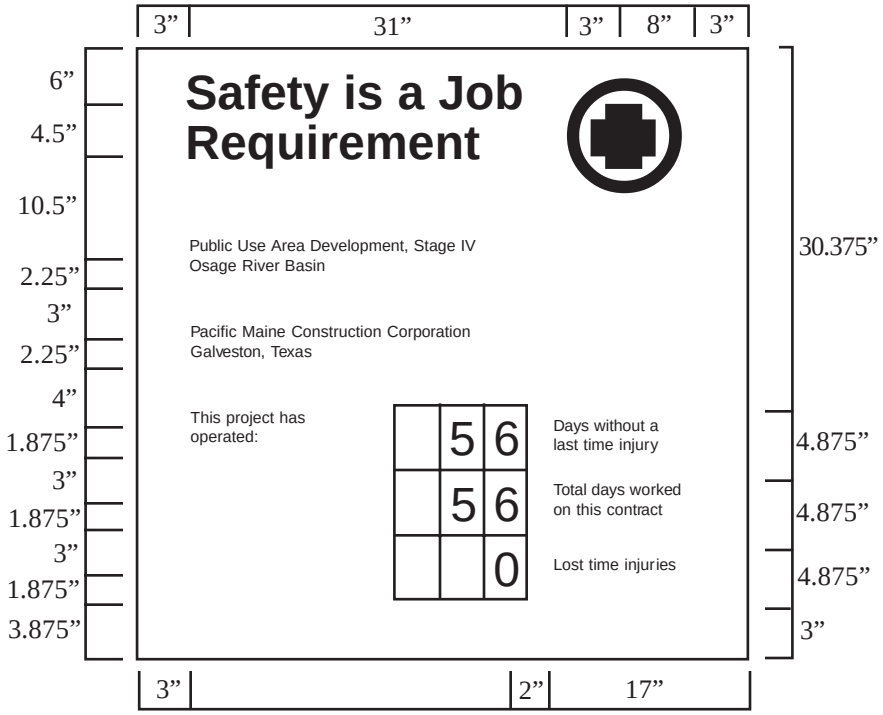
Safety record numbers are mounted on individual metal plates and are screw mounted to the background to allow for daily revisions to posted safety performance record.

Legend Group 1: Standard two-line title "Safety is a Job requirement" with (8 od.) Safety Green First Aid logo.
Color: to match PMS 347
Typeface: 3" Helvetica Bold
Color: Black

Legend Group 2: One to two-line project title legend describes the work being done under this contract and name of host project.
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Legend Group 3: One to two-line identification; name of prime contractor and city, state address.
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Legend Group 4: Standard safety record captions as shown.
Color: Black
Typeface: 12.5" Helvetica Regular



Sign Type	Legend Size	Panel Size	Post Size	Specification Code	Mounting Height	Color Bkg/Lgd
CID-02	Various	4' X 4'	4" X 4"	HDO-3	48"	WH/BK - GR

Replaceable numbers are to be mounted on white .060 aluminum plates and screw-mounted to background.
Color: Black
Typeface: 3" Helvetica Regular
Plate size: 2.5" X 5"

All typography is flush left and rag right. Upper and lower case with initial capitals only as shown. Letter - and word - spacing to follow Corps standards.

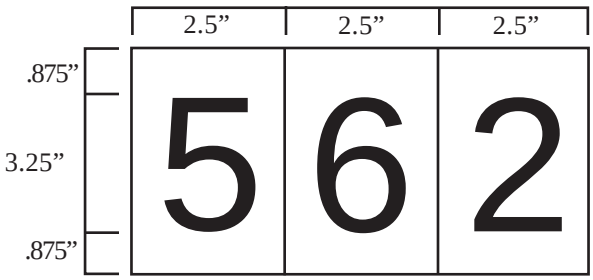


Fig. 2

SECTION 01780A

CLOSEOUT SUBMITTALS
11/99

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. 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-02 Shop Drawings

As-Built Drawings; GA-RE.

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; GA-RE

Two copies of the record listing the as-built materials and equipment incorporated into the construction of the project.

Warranty Management Plan; GA-RE

Two 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; GA-RE.

Two record copies of the warranty tags showing the layout and design.

Final Cleaning; GA-RE.

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. 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 Microstation 98 7.01 software and a Windows 2000 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. 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 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) 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 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 the 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 30 days 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. 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.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

SECTION 01800

HTRW CONTINGENCY PLAN
09/2000

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 basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH-02	(1995) 1995-1996 Threshold Limit Values or Chemical Substances and Physical Agents and Biological Exposure Indices

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI

ANSI Z358.1	(1990) Emergency Eyewash and Shower Equipment

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1904	Recording and Reporting Occupational Injuries and Illnesses
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 261	Identification and Listing of Hazardous Wastes
40 CFR 262	Standards Applicable to Generators of Hazardous Wastes
40 CFR 268	Land Disposal Restrictions
49 CFR 172-178	Transportation of Hazardous Materials
49 CFR 171	General Information, Regulations, and Definitions 49 CFR 172Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

ENGINEERING MANUALS

EM 385-1-1	1992) US Army Corps of Engineers Safety and Health Requirements Manual

ER 1110-1-263	(1990) Chemical Data Quality Management for Hazardous Waste Remedial Activities

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH Pub No. 85-115	NIOSH Pub No. 85-115

ENVIRONMENTAL PROTECTION AGENCY

EPA-540/R-93-071	(1993) Data Quality Objectives Process for Superfund
EPA-450/4-89-015	(1989) Guidance on Applying the Data Quality Objectives Process for Ambient Air Monitoring Around Superfund Sites (Stages I & II)
EPA-450/4-90-005	(1991) Guidance on Applying the Data Quality Objectives Process for Ambient Air Monitoring Around Superfund Sites, (Stage III)
EPA SW-846	Test Methods for Evaluating Solid Waste

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section, SUBMITTAL PROCEDURES:

SD-01 Data

Contingency Plan;GA-RE.

The Contingency Plan shall be submitted within twenty calendardays after Notice to Proceed. The Plan shall consist of a Site History Section, a Sampling and Analysis Plan Section, and a Site Safety and Health Plan Section. The Site Safety and Health Plan section of the Contingency Plan shall be signed and dated by the Contractor's Safety and Health Manager and the Site Superintendent.

1.3 SCOPE

This section details the required content, and implementation of a Contingency Plan (CP). The purpose of the CP is to establish, before work begins, field and laboratory procedures that shall be used to investigate potentially contaminated or hazardous material discovered during construction.

1.3.1 Content

The CP, as detailed in this section, describes Contractor capabilities and responsibilities that are necessary in order to accomplish site investigations in excess of those required in other sections of these specifications.

1.3.2 Implementation

The Contracting Officer in conjunction with the Contractor's Health and Safety Officer shall determine, upon discovery of site conditions warranting special consideration, if provisions of the CP will be implemented. The CP provisions shall only be executed at the direction of the Contracting Officer. If the CP is implemented, the Contractor shall perform additional work directed in conformance with this section. The additional work shall include disposal procedures. The local sponsor will provide the Hazardous Waste Disposal Number. Payment for any additional work will be according to paragraph "Payment for Contingency Plan Implementation" of this specification section.

1.4 GENERAL REQUIREMENTS

1.4.1 Contingency Plan Approval

Mobilization and other preliminary work approved by the COR may be performed before approval of the CP. Excavation, construction, and other field activities may not proceed until the CP has been approved by the COR. A copy of the approved CP shall be maintained on site if the CP is implemented.

1.4.2 Potentially Contaminated Material

If potentially contaminated material is encountered during any phase of construction, all work in the immediate area shall stop and the Contractor's Health and Safety Officer and the Contracting Officer shall be notified. Based on the initial inspection by the COR and SSHO, determination to implement the Contengency Plan shall be made according to paragraph IMPLEMENTATION. Payment for extra work required by implementing the CP is addressed in paragraph, PAYMENT FOR THE HTRW CONTINGENCY PLAN. Potentially contaminated material shall be identified by, but is not limited to, the following items:

a. Drums, tanks, or containers that contain unidentifiable substances encountered during excavation.

b. Stained soil.

1.5 REGULATORY REQUIREMENTS

Development of the CP, and subsequent work that may be done if the CP is implemented shall comply with EM 385-1-1, applicable Federal, state, and local safety and occupational health laws and regulations. This includes, but is not limited to, Occupational Safety and Health Administration (OSHA) standards, CFR 29 Part 1910, especially Section .120, "Hazardous Waste Site Operations and Emergency Response" and CFR 29 Part 1926, especially Section .65, "Hazardous Waste Site Operations and Emergency Response." Matters of interpretation of standards shall be submitted to the appropriate administrative agency or 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 CHEMICAL QUALITY MANAGEMENT

A chemical data quality control system shall be established that meets the requirements for the chemical measurement data quality objectives applicable to the project. The system shall include chemical measurement requirements for both contractor and subcontractor produced chemical data. The system shall have a Chemical Quality Management staff that is responsible for the sampling and measurement plans, analytical procedures, minimum data reporting requirements, and the organization necessary to produce the required chemical data. If the Contingency Plan is implemented, the Contractor shall be responsible for chemical sample acquisition, sample analysis, instrumental measurements of chemical parameters, and for chemical data quality control.

1.7 DEFINITIONS

The definition of acronyms used by the Contractor that pertains to the Contingency Plan shall be clearly defined for all contract related products and communications.

1.8 MEASUREMENT AND PAYMENT

1.8.1 HTRW Contingency Plan

Separate measurement or payment will be made for for the HTRW Contingency Plan LS under HTRW Contingency Plan

1.8.2 HTRW Contingency Plan Implementation

If the Contingency Plan is implemented, payment for additional work, as required in this section or directed by the Contracting Officer, will be made under the paragraph "Changes" of the CONTRACT CLAUSES.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall develop and submit for approval a Contingency Plan that consists of a Sampling and Analysis Plan and a Site Safety and Health Plan.

3.2 SAMPLING AND ANALYSIS PLAN

The Sampling and Analysis Plan (SAP) shall be a two part document that contains two distinct elements: A Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP). Sections of the FSP and QAPP may be cross referenced. The SAP shall confirm the Contractor's understanding of the government's requirements for chemical data quality control for the contract and provides direction to personnel responsible for field sampling and sample submittal for analysis, field chemical parameter measurement, data documentation, data validation and data reporting requirements. As a single interrelated document, the SAP shall be provided to both field and laboratory personnel. The SAP shall describe chemical parameter measurements for all matrices in the contract. In preparing the SAP, the Contractor may propose original/innovative approaches to chemical parameter

measurements for cost reduction and efficiency by abbreviated sampling, indicator or tracer analysis, on-site analytical services, equivalency or screening methods, etc., while complying with the chemical data quality requirements.

3.2.1 SAP Objective

The objective of the Sampling and Analysis Plan is to obtain usable chemical data. This shall be accomplished by following the protocols outlined in the United States Environmental Protection Agency's (USEPA's) Test Methods for Evaluating Solid Waste (SW-846). Chemical data obtained from a contingency action will be used to:

a. Identify chemical constituents of suspect material.

b. Ascertain if suspect material is a threat to human health and the environment.

c. Determine if further delineation of contamination is required.

d. Decide material characterization for proper handling and disposal.

3.2.2 Personnel Requirements and Qualifications

In the Sampling and Analysis Plan, the Contractor shall designate a Project Chemist. The Project Chemist shall have the overall responsibility of implementing the SAP and compliance of actual practices to the SAP if the Contingency Plan is implemented. The minimum educational requirements for the Project Chemist and Bench Chemists shall be a Bachelor of Science Degree in Chemistry. The Project Chemist shall have a minimum equivalent to 4 years full time hands on experience in organic analytical chemistry and a minimum equivalent of 2 years full time experience in inorganic analytical chemistry. Bench Chemists shall have a least 2 years experience in their assigned tasks. Technicians shall have a minimum of an associate of science degree plus six months of directly relatable experience and shall be used only for support functions and under the continuous supervision of Bench Chemist.

3.2.3 Data Evaluation Requirements

If the Contingency Plan is implemented, data collected shall be evaluated using SW-846 criteria. Data shall be rejected if any part of this criteria has not been met and no documented corrective actions have been taken. Rejected data is not usable. If corrective actions have been taken but QC criteria still could not be met, data shall be flagged providing the corrective action taken was the best possible corrective action as judged by the Contracting Officer. Such data shall be defined as usable. Quality data is data obtained in a sample batch for which all quality control criteria were met. The Contracting Officer will further evaluate the data by comparison with data from the USACE MRD QA laboratory. The Contracting Officer shall have the final decision as to the acceptability and quality of the data; however, the Contractor shall independently assess the data and arrive their own conclusions. The Contractor assessment shall be presented in the Chemical Quality Control Summary Report (CQCSR).

3.2.4 Data Completeness Requirements

Completeness for sample collection is defined as the percentage of samples directed to be collected for a contingency action that were actually

collected. This completeness shall be 95%. Completeness for usable data (as usable data is defined in paragraph "Site Safety and Health Plan Requirements") is defined as the percentage of usable data out of the total amount of data generated. This completeness shall be 98% for each of the individual analytical methods listed in the SAP. Completeness for quality data shall be 80% and is defined as the percentage of quality data out of the total amount of data generated.

3.2.5 Content of Field Sampling Plan

The FSP shall contain necessary technical detail and direction such that field personnel understand all sampling and field measurement requirements. It shall contain sufficient direction and detail that on-site personnel can perform all contingency action activities required to attain project data quality objectives (DQO), including; collection of samples for on-site and off-site chemical analysis, shipment of samples for off-site analyses, performance of on-site and off-site instrumental parameter measurements, and data documentation and reporting requirements. The FSP shall have a Title Page that includes project name and location followed by a Table of Contents and the following elements:

a. Project Organization and Responsibilities. The Project Organization and Responsibility Section of the FSP shall present relevant information on all Contractor/subcontractor positions that have responsibility for obtaining analytical data during a contingency action. Information in the section shall include the names of all personnel planned to participate in generation of analytical data from the collection and analysis of samples through final data report to include QA functions. At a minimum the following information shall be included:

1. Summary of Key Personnel. A brief summary of contractor management personnel and all key project personnel involved with on-site sample acquisition and delivery, on-site chemical parameter measurements, on-site data documentation and reporting, and corrective actions.

2. Points of Contact. Include to the extent possible, all key government, regulatory, contractor and any subcontractor personnel along with their location, address, phone numbers and organization affiliation. This section shall clearly identify to on-site personnel performing chemical measurements and acquiring chemical samples whom to contact for guidance and decision authority.

b. Scope and Objectives. The Scope and Objectives Section of the FSP shall contain, as a minimum, a summary of the types of contaminated material that may be encountered, the chemical parameters of concern, and the DQOs required to support the intended use of the chemical data for soil/sediments and water.

c. Sampling Requirements. The Sampling requirements Section of the FSP shall indicate that sample locations, sampling methods, and analysis to be conducted will be directed by the Contracting Officer.

d. Analytical Methods. The FSP shall indicate that analytical methods will be used in accordance with SW-846 methodologies. Analytical parameters that could be used for this project are shown in Table 1. The parameters that a sample will be analyzed for will be directed by the Contracting Officer. Method detection limits, quality control, and quality assurance requirements shall be those specified in the methods.

TABLE 1: ANALYTICAL PARAMETERS

Analyte	Technique	Extraction/Method Soil	Sediment Aqueous
Volatiles	GC/MS	5035/8260B	included/8260B
Semivolatiles	GC/MS	3540C,3510C,3550B/8270C	3520C/8270C
Pesticides	GC	3550B/8081A	3520C/8081A
PCB	GC	3550B/8082	3520B/8082
Se	GF	3050B/7740	included/7740
Hg	CV	included/7471A	included/7470A
As	GF	3050B/7060A	included/7060A
BTEX	GC	5030B/8020A	5030B/8020A
TPH	GC	8015B	
TCLP	extraction	1311	1311
Flash Point		1010	1010
Paint Filter		9095A	

e. Field Activities. The Field Activities Section of the FSP shall contain a description of the types of field activities that may be required during a contingency action and shall include, but not limited, to the following:

1. Sampling procedures and techniques to be followed during the collection of samples for chemical analysis.

2. Sampling and preservation procedures for each type of sample as specified in Table 1.

3. Sample numbering procedures for assigning a unique identification number to each sample including quality control/quality assurance samples.

4. Quality assurance/quality control (QA/QC) sampling requirements to include duplicates (blind), splits, blanks, rinsates, trip blank, government QA samples, etc. QA/QC split samples shall be collected at a 10% frequency or as a minimum, one per contingency action.

5. Field measurements.

6. Decontamination procedures to be used to ensure all sampling equipment is clean or precleaned. At a minimum, all equipment shall be decontaminated before and after conducting sampling at each location. All sample containers shall be obtained from a source that certifies them to be clean and that performs appropriate QC analysis to ensure cleanliness. The Contractor shall be responsible for the collection and disposal of all investigation derived wastes according to Local, State, and Federal

regulations.

f. Sample Chain-of-Custody/Documentation. The Sample Chain of Custody/Documentation (COC) Section of the FSP shall contain examples of the COC forms to be used on the project. All COC forms shall include, as a minimum, the following items:

1. A unique sample number.

2. Time and date acquired.

3. Sampler's name or initials.

4. Analysis to be performed.

5. Matrix type.

6. Preservation used.

7. Any special instructions.

The COC shall be signed by the person designated in the Project Organization and Responsibilities section. In addition, the COC must be signed by an authorized representative of the local sponsor.

g. Sample Packaging and Shipping. The Sampling Packaging and Shipping Section of the FSP shall contain, as a minimum, the following elements:

1. SOPs for sample labeling (including an example label), sample packaging, sample cooling, shipping procedures and procedures for corrective actions such that the sample integrity is established and maintained throughout custody process. Sample handling, packaging and shipping shall be in accordance with ER 110-1-263.

2. Shipping Companies that will be used to ship the project and government QA samples. Include address, phone numbers, and hours available for sample pickup or delivery.

3. Shipping Destinations, including the shipping addresses for all project chemistry labs, the government QA Lab and other regulatory labs. This section shall specify points-of-contact for all chemistry labs required for the project and include both phone numbers and addresses. This section shall include any prenotification time requirements for sample shipment and the receiving hours of the Labs.

h. Sampling Apparatus and Field Instrumentation. The Sample Apparatus and Field Instrumentation Section of the FSP shall contain, as a minimum, a general list of sampling equipment, apparatus, instruments, containers, supplies, standard forms and labels, and chemical reagents to be taken to the site. When applicable, equipment name, model, serial number, calibration equipment requirements, audit material requirements, and total number of each piece of equipment shall be provided.

i. Contractor Chemical Quality Control. The Contractor Chemical Quality Control Section of the FSP shall contain information that details implementation of a three phase quality control procedure required for chemical parameter measurement and sample acquisition and shipment. The procedure shall include a preparatory, initial and follow-up phase for each

definable feature of work. The contractor's three phase chemical data control procedure shall assure that minimum data reporting requirements are achieved and shall be implemented, if the Contingency Plan is implemented, according to ER 1180-1-6, EP 715-1-2 and CEGS 01440. The three phase process shall consist of the following:

1. The preparatory phase shall include a review of the specification, SAP, and all relevant SOPs for the chemical parameter measurement and/or chemical sample acquisition and shipment. It shall include a physical examination of all required forms, materials, and equipment to ensure conformance with the SAP and that all materials are on-site. It shall include a demonstration of sampling procedures by the contractor's field sampling personnel.

2. The initial phase shall be performed at the initiation of each definable work feature by the CQC Representative to confirm compliance with the SAP, including: instrument calibration, operation and performance checks, sample acquisition, labelling, and shipment in accordance with required SOPs, sampling equipment decontamination and required documentation.

3. The follow-up phase shall require daily inspections to ensure compliance with the SAP and shall not be complete without the daily chemical quality control reports.

j. Daily Chemical Quality Control Report (DCQCR). If the Contingency Plan is implemented, a DCQCR shall be generated by on-site personnel responsible for chemical parameter measurement and chemical sample acquisition. The report shall be signed by the person designated in the Project Organization and Responsibilities section to assure that chemical data resulting from these activities meets the contract documentation requirements. Format of the DCQCR shall be presented in the FSP. The DCQCR shall contain, as a minimum, the following:

1. Job identification and location descriptions.

2. Weather, including temperature, approximate wind speed and direction, significant wind changes, etc.

3. Chemical Data acquisition work performed, including who performed the sampling, specific information identifying project and QA samples collected, and calibrations.

4. Sampling and sample shipments including shipment and delivery problems that may affect project DQO requirements.

5. Chemical parameter measurement problems that may affect project DQO requirements, including instrument malfunction, performance requirement failure, etc.

6. Corrective Actions and/or deviations from the approved SAP including approvals.

7. Chemical quality control activities, as part of the three phase control procedures, that were implemented and confirmation that all deviations or actions jeopardizing project DQOs have been forwarded to project management. A summary of the feedback procedure for any corrective actions taken.

8. Signatures of responsible authority and initials of all persons conducting changes/corrective actions.

k. Corrective Actions. The Corrective Actions Section of the FSP shall contain, as a minimum, personnel responsible for project data quality objective monitoring, points-of-contact for discrepancies in sampling procedures, instrument calibration procedures, performance specification requirements, sample shipping and receiving, data check failures, data reporting, evaluation failures, and verification of corrective action implementation.

l. Appendices. The Appendices Section of the FSP shall contain, as a minimum, all Contractor standard forms and standard operating procedures that are referenced but not included previously. References, including project and Contractor specific, standard measurement methods, guidance documents, etc. shall also be included.

3.2.6 Contents of Quality Assurance Project Plan

The QAPP shall contain necessary technical detail and direction such that laboratory personnel understand all project sample analysis, quality control and data reporting requirements. It shall contain sufficient direction and detail that analytical laboratory personnel understand analytical methods, method required detection limits, method QC requirements, and data validation/reporting requirements. The QAPP shall have a Title Page, including the site specific project name and location followed by a Table of Contents and each of the following elements:

a. Project Organization and Responsibilities. The Project Organization and Responsibilities Section of the QAPP shall contain, as a minimum, an organizational chart depicting the following elements:

1. Summary of personnel, including a brief summary of key management personnel and all key laboratory personnel involved with sample analysis, project DQOs, documentation, corrective action procedures, data validation and reporting requirements. To the extent possible, all key personnel of all subcontractor organizations are required.

2. The locations, addresses, phone numbers and organizations of key government project management, regulatory personnel, and laboratories. This section shall clearly identify to laboratories performing project sample analysis whom to contact for sample receipt problems, data reporting problems, guidance, and decision authority, etc.

3. Personnel qualification requirements that specify project specific requirements for analytical laboratory personnel, such as organic and inorganic supervisors, laboratory Quality Assurance (QA) officers, etc. Analytical personnel requirements must be according to ER 1110-1-263.

b. Data Quality Objectives (DQO). The DQO Section of the QAPP shall contain, as a minimum, a definition of each sample analysis as required in the Paragraph 2.3.5.d. The DQOs shall clearly define to the analytical laboratories, for all samples submitted, the final uses of the analytical data. Contractor developed DQOs shall be in accordance with EPA-540/G-87/003 and shall address the following required key elements:

1. Precision

2. Accuracy

3. Representativeness

4. Comparability

5. Completeness

6. Method Sensitivity

7. Documentation

8. Data Validation

9. Data Reporting.

c. Sample Custody and Holding Times. The Sample Custody and Holding Times Section of the QAPP shall contain, as a minimum, the following laboratory requirements:

1. A copy of a generic sample receipt form that must be completed for each shipping container received and must include, as a minimum, the unique sample number, time and date acquired, sampler's name, preservative check, cooler temperature, analysis to be performed, matrix type, method holding time, and any special instructions.

2. The standard operating procedures for Intra-laboratory chain-of-custody requirements for all samples received and subsequently forwarded to another lab.

3. Project specific requirements for inter-laboratory sample custody, traceability including standards, spiking, witness and analyst initialling, etc.

d. Analytical Procedures. The Analytical Procedures Section of the QAPP shall contain, as a minimum, the following elements:

1. A table depicting the QC samples, analytical methods, and required method detection limits for each analysis of solid materials such as; soils, sludges, borrow materials, material for off-site transportation and disposal, etc.

2. A table depicting the QC samples, analytical methods and required method detection limits for each analysis of liquid media such as groundwater, surface water, etc.

e. Calibration Procedures and Frequency. The Calibration Procedures and Frequency Section of the QAPP shall contain, as a minimum, the following:

1. Calibration procedures.

2. Calibration schedules.

3. Detection limit and retention time window files.

4. Performance acceptance criteria and calibration verifications for each analytical procedure required.

The selected laboratory's Laboratory Quality Management Manual (LQMM) may be submitted as an appendix to partially fulfill this requirement.

f. Internal QC Checks. The Internal QC Checks Section of the QAPP shall contain, as a minimum, the following:

1. Batch definition.

2. Continuing calibration verifications.
3. Blanks.
4. Audits Surrogate and spike recovery criteria.
5. Internal standards.
6. Government and intralaboratory studies.
7. Matrix and duplicate matrix spike results.
8. Standard reference material and traceability.
9. Monitor or instrument audits and performance audit sample results.

The selected laboratory's LQMM may be submitted as an appendix to partially fulfill this requirement.

g. Calculation of Data Quality Indicators. The Calculation of Data Quality Indicators Section of the QAPP shall contain, as a minimum, the following:

1. Calculations used to determine method detection limits and standard deviation of replicate analysis.

2. Accuracy from matrix spikes or standard reference materials.

3. Precision from duplicate analysis and includes standard deviation from triplicate analysis and completeness based on the number of measurements judged valid.

4. The total number of measurements required.

The selected laboratory's LQMM may be submitted as an appendix to partially fulfill this requirement.

h. Corrective Actions. The Corrective Actions section of the QAPP shall contain, as a minimum, the following:

1. The corrective action criteria for sample receipt problems, sample holding times, analytical QC problems, etc., and the CPs for each implemented corrective action.

2. Personnel points of contacts for persons responsible for corrective action reporting, implementation, and documentation consistent with the organizational chart responsibilities.

i. Data Reduction, Validation and Reporting. The Data Reduction, Validation and Reporting section of the QAPP shall contain, as a minimum, the following:

1. Data reduction procedures. The methods or equations of concentration calculations, reporting units of concentrations, treatment of blank data, significant figures, moisture related data and the procedure for calculating precision and accuracy.

2. Data validation procedures used for all laboratory chemical data, flagging and data qualifying procedures, required levels of validation and

the responsible personnel for each analytical lab and data validation confirmation by successive lines of review as assigned in QAPP organization.

3. Data Reporting, including chemical data flow, analysis and reporting turnaround times, minimum data reporting requirements, destinations and delivery times for each report and data reporting formats such as SW-846, Contract Laboratory Plan (CLP), or other government agency specific formats.

4. Project specific reporting requirements, including Chemical Data Interim Report (CDIR) frequency and the minimum data reporting requirements to the Government QA Lab, specific data and time requirements for each lab and data report destination points.

j. Preventative Maintenance. The Preventative Maintenance section of the QAPP shall contain, as a minimum, the preventative maintenance plan/s to be implemented by each on-site and off-site laboratory to minimize downtime of laboratory instruments. The selected laboratory's LQMM may be submitted as an appendix to partially fulfill this requirement.

k. Performance and System Audits. The performance and system section of the QAPP shall contain, as a minimum, lab validation audits, method required audits, regulatory required audits, etc. for each on-site and off-site chemical analytical laboratories. The selected laboratory's LQMM may be submitted as an appendix to partially fulfill this requirement.

l. QC Reports to Management. The QC reports to management section of the QAPP shall contain as a minimum, the format for reporting an assessment of data accuracy, precision and completeness, personnel responsible for reporting, personnel receiving the reports and the frequency of the reports.

m. Appendices. The appendices section of the QAPP shall contain, as a minimum, the following:

1. Standard forms.

2. Definitions.

3. Acronyms.

4. References pertaining to the project requirements included in the QAPP relating to project DQOs.

5. Standard and nonstandard measurement methods.

6. Equivalency data.

7. US Government and regional agency guidance and regulatory documents.

8. Existing site related documents.

9. Other contract related chemical analysis documents, etc.

SOPs required in the above elements may be included in the Appendices and referenced in the applicable element.

3.2.7 Chemical Quality Control Summary Report (CQCSR)

If the Contingency Plan is implemented, the Contractor shall submit a CQCSR to the Contracting Officer within 15 days following completion of the contingency action. The CQCSR shall include a summary of all chemical parameter measurement activities. The summary shall include an evaluation of the achievement of the construction contract required chemical DQOs. The CQCSR shall contain, as a minimum, the following elements:

a. Sampling Procedures. Describe deviation from SAP and resultant effect on data.

b. Sample Handling and Sample Custody. Describe deviation from SAP in the sample handling, resultant effect on data collected, and rationale for deviation. Describe rationale for deviation in sample custody procedures.

c. Equipment Calibration and Maintenance. If any alterations to these procedures as described in the SAP were used, describe the procedure used in detail, and discuss the reasons for the alterations.

d. Analytical Procedures Used. If the standard methods (EPA, NIOSH, ASTM, etc.) were used, simply list the analytes and the number of the method used for each analyte. If any alterations to the standard methods were used, describe the alterations in detail and discuss why the methods were altered. Analytical procedures other than standard EPA methods (NIOSH for air monitoring) must have Corps of Engineers (CE) approval before being used. If non-standard methods were used, but not previously described in the SAP, describe the method in detail in the CQCSR. The detailed analytical procedure may be placed in the appendices and discussed in the body of the CQCSR. The following factors shall be addressed in this description:

1. Describe changes in instrumentation (make and model including detectors), operating parameters including chromatography columns, if applicable, and chemicals (state source and purity).

2. Standards. Describe changes from SAP. Include calibration standards.

3. Procedures. Describe changes in extraction of the sample (if applicable), for analyzing the sample or its extract, and for validating the method for the matrices in question (method blanks, calibration checks, recoveries, reference standards, replicate analyses, split samples, spiked samples, standard additions, etc.).

4. References. Cite sources for each method used.

e. Data Analysis and Validation. Description of the statistical procedures used in the assessment of data, including the use of control limits, if applicable. Discuss outliers and how they were treated. Discuss any results which seem to show bias or larger than expected standard deviations.

f. Data Summaries. The data summaries shall consist of the following:

1. A summary of analytical results listing which chemicals were found at what concentration levels at various locations of the site, and types of samples. To satisfy this requirement, a table of analytical results (positive hits only) by client sample number and laboratory sample number shall be presented along with a minimum of one map with client

sample numbers written next to their locations. Alternatively, map(s) only with sample numbers and analyte identity and concentrations located. Complete analytical results shall be included in the appendix (see paragraph g below).

2. A summary of the contract laboratory's QC analysis results. The summary shall consist of a table listing each QC result outside of established criteria. The established criteria shall be listed next to the result. QC results within criteria do not have to be listed separately, but summarized by number. Complete QC results shall be included in the appendix (see paragraph g below). Comments shall be included on how these data affect the validity of analytical results of the samples.

g. System Audits. Report on any inspections performed including when and by whom, any deficiencies encountered, and corrective actions taken.

h. Chemical, Analytical and QC/QA Problems Encountered. This section should include the degree to which each analytical system met or failed to meet the Data Quality Objectives (DQO) summarized in the SAP. Problems, especially those not anticipated in SAP and their respective resolutions should be noted. Examples might include but are not limited to:

1. Additional chemicals for which analyses should have been conducted.

2. Unexpected chemicals found which were due to secondary reactions or degradation processes.

3. Safety problems which might have been eliminated or reduced by better understanding of chemistry.

4. Analytical methods which did not work properly or which required modification for certain types of samples.

5. Analytical results which showed greater than expected variability, and the reasons for their variability calibration, instrumentation breakdown problems, and their resolution.

6. Specific QC/QA checks which should be increased or decreased, e.g., more field blanks, etc.

i. Appendices to the CQCSR. The appendices to the CQCSR report shall contain the following items:

1. The Daily Quality Control Reports.

2. All analytical data including the QC data required for the contract. The analytical data shall include the client ID number (sample number) with the corresponding laboratory ID number (if used).

3. Photocopies of an example of each of the types of documentation used to control data collection, labeling, analysis, and reporting. The appendix, however, shall include complete copies of the Chain-of-Custody forms, Cooler Receipt Forms, and Field Daily Quality Control Reports.

3.2.8 Chemical Data Interim Report (CDIR)

After completion of a contingency action, a CDIR shall be produced and provided through USACE management to the USACE Quality Assurance lab assigned to the project. It is equivalent to the Data Report to the QA Laboratory as specified on page D-11 of ER 1110-1-263 and meets the requirements stated in the Aug 16, 1989 memorandum from the Missouri River Division. The CDIR serves as part of the follow-up phase of the quality control system mechanism. The CDIR enables the government QA function to compare QA sample results to corresponding primary sample results to enable the government to assess the contractor's compliance with the SAP and initiates corrective actions. The CDIR shall contain, as a minimum, the following elements:

a. A summary of all chemical samples acquired during the specified interim period including sample number, collection date, analytical parameter, shipment date, COC forms, laboratory receipt date, sample receipt forms, sample prep date and sample analysis date.

b. A summary of all corresponding QA samples acquired and sent to the lab including the collection dates and sample identifications. The summary shall include a table which relates project and QA samples.

c. A summary of all chemical analysis for the samples including the following laboratory QC procedures and results: 1) accuracies from surrogate spike recoveries, matrix spikes and spike duplicates and laboratory control samples, 2) precisions from matrix spikes and spike duplicates, field duplicates and laboratory duplicates, 3) method blank results, 4) rinsate results and, 5) holding time discrepancies.

d. A summary of all analytical activities which result in deviations/effects the PARCC project goals.

e. Evidence that deviations were provided to management authority responsible for Chemical QC.

f. Summary of all corrective actions taken to correct deficiencies/deviations from contract requirements.

3.2.9 Analytical Testing Laboratories

The Contractor shall propose, when the Contingency Plan is submitted, the analytical laboratory or laboratories to be used for all sample analyses. All project laboratories performing process, non-process, air and off-site sample analysis must have attained a USACE validation. The Contractor has the option of performing chemical analyses either onsite or offsite by the contractor's or subcontractor's lab to achieve the primary required sample analyses. Before sample analysis, all analytical laboratories shall have attained USACE validation in accordance with EM 200-1-1. The Contractor is responsible for all chemical data and the project required chemical data quality and must not use laboratories until USACE validation is attained.

3.2.9.1 Laboratory Analytical Requirements

The Contractor shall provide chemical analysis directed by the Contracting Officer either by the contractor's and/or by subcontractor's laboratory. The Contractor shall provide chemical analysis for all parameters by methods specified in SAP or as directed by the Contracting Officer to achieve the project DQOs. Three days turn around shall be required on all analytical samples submitted for analysis unless otherwise directed by the

Contracting Officer.

3.2.9.2 Laboratory Performance

The Contractor shall provide and/or require continued acceptable analytical performance and shall establish a procedure to address data deficiencies noted by review and/or quality assurance sample results. The Contractor must provide and implement a mechanism for providing all analytical labs with the SAP or QAPP portion of the SAP, for monitoring all labs performance and for performing corrective action procedures. The Contractor is responsible for acquiring analytical services with additional USACE validated laboratories in the event a project lab loses its USACE validation status during the project.

3.2.10 Documentation

Documentation records are required to provide factual evidence that required chemical data has been produced and chemical data quality has been achieved. The documentation shall comply with the requirements specified in Paragraphs Sampling and Analysis Plan, Daily Chemical Quality Control Report, Chemical Data Interim Report and Chemical Quality Control Summary Report.

3.3 SITE SAFETY AND HEALTH PLAN

A Site Safety and Health Plan (SSHP) shall be prepared and submitted for approval covering work anticipated to be performed if the Contingency Plan is implemented. The Safety and Health Manager shall be responsible for the development, implementation and oversight of the SSHP. The SSHP shall establish, in detail, the protocols necessary for the anticipation, recognition, evaluation, and control of hazards associated with each task performed during a contingency action. The SSHP shall address site-specific safety and health requirements and procedures based upon suspected site-specific conditions. The level of detail provided in the SSHP shall be general in nature and address the type of work it is anticipated will be performed. Details about some activities may not be available when the initial SSHP is prepared and submitted. Therefore, the SSHP shall address, as defined by this specification, anticipated tasks, their related hazards and anticipated control measures. Additional details shall be included in the activity hazard analyses as described in paragraph "Activity Hazard Analysis".

3.3.1 Field Changes

The SSHP shall be adapted to new situations and new conditions. Changes and modifications to the accepted SSHP shall be made with the knowledge and concurrence of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer. Should any unforeseen hazard become evident while the CP is implemented, the Site Safety and Health Officer (SSHO) shall bring such hazard to the attention of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, necessary action shall be taken to re-establish and maintain safe working conditions in order to safeguard on site personnel, visitors, the public, and the environment.

3.3.2 Availability

The SSHP shall be made available in accordance with CFR 29 Part 1910,

Section .120 (b)(1)(v) and CFR 29 Part 1926, Section .65 (b)(1)(v).

3.3.3 Site Safety and Health Plan Requirements

Topics required by CFR 29 Part 1910, Section .120 (b)(4) CFR 29 Part 1926, Section .65 (b)(4) and those described in this section shall be addressed in the SSHP. Where the use of a specific topic is not applicable to the project, the SSHP shall include a statement to justify its omission or reduced level of detail and establish that adequate consideration was given the topic. Where adequate detail can not be given due to the unknown nature of the hazard, the SSHP shall give good general procedures with the knowledge the procedures will have to be adapted when contamination is encountered.

3.3.3.1 Staff Organization, Qualifications, and Responsibilities

An organizational structure shall be developed that sets forth lines of authority (chain of command), responsibilities, and communication procedures concerning site safety, health, and emergency response. This organizational structure shall cover management, supervisors and employees of the Contractor and subcontractors. The structure shall include the means for coordinating and controlling work activities of subcontractors and suppliers. The SSHP shall include a description of this organizational structure as well as qualifications and responsibilities of each of the following individuals. The Contractor shall obtain Contracting Officer's acceptance before replacing any member of the Safety and Health Staff. Requests shall include the names, qualifications, duties, and responsibilities of each proposed replacement. At a minimum, the Safety and Health Staff shall contain the following persons:

a. The Contractor's Certified Industrial Hygienist identified in the ACCIDENT PREVENTION PLAN shall act as the Contractor's Safety and Health Manager as identified in this plan. The Safety and Health Manager shall:

1. Be responsible for the development, implementation, oversight, and enforcement of the SSHP.

2. Sign and date the SSHP prior to submittal.

3. Conduct initial site-specific training.

If the Contingency Plan is implemented, the CIH shall:

4. Be present on site during the first day of contingency activities and as necessary to ensure compliance with SSHP requirements.

5. Visit the site as needed to audit the effectiveness of the SSHP.

6. Be available for emergencies.

7. Provide on site consultation as needed to ensure the SSHP is fully implemented.

8. Coordinate any modifications to the SSHP with the Site Superintendent, the SSHO, and the Contracting Officer.

9. Provide continued support for upgrading/downgrading of the level of personal protection.

10. Be responsible for evaluating air monitoring data and recommending changes to engineering controls, work practices, and PPE.

11. Review accident reports and results of daily inspections.

12. Serve as a member of the Contractor's quality control staff.

c. An individual shall be designated the Site Safety and Health Officer (SSHO). The person identified to be in charge of site safety and health in the Contractor's Accident Prevention Plan may be designated as the SSHO, if qualified. The name, qualifications, education, training summary, and work experience of the Site Safety and Health Officer shall be included in the SSHP. The SSHO shall have a minimum of 1 year experience in implementing safety and health programs at hazardous waste sites or in the hazardous waste disposal industry where Level C personal protective equipment was required. The SSHO shall have experience in construction techniques and construction safety procedures and have a working knowledge of Federal and state occupational safety and health regulations. The SSHO shall have training in personal and respiratory protective equipment program implementation, confined space program oversight, and in the proper use of air monitoring instruments, and air sampling methods. The Site Safety and Health Officer shall:

1. Assist and represent the Safety and Health Manager with site training and the implementation and enforcement of the accepted SSHP, if the Contingency Plan is implemented.

2. If the Contingency Plan is implemented, be assigned to the site of a contingency action on a full time basis for the duration of field activities. The SSHO shall have no duties other than Safety and Health related duties. If operations are performed during more than one work shift per day, a Site Safety and Health Officer shall be present for each shift.

3. Have authority to ensure site compliance with specified safety and health requirements, Federal, state and OSHA regulations and all aspects of the SSHP including, but not limited to, activity hazard analyses, air monitoring, use of PPE, decontamination, site control, standard operating procedures used to minimize hazards, safe use of engineering controls, the emergency response plan, confined space entry procedures, spill containment program, and preparation of records by performing a daily safety and health inspection and documenting results on the Daily Safety Inspection Log.

4. Have responsibility and authority to stop work if unacceptable health or safety conditions exist, and take necessary action to re-establish and maintain safe working conditions.

5. Consult with and coordinate any modifications to the SSHP with the Safety and Health Manager, the Site Superintendent, and the Contracting Officer.

6. Review results of daily quality control inspections in the contaminated area and document safety and health findings into the Daily Safety Inspection Log.

7. In coordination with site management and the Safety and Health Manager, recommend corrective actions for identified deficiencies and oversee the corrective actions.

3.3.3.2 Contamination Characterization

The SSHP shall include a list of contaminants that may present occupational health and safety hazards. This list shall be created by evaluating the site histories and analytical results provided in the Site Investigation Report. The contamination characterization shall be reviewed and revised if new chemicals are identified as work progresses.

3.3.3.3 Hazard/Risk Analysis

The SSHP shall include a safety and health hazard/risk analysis for each contingency action task and operation expected to be performed with potentially contaminated material. Available site information shall be reviewed when preparing the "Hazard/Risk Analysis" section of the SSHP. The Hazard/Risk Analysis section of the SSHP shall describe the chemical, physical, and toxicological properties of contaminants, sources and pathways of employee exposures, anticipated on site and offsite exposure level potentials, and regulatory (including Federal, state, and local) or recommended protective exposure standards. The SSHP shall also address employee exposure to hazardous substances brought on site, and shall comply with the requirements of CFR 29 Part 1910, Section .1200 and CFR 29 Part 1926, Section .59, Hazard Communication. The following elements, at a minimum, shall be addressed and may be presented in Table format:

a. Safety Hazards: Excavation, heavy equipment, and underground and overhead utilities.

b. Chemical Hazards: A record of potential site contaminants and a descriptions of the sites is provided is available to assist in preparing the SSHP. Construction will take place in areas that to be excavated has elevated levels of petroleum hydrocarbons, and lead.

c. Physical Agents: Noise, and confined space, heat and cold stress.

d. Biological Hazards: Poisonous plants, snakes, and tics.

e. Action Levels: Action levels shall be established for the situations listed below, at a minimum. The action levels and required actions (engineering controls, changes in PPE, etc.) shall be presented in the SSHP in both text and tabular form.

1. Implementation of engineering controls and work practices.

2. Upgrade or downgrade in level of personal protective equipment.

3. Work stoppage and/or emergency evacuation of on site personnel.

4. Prevention and/or minimization of public exposures to hazards created by site activities.

f. Site Tasks and Operations: Address the logistics and resources required to complete the projected tasks and objectives of the Contingency Plan. Based on the type of work anticipated, the following is a list of site tasks and operations that may be required:

1. Surface and subsurface sample collection.

2. Decontamination of personnel and sampling equipment.

3. Excavation of contaminated material.

A complete list of site tasks and operations, can not be developed at this time. If the Contingency Plan is implemented, the list may have to be expanded and/or revised.

3.3.3.4 Exposure Monitoring/Air Sampling Program

An exposure monitoring/air sampling program shall be presented in the SSHP to identify and quantify safety and health hazards and airborne levels of hazardous substances. The program shall be implemented if the Contingency Plan in implemented. Direct reading monitoring shall be required during all contingency action activities. The specific type of direct reading will be dependent on the hazard/s identified when the Contingency Plan is implemented. The Contractor shall develop direct reading instrumentation and time weighted average air sampling dependent on the tasks required. The purpose of the sampling is to assure proper selection of engineering controls, work practices and personal protective equipment for affected site personnel. Minimum initial requirements for the program are delineated below. Available site information shall be reviewed and the exposure monitoring/air sampling program shall be expanded and/or revised for submittal as part of the SSHP.

3.3.3.5 Safety Procedures, Engineering Controls, and Work Practices

The SSHP shall describe the standard operating safety procedures, engineering controls and safe work practices to be implemented if the Contingency Plan is implemented. These shall include, but not be limited to, the following:

a. General site rules/prohibitions (buddy system, eating, drinking, and smoking restrictions, etc.):

b. Work Permit Requirements: Excavation, hot work, confined space, etc.

c. Material Handling Procedures

d. Materials Transfer Safety

e. Drum and Container Handling: Procedures and Precautions (opening, sampling, overpacking) prepared in accordance with 29 CFR 1926 Part 65 and EM 385-1-1.

f. Confined Space Entry Procedures

g. Fire Protection and Prevention

h. Excavation and Trench Safety

i. Guarding of Machinery and Equipment

j. Hazard Communication

k. Engineering Controls

l. Signs and Labels

3.3.3.6 Personal Protective Equipment Requirements

In accordance with CFR 29 Part 1910 Section .120 (g)(5) and CFR 29 Part 1926 Section .65 (g)(5), a written Personal Protective Equipment (PPE) program which addresses the elements listed in that regulation, and which complies with respiratory protection program requirements of CFR 29 Part 1910 Section .134, shall be included in the Contractor's Site Safety and Health Plan. The SSHP shall detail the minimum PPE ensembles (including respirators) and specific materials from which the PPE components are constructed. Components of levels of protection (B, C, D and modifications) must be relevant to site-specific conditions. Only respirators approved by NIOSH shall be used. On site personnel shall be provided with appropriate personal protective equipment if the Contingency Plan is implemented. The PPE section of the SSHP shall include site-specific procedures to determine PPE program effectiveness and for on site fit-testing of respirators, cleaning, maintenance, inspection, and storage of PPE. The following requirements shall be addressed in the PPE section of the SSHP.

a. The Safety and Health Manager shall establish appropriate levels of protection for a contingency action based on review of historical site information, existing data, an evaluation of the potential for exposure (inhalation, dermal, ingestion, and injection) during each task, past air monitoring results, and a continuing safety and health monitoring program. The Contractor's Health and Safety Manager shall provide a copy of the initial level of protection to the Contracting Officer for approval if the Contingency Plan is implemented.

b. The Safety and Health Manager shall also establish action levels for upgrade or downgrade in levels of PPE from the following specified minimum levels of protection. Protocols and the communication network for changing the level of protection shall be described in the SSHP. The PPE reassessment protocol shall address air monitoring results, potential for exposure, changes in site conditions, work phases, job tasks, weather, temperature extremes, individual medical considerations, etc. The following items constitute minimum protective clothing and equipment ensembles to be utilized during a contingency action:

1. Level D

Steel Toe and Sole Work Boots
Boot Covers for the Specific Chemical
Work Clothes, including Shirts and Long Pants
Hard Hats
Safety Glasses (Splash Goggles or Face Shields if there is a Splash Hazard)

2. Modified Level D

Steel Toe and Sole Work Boots
Boot Covers for the Specific Chemical
Work Clothes, including Shirts and Long Pants
Hard Hats
Safety Glasses (Splash Goggles or Face Shields if there is a Splash Hazard)
Inner and Outer Gloves for the Specific Chemical
Disposable Coveralls for the Specific Chemical

3. Level C

Steel Toe and Sole Work Boots
Boot Covers for the Specific Chemical
Work Clothes, including Shirts and Long Pants
Hard Hats
Inner and Outer Gloves for the Specific Chemical
Disposable Coveralls for the Specific Chemical
Full Face Respirator with Chemical Specific Cartridges

4. Level B

Steel Toe and Sole Work Boots
Boot Covers for the Specific Chemical
Work Clothes, including Shirts and Long Pants
Hard Hats
Inner and Outer Gloves for the Specific Chemical
Disposable Coveralls for the Specific Chemical
Air Supplied Respirator With Escape Provisions

3.3.3.7 Site Control Measures

In order to prevent the spread of contamination and control the flow of personnel, vehicles, and materials into and out of a contingency action area, site control measures shall be established if the Contingency Plan is implemented. The SSHP shall include procedures for the implementation and enforcement of safety and health rules for all persons on the site, including employers, employees, outside Contractors, government representatives, and visitors. The Contractor shall be responsible for the following site control requirements if the Contingency Plan is implemented.

a. Initial anticipated work zone boundaries shall be established by the Health and Safety Manager. Utilizing this guidance, work zone boundaries (exclusion zone, including restricted and regulated areas; contamination reduction zone; and support zone) and access points shall be established and the boundary delineations shall be included on drawings and provided to the Contracting Officer. As work progresses and field conditions are monitored, work zone boundaries may be modified with approval of the Contracting Officer. Work zones shall be clearly identified and marked in the field (using fences, tape, signs, etc.). A site map, showing work zone boundaries and locations of decontamination facilities, shall be posted in the on site office. Work zones shall consist of the following:

1. Exclusion Zone (EZ): The exclusion zone is the area where hazardous contamination is either known or expected to occur and the greatest potential for exposure exists. Entry into this area shall be controlled and exit may only be made through the CRZ.

2. Contamination Reduction Zone (CRZ): The CRZ is the transition area between the Exclusion Zone and the Support Zone. The personnel and equipment decontamination areas shall be separate and unique areas located in the CRZ.

3. Support Zone (SZ): The Support Zone is defined as areas of the site, other than exclusion zones and contamination reduction zones, where workers do not have the potential to be exposed to hazardous substances or dangerous conditions resulting from hazardous waste operations. The Support Zone shall be secured against active or passive contamination. Site offices, parking areas, and other support facilities shall be located in

the Support Zone.

b. A separate log of personnel visiting, entering, or working in the contamination reduction or exclusion zone shall be maintained for each area identified under the Contingency Plan. The log shall include the following: date, name, agency or company, time entering and exiting site, time entering and exiting the exclusion zone (if applicable), and personal protective equipment utilized. Before visitors are allowed to enter the Contamination Reduction Zone or Exclusion Zone, they shall show proof of current training, medical surveillance and respirator fit testing (if respirators are required for the tasks to be performed) and shall fill out the Certificate of Worker or Visitor Acknowledgment. This visitor information, including date, shall be recorded in the log. A copy of a Contractor-generated certificate of worker/visitor acknowledgement shall be completed and submitted to the Contracting Officer for each visitor or each employee allowed to enter contamination reduction or exclusion zones, following the example certificate at the end of this section.

c. Site security shall be provided. Temporary fencing shall be placed around the contamination reduction and exclusion zones. The fencing shall clearly separate the areas of the site which contain hazardous waste or suspected hazardous waste. Signs shall be printed in bold large letters on contrasting backgrounds. Signs shall be visible from all points where entry might occur and at such distances from the restricted area that employees may read the signs and take necessary protective steps before entering.

3.3.3.8 Personal Hygiene and Decontamination

Personnel entering the Exclusion or Contamination Reduction Zones or otherwise exposed or subject to exposure to hazardous chemical vapors, liquids, or contaminated solids shall adhere to the following personal hygiene and decontamination provisions. Decontamination shall be performed in the CRZ prior to entering the Support Zone from the Exclusion Zone. Chapter 10.0 of NIOSH Pub No. 85-115 shall be consulted when preparing decontamination procedures. A detailed discussion of personal hygiene and decontamination facilities and procedures to be followed by site workers shall be submitted as part of the SSHP. Employees shall be trained in the procedures and the procedures shall be enforced if the Contingency Plan is implemented. Persons disregarding these provisions of the SSHP shall be barred from the site. Available site information shall be reviewed and the Health and Safety Manger shall determine the decontamination procedures. The procedures shall be presented to the Contracting Officer for approval. The SSHP shall contain a generic decontamination procedure which can be used with the suspected hazards on the site.

3.3.3.9 Equipment Decontamination

If the contingency Plan is implemented, vehicles and equipment used in the EZ shall be decontaminated in the CRZ prior to leaving the site. The procedures for decontamination of vehicles and equipment shall be addressed in the SSHP. The procedures shall address disposal of contaminated products and spent materials used on the site, including containers, fluids, oils, etc. Any item taken into the EZ shall be assumed to be contaminated and shall be inspected and/or decontaminated before the item leaves the area. Vehicles, equipment, and materials shall be cleaned and decontaminated prior to leaving the site. Construction material shall be handled in such a way as to minimize the potential for contaminants being

spread and/or carried offsite. Prior to exiting the site, vehicles and equipment shall be monitored to ensure the adequacy of decontamination.

3.3.3.10 Emergency equipment and First Aid Requirements

The SSHP shall describe the emergency and first aid equipment to be available if the Contingency Plan is implemented. The following items, as a minimum, shall be maintained onsite and available for immediate use:

a. First aid equipment and supplies approved by the consulting physician.

b. Emergency eyewashes and showers which comply with ANSI Z358.1.

c. Emergency-use respirators. For rescue purposes, 2 positive pressure self-contained breathing apparatus (SCBA) shall be supplied. These shall be dedicated for emergency use only and maintained onsite in the Contamination Reduction Zone.

d. Fire extinguishers with a minimum rating of 20-A:120-B:C shall be provided at site facilities and in all vehicles in the exclusion zone.

3.3.3.11 Emergency Response Procedures

An Emergency Response Plan, that meets the requirements of CFR 29 Part 1910 Section .120 (l) and CFR 29 Part 1926 Section .65 (l), shall be developed and presented as a section of the SSHP. In the event of any emergency associated with a contingency action, the Contractor shall, without delay, alert all onsite employees that there is an emergency situation; take action to remove or otherwise minimize the cause of the emergency; alert the Contracting Officer; and institute measures necessary to prevent repetition of the conditions or actions leading to, or resulting in, the emergency. Employees that are required to respond to hazardous emergency situations shall be trained in how to respond to such expected emergencies. The plan shall be rehearsed regularly as part of the overall training program for site operations. The plan shall be reviewed periodically and revised as necessary to reflect new or changing site conditions or information. The following elements, as a minimum, shall be addressed in the plan:

a. Pre-emergency planning. The local emergency response agencies shall be contacted. Agencies to be contacted include local fire, police, and rescue authorities with jurisdiction and nearby medical facilities that may be utilized for emergency treatment of injured personnel.

b. Personnel roles, lines of authority, communications for emergencies.

c. Emergency recognition and prevention.

d. Site topography, layout, and prevailing weather conditions.

e. Criteria and procedures for site evacuation (emergency alerting procedures, employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, site security and control).

f. Specific procedures for decontamination and medical treatment of injured personnel.

g. Route maps to nearest prenotified medical facility. Site-support

vehicles shall be equipped with maps. At the beginning of project operations, drivers of the support vehicles shall become familiar with the emergency route and the travel time required.

h. Emergency alerting and response procedures including posted instructions and a list of names and telephone numbers of emergency contacts (physician, nearby medical facility, fire and police departments, ambulance service, Federal, state, and local environmental agencies; as well as Safety and Health Manager, the Site Superintendent, the Contracting Officer and/or their alternates).

i. Criteria for initiating community alert program, contacts, and responsibilities.

j. Procedures for reporting incidents to appropriate government agencies. In the event that an incident such as an explosion or fire, or a spill or release of toxic materials occurs during the course of the project, the appropriate government agencies shall be immediately notified. In addition, the Contracting Officer shall be verbally notified immediately and receive a written notification within 24 hours.

3.3.3.12 Inspection Requirements

If the Contingency Plan is implemented, the SSHO shall perform daily inspections of the exclusion zone and the work in progress to ensure compliance with EM 385-1-1, the Safety and Health Program, the SSHP and other occupational health and safety requirements of the contract, and to determine the effectiveness of the SSHP. Procedures for correcting deficiencies (including actions, timetable and responsibilities) shall be described in the SSHP. Follow-up inspections to ensure correction of deficiencies shall be conducted and documented. Daily safety inspection logs shall be used to document the inspections, noting safety and health deficiencies, deficiencies in the effectiveness of the SSHP, and corrective actions taken. The SSHO's Daily Inspection Logs shall be attached to and submitted with the Daily Quality Control reports. Each entry shall include the following: date, work area checked, employees present in work area, PPE and work equipment being used in each area, special safety and health issues and notes, and signature of preparer. In the event of an accident, the Contracting Officer shall be notified according to EM 385-1-1. Within 2 working days of any reportable accident, an Accident Report shall be completed on ENG Form 3394 and submitted.

EXAMPLE CERTIFICATE OF WORKER/VISITOR ACKNOWLEDGMENT

PROJECT NAME CONTRACT NO.
PROJECT ADDRESS
CONTRACTOR'S NAME
EMPLOYEE'S VISITOR'S NAME

The contract for the above project requires the following: that you be provided with and complete formal and site-specific training; that you be supplied with proper personal protective equipment including respirators; that you be trained in its use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that your employer has met these obligations to you.

I HAVE READ, UNDERSTAND AND AGREE TO FOLLOW THE SITE SAFETY AND HEALTH PLAN FOR THIS SITE.

Name Date

--- ---

FORMAL TRAINING: I have completed the following formal training courses that meet OSHA's requirements:

Date Completed

40 hour: ....._____
8 hour supervisory:....._____
8 hour refresher:....._____

SITE-SPECIFIC TRAINING: I have been provided and have completed the site-specific training required by this Contract. The Site Safety and Health Officer conducted the training. _____

RESPIRATORY PROTECTION: I have been trained in accordance with the criteria in the Contractor's my Employer's Respiratory Protection program. I have been trained in the proper work procedures and use and limitations of the respirator(s) I will wear. I have been trained in and will abide by the facial hair policy. _____

RESPIRATOR FIT-TEST TRAINING: I have been trained in the proper selection, fit, use, care, cleaning, and maintenance, and storage of the respirator(s) that I will wear. I have been fit-tested in accordance with the criteria in the Contractor's my employer's Respiratory Program and have received a satisfactory fit. I have been assigned my individual respirator. I have been taught how to properly perform positive and negative pressure fit-check upon donning negative pressure respirators each time._____

CERTIFICATE (continued)

MEDICAL EXAMINATION: I have had a medical examination within the last twelve months which was paid for by my employer. The examination included: health history, pulmonary function tests and may have included an evaluation of a chest x-ray. A physician made determination regarding my physical capacity to perform work tasks on the project while wearing protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's industrial hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below. The physician determined that there:

were no limitations to performing the required work tasks;

were identified physical limitations to performing the required work tasks.

Date medical exam completed

Employee's Visitor's Signature _____ Date _____

Printed Name _____

Social Security Number _____

Contractor's Site Safety and Health Officer Signature _____

Date _____

Printed Name _____

Social Security Number _____

-- End of Section --

PHASEI

DIVISION 2 – SITE WORK

02101	Special Scheduling
02102	Clearing, Grubbing, and Stripping
02104	Dredging Operations
02228	Rockfill
02316	Excavation, Trenching, and Backfilling for Utilities Systems and Structures (TO BE PROVIDED BY AMENDMENT)
02318	Controlled Low Strength Backfill (Flowable Fill)
02331	Levee Construction and Earthwork
02370	Soil Surface Erosion Control
02380	Stone Protection
02431	Pipe Jacking Concrete Pipe
02456	Steel H-Piles
02630	Storm-Drainage System
02700	Asphaltic Concrete Intermediate Leveling and Surface Courses (Central Plant Hot Mix)
02721	Rigid Base Course
02722	Graded, Crushed Aggregate Base Course and Rigid Base Course
02731	Aggregate Surface Course
02748	Bituminous Tack and Prime Coats
02754	Concrete Pavements for Small Projects
02821	Fencing
02921	Seeding
02945	Tree Protection
02950	Trees, Shrubs and Ground Covers

SECTION 02101

SPECIAL SCHEDULING
12/01

PART 1 GENERAL

1.1 SCOPE

This section covers special scheduling and general guidelines for performance of the work of this construction contract. The work shall consist of the various types of construction indicated on the drawings and within the specifications and shall be scheduled to minimize disruption of normal usage of streets, railroads, spur lines, plant operations, and utilities. Changes in the approved schedules, sequences, and methods of construction specified herein must be approved in writing by the Contracting Officer's Representative (COR) and all affected third parties.

1.2 REFERENCES

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

KANSAS CITY DISTRICT GUIDANCE AND CRITERIA

KCD GUIDANCE	Guidance for Work Proposed Near or Within a Federally Constructed Flood Control Project; http://www.nwk.usace.army.mil/local_protection/levees.html

U.S. ARMY CORPS OF ENGINEERS MANUALS/DOCUMENTS

TECH INFORMATION	TECHINFO; http://www.hnd.usace.army.mil/techinfo/index.htm

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330: SUBMITTAL PROCEDURES.

SD-01 Data

Sanitary Lagoon--Plan of Operations; GA-RE; GA-EC.

The Contractor shall submit a plan of operations identifying the sequencing of work for processing the sanitary lagoon contents. The proposed land application areas for disposition of the sanitary lagoon contents shall be included in the submittal and shall comply with the

requirements of the Missouri Department of Natural Resources Conservation Services.

Sandblasting Facility--Plan of Operations; GA-RE; GA-EC.

The Contractor shall submit a plan of operations identifying the sequencing of work for temporarily relocating the sandblasting facility and then re-establishing once fill operations are complete. The Contractor shall demonstrate the requested down-time for the sandblasting facility is necessary.

Q2 Stoplog Gap--Plan of Operations; GA-RE; GA-EC.

The Contractor shall submit a plan of operations identifying the sequencing of work for construction of Q2 gap. The submittal shall allow for 120 calendar days of review by the COR. The submittal shall shall include sequencing and scheduling that creates the minimum impact on Intercontinental Engineering-Manufacturing Corporation's operations. The submittal shall also propose a testing procedure.

SD-18 Records

Permits; FIO-RE

The Contractor shall provide a copy of all permits to the COR for Government records.

1.4 GENERAL

References to Intercontinental Engineering-Manufacturing Corporation may utilize the full title or variations of it and all references shall be considered equivalent. Flood control works and levee shall be considered interchangeable.

1.5 NOTICE TO CONTRACTOR

Construction of flood control projects and affected features within and adjacent the flood control project often require construction techniques and sequencing not typically required of other types of construction. The Contractor shall review the construction documents and address speciality items within the respective work plans. When the Contractor is unsure of a requirement of the construction documents, the Contractor shall submit in writing a request to the COR for a clarification. The Contractor is not relieved of responsibility of construction requirements when a requirement is overlooked or has been incorrectly applied to construction.

1.6 COOPERATION BETWEEN CONTRACTORS

The Contractor shall coordinate with other work occurring within and adjacent to the work within this construction contract. The Contractor shall prevent work conflicts and delays by developing and adjusting plans of operations (as necessary) and scheduling and sequencing work on a cooperative basis with all other activities occurring within the project limits, outside the project limits, and in support of this construction

project to include but not limited to suppliers, utility companies, utility owners, utility contractors, private landowners, other dredge operations, navigation and general water craft traffic, other general construction activity, and business activities. The Corps of Engineers contract, "Missouri River Levee System, Quindaro - Riverside Levees and Structures, (L-285 Phase II)" will be concurrent with this contract work.

1.7 POINTS OF CONTACT

Points of contact at the time of this writing include the list below. The list also includes the telephone number for Dig Rite. The list may not be all inclusive.

COMPANY	CONTACT	TELEPHONE NO.
Conoco	Ms. Christy Turnbaugh	580-767-3208
	Mr. Les Spence	816-587-1442
Intercontinental Corp.	Mr. C.J. Kuhlman	816-741-0700
	Mr. Brian Everist	816-741-0700
Kansas City Water Services Department	Mr. Brian Schroeder	816-513-2203
	Mr. Bob Williamson	816-513-7205
Kansas City Power and Light Company	Mr. Pat O'Malley	816-556-2200
	Mr. Cory Paczosa	816-245-3835
	Mr. Morris Wilson	816-719-1019
Missouri Department of Transportation	Mr. Brian Wrisinger	816-622-0414
Southwestern Bell	Mr. Ken Morse	816-325-5652
Williams Natural Gas	Mr. Bill Long	270-688-6362
	Mr. Kevin Hoover	270-688-6323
Dig Rite		800-DIG-RITE

1.8 PERMITS

1.8.1 General

For the work within this construction contract the Contractor shall be responsible for coordinating and obtaining all permits required by Federal, state, and local entities other than those identified as already obtained by the Government. Some of the permit requirements are included hereinafter but shall not be considered as all inclusive. The Contractor shall comply with requirements and provisions of the permits.

1.8.2 Environmental

Both the Section 404 Authorization and the National Pollutant Discharge Elimination System (NPDES) permit have been or are being obtained by the Government. The Contractor shall coordinate with the COR for obtaining

copies of the Section 404 Authorization and the NPDES permit. The Contractor shall comply with the special conditions of the Section 404 Authorization and the NPDES permit. Additional Contractor environmental permit responsibilities are included within Section, "Environmental Protection For Civil Works".

1.8.3 Missouri Department of Transportation

The Contractor shall obtain the necessary Missouri Department of Transportation (MoDot) construction permits. Information on this permit process may be obtained by telephoning Mr. Brian Wrisinger at 816-622-0414.

1.8.4 Relocations

Where permits for relocations are required, the Contractor shall be responsible for application, receipt, and compliance with the permit. Efforts required for the sanitary lagoon closure are considered part of relocations.

1.9 ACCESS AND STAGING

Access to the site and staging area shall be limited to the available public roads: Van de Populiere and Highway 69 . Alternate access proposed by the Contractor must be reviewed and approved by the COR prior to Contractor use. If the alternate access is denied, the Contractor shall limit access to that identified herein. Staging areas shall be limited to the areas identified as staging areas on the drawings and in general within the identified right-of-way limits. The Contractor shall be responsible for damages to the access. During construction, the Contractor shall maintain the access roads and staging areas. As a minimum the Contractor shall complete the necessary efforts to prevent dust, rutting, interference with normal traffic flow, liter, and general damage or deterioration of the access roads and staging areas. At the completion of construction, the access roads and staging areas (other then where flood control construction occurred) shall be put in its pre-construction activities' condition.

1.10 LEVEE EMBANKMENT AND BERMS

1.10.1 General

Requirement details of levee embankment and berms and associated borrow operations are included within the Section, "Levee Construction and Earthwork" and the references made within the same section.

1.10.2 Fill Sources

1.10.2.1 General

Sources of fill have been identified for this project. They include required excavation as well as foreshore borrow areas, hillside borrow area, and the sands beneath the Missouri River. The sources identified for this project should be sufficient for construction of this project. The Contractor shall use the required excavation for fill with the exception of unacceptable material. The volume of hillside borrow available under this

contract is 100,000 bank cubic yards. The Contractor may submit for review and approval to the COR alternate borrow sources to supplement fill from required excavations and partial borrow operations of identified borrow sources. The COR will make the final determination on approval of alternate borrow sources. If the Contractor elects to submit an alternate borrow source or sources, the Contractor shall first coordinate with the COR to obtain Contractor requirements for addressing within the submittal the engineering properties, scheduling of work, impacts to the levee, proximity to the levee, environmental regulations, and cultural regulations. An incomplete borrow submittal will be grounds for disapproval. If the initial submittal is disapproved, the Contractor shall not submit additional alternate borrow sources and shall utilize sources of fill identified within these construction documents.

1.10.2.2 Variability of Borrow and Required Excavation Properties

The Contractor shall review all available soil information to develop an appreciation of the soil properties and the need for efforts to adjust soil properties to meet placement and compaction requirements. Of special concern is the moisture content and the Contractor's proposed procedure for adjusting the moisture content to an acceptable level while not wasting the available impervious fill borrow.

1.10.3 New Levee Embankment

Within 90 days of notice to proceed, the Contractor shall have constructed full levee embankment and berm sections at the beginning and end of each continuous reach of levee embankment where a separate levee construction contract will connect. The length of this initial levee and berm construction shall be 100 feet of full section with 1 vertical on 3 horizontal slopes at the ends of each reach necessary for the separate levee construction contract. The length of initial levee and berm construction for utility crossings shall be as required to facilitate utility crossing construction with location and end slopes as defined in the plan drawings.

1.10.4 Existing Levee

The portion of the existing levee located within the random zone and/or landside berm of the new levee shall be incorporated into the new levee and/or landside berm after the existing levee has been cleared, grubbed, and stripped. The portion of the existing levee located outside of the random zone and/or landside berm shall be removed and utilized as fill in the appropriate fill zones except for material identified as unacceptable. The portion of the existing levee located outside of the random zone and/or the landside berm will be considered required excavation. The existing levee level of flood protection shall be maintained until the new levee is constructed to the height of the existing levee. Layout and sequencing shall be as such to maintain flood protection to the level currently provided by the existing levee.

1.10.5 Tie-Back Levees

The Contractor shall construct temporary tie-back levees connecting the end

limits of the new levee within this construction contract to the existing levee. This effort shall be completed within 90 days of notice to proceed. The tie-back levees shall be constructed of impervious fill and to the elevation and section as that of the existing levee it ties into. The placement and compactive effort shall comply with the provisions of Section, "Levee Construction and Earthwork". The tie-back levees constructed from the ends of the new levee to the existing levee will be removed by a separate contract. The Contractor of this contract shall be responsible for maintaining these tie-back levees until the conclusion of the construction contract. The Contractor may need additional tie-back levees or existing levee offsets to maintain the existing level of protection until the new levee has been constructed to the height of the existing levee. The Contractor shall remove these additional tie-back levees and levee offsets once the same level of protection is obtained with the new levee. Separable levee reaches tied to existing features, such as the I-635 embankment, that facilitate maintaining the existing level of protection should be utilized as much as is practical. Limited reaches of the existing levee may be breached if a contingency plan demonstrating sufficient emergency levee construction to deter flooding is submitted and approved by the COR. The reach breached should be limited to that necessary for traffic or dredge pipe layout.

1.11 RELOCATIONS

1.11.1 General

Relocations shall include all work necessary to modify a utility to accommodate the new flood control works project; processing the sanitary lagoon closure; and removing and resetting the sandblasting facility. Regardless of which entity is performing a relocation, the Contractor shall be responsible for coordinating the effort.

1.11.2 Relocation Responsibility and Coordination

1.11.2.1 General

The Contractor shall coordinate all relocations regardless of which entity is performing the relocation. The Contractor shall refer to Sheet U-9 for utility schedule. The Contractor shall notify Williams utility owners 180 days prior to requiring relocations to be completed.

1.11.2.2 Sanitary Lagoon

The sanitary lagoon located within the Intercontinental Engineering-Manufacturing Corporation shall be considered part of relocation to the extent necessary to process the contents and to remove or abandon the sewer pipe. Sequencing of work shall be included in the submitted plan of operations. The Contractor shall also submit to the COR for review and approval the Contractor's proposed land application areas for disposition of the sanitary lagoon contents. All work shall be in accordance with the Missouri Department of Natural Resources Conservation Services requirements and regulations. No work shall begin on the sanitary lagoon until the new sanitary sewer system is completed and operational by a separate construction contract. Once the relocation part of the sanitary

lagoon is completed, additional efforts as indicated within Section, "Levee Construction and Earthwork" shall be required of the Contractor prior to placement of fill. If the Contractor elects to dispose of lagoon contents on-site, the sequencing shall be in accordance with the following steps:

1. For removal of wastewater and sludge and land application, see the drawings.
2. For requirements after the sanitary lagoon contents are removed, see Section, "Levee Construction and Earthwork".

1.11.2.3 Sandblasting Facility

The sandblasting facility shall be temporarily removed and then reset in-place after fill operations. The Contractor shall address sequencing within the plan of operations submittal and shall minimize impacts to Intercontinental Engineering-Manufacturing Corporation's operations. The Contractor shall provide a minimum of 30 days notice to the COR of when the work will be completed and the COR will notify Intercontinental Corporation. The downtime shall be kept to the absolute minimum.

1.11.2.4 Oil Well

An oil well located on the north side of I-635 at approximately northing 1089319 and easting 458554, is schedudle to be capped by others. The Contractor shall not construct any berm over the well until 90 days after the notice-to-proceed.

1.12 Q2 STOPLOG GAP

1.12.1 General

The Contractor shall notify the COR at least six months in advance of Q2 stoplog construction, and the COR will notify Intercontinental Engineering-Manufacturing Corporation of the schedule. The maximum duration for disconnection of service on the railroad spurline and access road through Q2 gap is eight weeks. The Contractor shall submit a plan of operations for Q2 stoplog gap construction to the COR for review and approval prior to construction. The plan of operations shall include sequencing and scheduling that creates the minimum impact on Intercontinental Engineering-Manufacturing Corporation's operations. The sequencing shall be in accordance with the following steps:

1. Coordinate Q2 construction schedule with the COR at least six months in advance of work beginning.
2. Prepare plan of operations. No work until approved by the COR. Schedule submitted to the COR a minimum of 120 days in advance of construction.
3. Construct stoplog gap, spurline raise and access road raise.
4. Open completed spurline to rail traffic.

5. Open completed access road to traffic.

1.12.2 Acceptance of Q2 Stoplog Gap

The closure system shall be fully operational before acceptance. The Contractor shall submit a test procedure demonstrating performance for approval by the COR. Approval and acceptance of the closure system shall be based on the performance of the closure system during closure and subsequent opening. All coordination involved to conduct the performance tests at the gap are the responsibility of the Contractor. The closure system shall not be accepted until all operation and maintenance data are accepted and approved.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL

All work shall be in compliance with the requirements of the contract documents including the approved submittals. Where work impacts Intercontinental Engineering-Manufacturing Corporation, applicable submittals once approved by the COR, shall be provided to Intercontinental Engineering-Manufacturing Corporation. Contractor shall be responsible for coordination with all utility companies and impacted parties. Excavation, stockpiling, and backfill shall be in compliance with the requirements herein and with the requirements of Section, "Levee Construction and Earthwork". When there is an earthwork contradiction, the Section, "Levee Construction and Earthwork", shall govern.

3.2 SANITARY LAGOON

In general, the contents of the sanitary lagoon shall be removed and disposed in accordance with these construction documents and approved submittals. No work shall begin until the sanitary sewer line is constructed by a separate construction contract and fully operational whereas the sanitary lagoon is no longer needed. Once the contents are removed and disposed, the lagoon shall be subject to the requirements of Section, "Levee Construction and Earthwork".

3.2.1 Sanitary Lagoon Contents

The sanitary lagoon shall be closed by removal through either land application or disposal off-site of all wastewater and sludge. If the removal of wastewater and sludge is land disposed of, normal agricultural rates for nitrogen fertilizer is not to exceed the maximum nitrogen utilization of the vegetation growth and shall be applied at controlled rates so that there will be no discharge to waters of the state. See Drawings for details. After removal and proper land application of wastewater and sludge, the earthen basin of the former lagoon shall be subject to the requirements of Section, "Levee Construction and Earthwork".

3.2.1.1 Disposition Limits

(deleted) If additional area for land application is required, the contractor shall make the necessary arrangements and submit the application plan to the Corps of Engineers for review prior to the land application of these areas. The contractor may be allowed to have the wastewater and sludge removed and land applied by others, however this option is contingent on the contractor submitting a plan and schedule to the Corps of Engineers for review and approval.

3.2.1.2 Application Rates

The biosolids application rate shall be less than two dry tons per acre and the nitrogen content of the biosolids shall not exceed 50,000 MG/KG of total nitrogen on a dry weight basis. The land application area shall be seeded with established vegetation prior to land application of wastewater and sludge. All wasterwater removal, sludge removal and land application shall be done in accordance with all Missouri Department of Natural Resources rules and regulations.

3.2.2 Eight Inch Sanitary Sewer Line Disposition

The eight inch sanitary sewer line shall be abandoned by plugging it with flowable fill as shown on the drawings. The Contractor shall coordinate with Intercontinental Corporation prior to work near the sanitary sewer. The Contractor shall coordinate the removal of the sanitary sewer system with the contractor for the MRLS L-385 Phase II contract, who will be installing the new sanitary sewer system. The Contractor shall not remove the existing sanitary sewer system until the new sanitary sewer system is in use and working properly.

3.3 SANDBLASTING FACILITY

The sandblasting facility temporary relocation and re-established setup shall be completed in accordance with the construction documents and the approved submittals. The facility shall be relocated and protected against damage. The construction fill shall be placed for the levee and berm. Additional fill shall be added to provide for an equivalent, but elevated, site layout as that of the preconstruction condition. Foundations and paved areas shall be removed and disposed. Once the fill is placed, equivalent foundations and paved areas shall be constructed. Once the fill is placed and preparatory work completed, the sandblasting facility shall be re-set.

3.4 Q2 STOPLOG GAP

The Q2 Stoplog gap shall be completed in accordance with the construction documents and approved submittals. Duplicate approved submittals shall be provided to Intercontinental Corporation.

3.5 TRACT 29 (Approximate Sta 67+50 to 88+00, Both Landside and Riverside of Levee)

The Contractor shall give notice to the Contracting Officer's

Representative in advance of his schedule to do work in this area so farmers on this tract can harvest their crops prior to any construction in these areas.

3.6 INTERCONTINENTAL ENGINEERING

3.6.1 Plant and Railyard Limitations

The roadways and railways (including without limitation the railroad beds, tracks and switches) leading from Intercontinental's plant to its crane and docking facilities will not be damaged, and the Contractor will coordinate with Intercontinental to assure that Intercontinental has reasonable access to and use of such roadways and railways during the construction process.

-- End of Section --

SECTION 02102

CLEARING, GRUBBING, and STRIPPING
03/01

PART 1 GENERAL

1.1 GENERAL

The work covered by this section consists of furnishing all submittals, labor, equipment, materials, and efforts necessary to perform clearing, grubbing, and stripping as defined for this project. The work covered by this section also includes filling where clearing, grubbing, and stripping has occurred. The work within this section does not apply to clearing, grubbing, and stripping for utility relocations performed by others and preparatory work for the sewage lagoon.

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330: SUBMITTAL PROCEDURES.

SD-01 Data

Plan of Operations; GA-RE.

A detailed plan of operations shall be submitted for the Contracting Officer's Representative (COR) approval. No work shall be initiated until the plan of operations has been approved by the COR. As a minimum the plan of operations submittal for clearing, grubbing, and stripping shall include the scheduling, safety, staging layout and limits, sequencing of operations, structure removal, extent in advance of construction, maintenance of areas completed, protection of adjacent facilities, erosion control, coordination with other construction activities, stockpiling, and method or methods of disposal of cleared, grubbed, and stripped materials.

Disposal Plan(s); GA-RE.

A plan shall be submitted identifying the method or methods of disposal of cleared and grubbed items. Items subject for appropriate off-site disposal should be indicated as such in the plan. Disposal whether on site or off site shall not violate the requirements of this contract and Federal, state, and local regulations. The submittal shall address all required permits necessary for this work and outline the Contractor's application and acquisition of the required permits.

SD-18 Records

Disposition; GA-RE.

The Contractor shall submit for filing with the COR all agreements, permits, and disposition of materials' locations.

1.3 DISPOSITION WITHIN THE LEVEE'S CRITICAL AREA

Work within the L-385 levee's critical area shall not violate Federal levee criteria and will be subject to COR approval. The critical area shall be defined as from the river or tributary to a distance 500 feet landward of the L-385 levee.

1.4 INTERCONTINENTAL CORPORATION'S SEWAGE LAGOON

The Intercontinental Corporation's sewage lagoon will be eliminated as part of this construction contract. The preparatory work required for removal and disposition of the contents will not be included in this section and will be addressed as part of utility relocations. Clearing, grubbing, and stripping other than what is necessary for removal of contents shall be included as part of this section.

1.5 MERCHANTABLE TIMBER

Merchantable timber remaining within the areas to be cleared on or after the date of award of this contract may be disposed at the Contractor's discretion but the disposition shall not violate the requirements of construction documents.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL

Clearing, grubbing, and stripping shall be completed in accordance with the construction documents to include the approved plan of operations. Where deviation from the approved plan is necessary, the deviation shall first be submitted to the COR as an amendment to the plan of operations and not begun until approved by the COR. The Contractor shall execute clearing, grubbing, and stripping so as to protect all adjacent areas against damage. The Contractor shall not interfere with use, or safe passage to and from these areas. Any damage caused by these operations shall be repaired to the satisfaction of the COR at no additional cost to the Government.

3.2 CLEARING

3.2.1 GENERAL

In general, clearing shall consist of removal and disposal of all above grade items within the limits indicated hereinafter and items specifically identified within the construction documents for removal. Features identified to remain in-place shall be protected from damage. Items that may require clearing include, but are not limited to, structures, trees, brush, rubbish, stone, metal, stumps, downed timber, abandoned foundations, fencing, general debris, and other objectionable obstructions as directed. Trees, stumps, brush and other vegetation shall be cut flush with the

ground and grubbed out as directed in hereinafter. If regrowth of vegetation or trees occurs after clearing and before construction begins or within an ongoing construction area, the Contractor shall clear the area at no additional expense to the Government. All items shall be cleared in such a manner as to safeguard employees and others and to avoid damage adjacent features.

3.2.2 Felling of Trees

Felling and removal of trees shall be performed in such manner as to avoid damage to trees left standing, to existing structures and those under construction, and with due regard for the safety of employees and others.

3.2.3 Fence

Fencing and fence posts shall be cleared and disposed. Removed fence shall be replaced to the limits shown on the drawings. The post portion below grade shall be grubbed.

3.2.4 Clearing Limits

Complete clearing shall be conducted within the limits of excavation, fill, or general construction and 10 feet contiguous to the work but not to exceed the limits of the construction right-of-way. Clearing outside these limits shall not occur unless prior approval or direction is provided by the COR. Clearing shall also be conducted for features specifically identified for removal.

3.2.5 Riverward Borrow Areas and Dredging Activities

Riverward borrow areas shall be field located so as not to require removal of the tree stands adjacent the Missouri River. There may be some trees requiring removal between the trees adjacent the river and the landward extent of the borrow areas. Clearing for construction of borrow area drainage ditches shall be completed by the Contractor. However, the drainage ditches shall be located and routed so as to minimize impacts to trees. Drainage ditch locations shall be approved by the COR. Clearing for dredging operations equipment layout shall not be allowed unless approved by the COR. In general, layout of equipment and docking areas shall utilize already cleared areas for other purposes.

3.2.6 Inspection

Areas cleared shall be inspected by the Contractor and COR prior to fill, excavation, or general construction. If the area requires clearing due to new growth or the clearing in general is unsatisfactory, then the Contractor, at no expense to the Government, shall clear the area in accordance with the requirements herein.

3.2.7 Disposition of Cleared Materials

In general, disposition of cleared materials shall be completed in accordance with the approved plan of operations. The Contractor shall make a reasonable effort to channel merchantable material into the commercial market and to promote beneficial use of the materials obtained during clearing. Under no circumstances shall cleared materials be disposed within the critical area of the levee (river or tributary to a distance of 500 feet landward of the L-385 levee). Cleared materials shall not be dumped in the river or tributary or stockpiled in flood prone areas. Once materials have been cleared the Contractor shall dispose in accordance with the approved plan of operations. Stockpiles shall only be allowed as necessary for gathering and loading.

3.2.8 Cleared Wood Items

Wooden items cleared shall be disposed of by burning, offsite disposal at an approved facility, chipped, and/or stockpiled for public availability at an approved site. If burning is selected as the disposition practice, the Contractor shall be responsible for constructing all required facilities; limiting burn hours to those allowed, complying with all Federal, state, and local regulations and permitting practices; and maintaining on hand fire fighting equipment and provide the appropriate training. If burning is elected for use, the Contractor shall coordinate with the City of Riverside, Missouri at 816-741-1544 and the Missouri Department of Natural Resources (MDNR) at 573-634-2436 in obtaining the required permits. The Contractor shall not leave burning areas or areas susceptible to "flaring-up" unattended. If the Contractor elects to utilize chipping practices, the chips shall be removed from the site and hauled to approved sites.

3.3 GRUBBING

In general, grubbing shall consist of removal of objectionable items and materials below grade and the proper backfill and compaction of the cut resulting from the removal within the limits indicated hereinafter. Grubbing shall also be required for items specifically identified for removal. Items or features subjected to grubbing shall include, but not limited to, stumps, buried logs, debris, metal, roots of 1-1/2-inch or larger diameter, and other objectionable matter to a depth of 6 feet below natural ground surface. Grubbing shall also consist of the complete removal of underground structures, pipes, posts, and pavement not specifically indicated to remain that are encountered within the grubbing limits.

3.4 Grubbing Limits

Grubbing shall be completed within the limits of excavation, fill, or general construction and 10 feet contiguous to the work but not to exceed the limits of the construction right-of-way. Grubbing outside these limits shall not occur unless prior approval or direction is provided by the COR.

3.5 Utilities

Utilities shall either be removed or abandoned in-place per the limits and

requirements shown on the drawings.

3.6 Pavement

The removal of the existing pavement shall be to the limits shown on the drawings and specified herein. The pavement cut shall be made by a suitable power saw to provide a neat and smooth vertical edge. The equipment shall be tested by cutting a short test length in the area of the pavement structure that will be removed. As soon as the pavement cut is made, the Contractor shall restrict, by barricades as approved by the COR, all vehicle and pedestrian traffic from crossing the cut.

3.7 Inspection

Areas grubbed shall be inspected by the Contractor and COR prior to filling the cut. Grubbing not completed to the requirements herein shall be properly grubbed by the Contractor at no expense to the Government.

3.8 Disposition of Grubbed Materials

Disposition of cleared materials shall comply with the same requirements of disposition of cleared materials.

3.9 Filling of Cuts Resulting from Grubbing

In general, cuts resulting from grubbing shall be backfilled and compacted with impervious material per the requirements within the Section, "Levee Construction and Earthwork". Deep excavations may utilize the same material type as the undisturbed foundation adjacent the cut and at the same elevation subject to approval by the COR. Lift thickness and compaction requirements shall be determined based on the location of the fill. Fill located within the levee embankment slopes projected (not including the berms) shall be compacted per the requirements of the levee embankment for the appropriate fill type. Fill located outside the levee embankment slopes projected shall be compacted per the requirements of the levee berm for the appropriate fill type. Fill located elsewhere such as for pavement construction shall be per the requirements of the specific installation or construction.

3.10 STRIPPING

In general, stripping shall consist of scraping of the topsoil's upper zone to include light vegetative cover, root system, and organics within the limits indicated hereinafter. Prior to stripping an area, the area shall be cleared, grubbed, and mowed. The mower shall be of a type that shreds the vegetative cover. If regrowth occurs after stripping and before construction begins or within an ongoing construction area, the Contractor shall strip the area at no additional expense to the Government.

3.11 Stripping Limits

Complete stripping shall be completed within the limits of excavation, fill, or general construction and 10 feet contiguous to the work but not to exceed the limits of the construction right-of-way. Stripping outside

these limits shall not occur unless prior approval or direction is provided by the COR.

3.11.1 Stripping Within General Construction Areas

Stripping within general construction areas such as levee, berms, pavement, and general fill or construction areas shall be completed no deeper than 6 inches from the ground surface. Stripped areas may be less than 6 inches if the Contractor demonstrates that roots, organic soils, and vegetative cover has been removed. Depths greater than 6 inches shall comply with the requirements of grubbing.

3.11.2 Stripping Within the Borrow Areas

Borrow areas identified within the drawings and located between the Missouri River and the L-385 levee shall comply with the requirements hereinafter. Stripping shall be completed to a depth of 6 inches within the limits of the borrow areas. If additional topsoil is needed to cover fill areas such as the levee embankment and berms, an additional 6 inches may be obtained from the limits of the borrow areas for a total of 12 inches. If the lower 6 inch thickness is not needed, then it shall be placed in the appropriate fill zone.

3.12 Inspection

Areas stripped shall be inspected by the Contractor and COR prior to fill, excavation, or general construction. If the area requires stripping due to new growth or the stripping is unsatisfactory, then the Contractor, at no expense to the Government, shall strip the area in accordance with the requirements herein.

3.13 Disposition of Stripped Materials

In general, stripped materials shall be stockpiled and protected and used as topsoil for the fill construction such as levee embankment, berms, and ramps. Excess stripped material, if any, shall be spread within the excavation of the borrow areas located between the Missouri River and the L-385 levee. In the event material is stripped that does not classify as topsoil per the requirements of Section, "Levee Construction and Earthwork", the material shall be utilized within the appropriate fill zone. Material that does not meet classification requirements for any fill zone, shall be spread within the borrow areas referenced above.

-- End of Section --

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SECTION 02104

DREDGING OPERATIONS
12/01

PART 1 GENERAL

1.1 General

This section applies to pervious material from the Missouri River obtained through hydraulic pipeline dredge operations. There is no implied guarantee or warranty of what will be encountered within the Missouri River during during material extraction to obtain pervious material. The Contractor shall assume all risk, liability, and expense associated with dredging and materials and items encountered during dredging. The work covered by this section consists of furnishing all submittals,labor, equipment, and materials for performing all operations in connection with hydraulic pipeline dredging pervious material from the Missouri River and placement of the hydraulic dredge material.

All costs in connection therewith shall be included in the contract or unit prices for the items of work to which the work is incidental.

1.2 REFERENCES

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

ENGINEERING MANUALS (EM)

EM 385-1-1	(1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Plan of Operations; GA-RE .

A detailed plan of operations shall be submitted for COR approval. No work shall be initiated until the plan of operations has been approved by the (COR). As a minimum the submittal shall include or address qualifications of the dredging company and dredging supervisor; proposed equipment and piping; layout of equipment and piping; dredging sequence; placement of material; erosion protection; removal of sediment from the discharge; containment systems; protection of other work; discharge back into the river; dredging schedule; avoidance and protection of utilities, infrastructure, and navigation structures; avoidance of and coordination

with other operations on the river and land associated with both this contract and other activities.

SD-01 Data

SURVEY PLAN OF OPERATIONS; GA-RE .

The survey company qualifications shall be submitted for review as well as a plan of operations to perform the surveying. Survey work shall not begin until the qualifications and plan of operations have been approved. The survey company shall demonstrate experience with this type of work and river system. The plan of operations part of the submittal shall include the proposed equipment, survey coverage, indication of measurement interval, method of repeating measurements, and all applicable survey corrections.

1.4 DREDGING EQUIPMENT

Dredging equipment applicable to this section shall be limited to hydraulic dredgers appropriate for this river system. Features such as piping and pumps in support of the dredger shall be compatible with the dredger and capable of supporting the requirements of this construction contract.

1.4.1 Cutterhead

The cutterhead shall be equipped with cutting devices which will efficiently excavate the river sand materials, including boulders, encountered during the excavation. There is no implied guarantee or warranty of what will be encountered within the Missouri River. The Contractor shall assume all risk, liability, and expense associated with dredging and materials and items encountered during dredging.

1.4.2 Power Monitoring Devices

The dredge shall be equipped with power monitoring devices, such as electrical ammeters or hydraulic pressure gauges, to indicate the amount of power being used by the cutterhead at all times. The Contractor shall maintain a record of power usage correlated with the type material being excavated at that time. The record shall be made available to the COR at all times for verification.

1.4.3 Pump Size

The Contractor shall provide a dredge with pump size compatible with the cutterhead power requirements. Booster pumps shall be provided as necessary.

1.4.4 Discharge Lines

The Contractor shall provide discharge lines of a size compatible with the dredger.

1.4.4 Protective Devices

The Contractor shall furnish and use protective devices, such as screens and grills, over the cutterhead to prevent damage to the cutterhead and/or the pump due to passage of cobbles, boulders or other rock material.

1.5 LIMITS OF CONSTRUCTION/DREDGING

The Contractor will be required to limit activities to areas as outlined herein and as shown on the drawings. In general land operations shall not extend beyond the construction right of way limits. River operations shall be limited to the main channel as defined herein except as otherwise noted. Dredging shall be limited to the main channel as defined herein and from Missouri River mile 372.0 through 375.3 (1960 river miles).

1.5.1 Land Based Operations

The Contractor shall refer to the drawings to determine the limits of the construction right of way. The Contractor shall plan land based operations so as to remain within the construction right of way limits and avoid and/or coordinate with other land based operations. Clearing of timber and vegetation must be limited to the absolute minimum required to accomplish the work. The Contractor shall plan operations utilizing areas already cleared for project features instead of clearing additional areas for pipeline and discharge routing.

1.5.2 River Based Operations

Operations outside the limits indicated herein shall only be as necessary for discharge pipe layout, surveys, boat docking, and transport to and from the dredge facility. The Contractor shall comply with all U.S. Coast Guard, State of Missouri, State of Kansas, and Corps of Engineers regulations concerning the prevention of navigation obstructions in navigable waters in the United States. Dredging shall be limited to the Missouri River between river miles 372.0 and 375.3 (1960 river miles); hydrographic surveys may be required outside these river mile limits depending upon where the dredging is occurring. Dredging of pervious materials shall be limited to the area between the Rectified Channel Lines (RCL) with the following additional restriction: Dredging shall be conducted in such a manner to preserve the structural integrity of the landmass landward of the RCL. This shall be accomplished by maintaining an adequate "No Dredging" zone riverward of the RCL so that the material will stabilize into the dredge area at its natural angle of repose. Dredging shall not be allowed within 100 feet of any normal bank line or island. Dredging shall not be allowed within 500 feet of a levee centerline, pipeline or submerged utility crossing, bridge pier, or bridge abutment. Dredging shall not be allowed within a zone from 500 feet downstream to 500 feet upstream of water intake structures (distance may increase subject to meeting water quality requirements). Dredging shall not be allowed within 200 feet of any dike, revetment, or other structure built or authorized by the U.S. Government.

1.5.3 LOCATION/PROTECTION OF UTILITIES AND INFRASTRUCTURE

The Contractor shall complete field locations of all utilities, bridge piers, and navigation structures and verify or correct the location on the plan view. Dredge operations shall be planned accordingly addressing how the clear distances will be established in the field and how structures and pipes will be protected. Utilities shown on the plan drawings encroaching into the Missouri River continue beyond the terminus shown.

1.6 DREDGE QUANTITY LIMITATIONS AND SURVEYS

Dredge sand quantity overall extraction limits and quantity interim extraction limits shall be in accordance with the quantities and scheduling defined by this specification section. A dredging period is defined by

limits set by required before and after surveys whereas a dredging serious is a continuous duration of dredging not separated by time absent of dredging and may be a single dredging period or may be two back to back dredging periods when allowed to be continuous. Quantity limits are defined in units of placed (compacted) cubic yards. The Contractor shall propose a procedure, subject to COR approval, to monitor ongoing quantity removed from the river in terms of placed (compacted) cubic yards.

1.6.1 Quantity Limits by Dredging Period or Dredging Series

Dredging shall not extract more than 1.4 million placed (compacted) cubic yards of pervious material over two consecutive dredging extraction periods with no more than 0.85 million placed (compacted) cubic yards extracted in one period. Except as hereinafter provided, once a dredging extraction period has concluded, dredging operations shall cease for 11 continuous months at the end of which dredging of pervious material may resume obtaining up to the balance of the 1.4 million placed (compacted) cubic yards of pervious material. If more than two dredging periods are required, the dredging sequence stated above shall be repeated with each series separated by 11 months. The exception for extension of a single dredging period or dredging series or reducing the 11 month down time is addressed hereinafter. The Contractor shall maximize the extraction quantity to minimize the number of dredging periods or dredging series. In the event the Contractor does not maximize the extraction quantity, the Contractor shall be responsible for the additional hydrographic surveys at no expense to the Government.

1.6.2 Required Hydrographic Surveys

Hydrographic surveys shall be performed by a survey company and crew with experience of the required survey technique and experience with a river system similar to the Missouri River. Company and crew qualifications shall be submitted, and subject to COR approval. Hydrographic surveys shall be completed prior to and at the conclusion of each dredging period. Hydrographic surveys performed other than these occurrences shall be at the expense of the Contractor. The exception of payment for additional surveys is addressed below within the paragraph, "Optional Hydrographic Surveys". The Contractor is directed to the above paragraph, "Quantity Limits by Dredging Period or Dredging Series" for additional requirements. The hydrographic surveys shall be completed throughout the authorized reach--Missouri River mile 372.0 through Missouri River mile 375.3. Hydrographic surveys shall also be completed a minimum of 1 mile downstream and 1 mile upstream of the actual dredging extraction area, thus requiring hydrographic surveys outside the authorized reach if actual dredging extraction encroaches within 1 mile of the upstream or downstream authorized limit. Sequential hydrographic surveys shall be repetitive in that the measurements shall be completed at the same locations within the tolerances indicated herein. Survey control information adjacent the river shall be coordinated through the COR with the request for information a minimum of 5 working days prior to completing the surveys. Surveys shall be completed utilizing UTM Zone 15, NAD 83, and NGVD 29. All measurements shall be in feet. The survey pattern shall be cross river on a minimum 100 feet intervals with a survey reading obtained every 20 feet. Data shall be collected with a Real Time Kinematic (RTK) instrument. Underwater elevations shall be accurate to the nearest 1.0 foot. Horizontal accuracy for repetitive shots shall be within 5 feet. The Contractor shall provide the Government with a Digital Terrain Model in both Arc Info (TIN) and Microstation InRoads. The cross river (bank to bank) extent shall be to that allowed by the watercraft utilized. The survey route shall

incorporate the utility crossings and paths adjacent structures such as bridge piers. The data collector shall be continuous with travel between intervals. Surveys shall be completed and coordinated to minimize the effects of barge traffic, general river traffic, survey boat movement (boat speeds shall not exceed 3 miles per hour), and weather related river activity.

1.6.3 Dredging Period Extension or Reduction in Dredging Down Time

At the end of a dredging period if the hydrographic survey results indicate the river has recovered as demonstrated by 95 percent of the survey river bed area being within 1 foot of the previous pre-dredge survey, the Contractor may continue to extract up to the balance of the 1.4 million placed (compacted) cubic yards if within the series of two dredging periods or the maximum amount within a single dredging period as identified in the above paragraph, "Quantity Limits by Season". The Contractor may obtain surveys to demonstrate recovery at any time during the 11 month down period. However, if the Contractor elects to obtain additional surveys, it will be at no additional expense to the Government. The exception of payment for additional surveys is addressed below within the paragraph, "Optional Surveys". Regardless of survey results, the Contractor may resume dredging 11 months from the conclusion of the previous dredge period.

1.6.4 Optional Hydrographic Surveys

The Contractor at their own expense may complete hydrographic surveys other than those required within the paragraph, "Required Hydrographic Surveys". If the Contractor completes an optional survey per the survey requirements and demonstrates satisfactory river sediment recovery as defined by these specifications and opts to resume dredging extraction maximizing the extraction quantity, these optional surveys associated with the continuation or resumption of the dredging extraction shall be considered required surveys and the Contractor provided an equitable adjustment in price. In this event payment for hydrographic surveys shall be for each survey associated with actual dredging extraction. In the event dredging becomes continuous through demonstration of satisfactory Missouri River sediment recovery, surveys before and after dredging as well as a single survey completed to verify recovery shall be eligible for payment.

1.7 OTHER DREDGING ACTIVITIES

The Contractor is directed to the other dredging authorizations within this same river reach. In the event other dredging operations are occurring or are initiated while the Contractor is dredging, the Contractor shall coordinate so as not to conflict with the other dredging activities. The proposed coordination effort shall be included in the Contractor's submitted plan of operations. Other authorized dredging activities in this area may have an impact on the Missouri River's ability to recover with sediment and may be reflected in the Contractor's hydrographic surveys.

1.8 STOCKPILE AREAS

If the Contractor elects to stockpile hydraulic dredge material for later use or haul it with barges and/or with overland haulers in-lieu of placement at the point of discharge within the appropriate fill zones, the Contractor shall refer to and comply with placement of random material within the section, "Levee Construction and Earthwork".

1.9 UNSATISFACTORY AND/OR EXCESS MATERIALS

Materials obtained through the dredging process which are unsatisfactory for fill material per the requirements of section, "Levee Construction and Earthwork", for pervious material shall be removed from the site and appropriately disposed. Excess material dredged shall be the responsibility of the Contractor and shall be removed from the project limits.

PART 2 PRODUCTS

2.1 Pervious Material

Hydraulic dredging shall be limited to acquiring pervious material. Pervious material shall be free draining sand, gravely sand, sandy gravel, and/or gravel. Pervious material shall consist of sound durable particles and shall be free of plant growth, roots, humus, debris and deleterious substances. The particle size of pervious material shall be such that not more than 5 percent of the materials pass the U.S. Standard No. 200 sieve as determined with a washed gradation test. Acceptable pervious material will be SW, SP, GW, and/or GP as classified in accordance with ASTM D 2487.

PART 3 EXECUTION

3.1 DREDGING AND PLACEMENT REQUIREMENTS

3.1.1 General

The Contractor shall submit a plan of operations and shall not begin work until the plan of operations has been approved by the COR. All work shall be in compliance with the requirements of the contract documents including the approved plans of operations.

3.1.1.1 Dredging Operations

The Contractor shall plan the location of the dredge and pipeline to avoid interference with river traffic or adverse impacts to structures and pipes within or adjacent the river. The dredge extraction shall be located so as not to encroach upon the dredging limitations required of this construction contract. Where set-up of the operation impedes river traffic, the Contractor shall address how river traffic will be allowed to pass. A dredging period shall not begin until pre-dredge hydrographic surveys for that dredge period have been completed. The dredge operations shall be limited to obtaining pervious material. Contractor shall complete testing of the discharge material as required within the section, "Levee Construction and Earthwork" to ensure meeting the requirements of pervious material. Methods other than pipeline to transmit the pervious material from the extraction point to the point of placement, shall comply with the requirements of section, "Levee Construction and Earthwork." Dredge pipeline discharge shall be performed by either open-end discharge or by a combination of discharge traps in the pipes and open-end discharge. If trap discharge is used, the number of traps open at any one time shall be approved by the COR. If the number of approved open traps is not maintained in a free discharge condition, the COR may require that only open-end discharge may be used. The Contractor shall place a splash board or other device at points of pipe discharge in order to prevent or minimize the forming of holes or craters in the deposited material and prevent damage to the containment facilities. At all times when the dredge discharge pipe is being washed out or when the discharge consists of a high percentage of water with only a minimum amount of solid material being

pumped, all control plates at the bottom openings along the spill-pipe sections of the discharge pipe lines shall be closed immediately and shall remain in a closed position until the pumping operation produces a minimum of 10 percent solid materials in the discharge. If pipe supports and/or tagging are utilized within the fill zones, they shall be completely removed from the fill and fill restored to the required limits and compaction.

3.1.1.2 Placement of Hydraulic Pipeline Dredged Pervious Material

If the Contractor elects to stockpile hydraulic dredged pervious material for later use or haul it with barges and/or with overland haulers in-lieu of placement with a pipeline at the point of discharge within the appropriate fill zones, the Contractor shall refer to and comply with placement of random material within the section, "Levee Construction and Earthwork". Otherwise, placement shall be in accordance with requirements herein this section.

3.1.1.3 Containment Facilities

The Contractor shall include in their plan of operations their proposed method of containing the pervious material within the appropriate fill zone. The submittal shall include drawing details in plan view, profile, and section as necessary as well as the source of the containment fill. Staging, sequencing, and advance construction shall also be included in the submittal. In addition the Contractor shall address as part of their containment system the ability to transmit the dredge discharge such that the sediment load is deposited in the fill zone and the water content returned back to the river in a state that is as clear or clearer than river water taken from a location upstream of the dredge operation. Cross dikes with wastewater discharge weirs may be necessary to facilitate sediment deposition and clear water return. In the event the Contractor is unsuccessful in obtaining satisfactory water quality in the return to the river, the Contractor shall be required to incorporate stilling ponds as necessary. The stilling pond must be outside the foundation limits of the levee embankment and berm fill areas. If stilling ponds are required, they shall be included as part of the submittal process. Containment systems shall also be designed to allow complete drainage of the pervious material placed. Complete drainage may require drainage ports through the containment dikes. Adjustments in operation shall be completed as necessary for compliance with the requirements of these contract documents but shall not be incorporated into the project until approved by the COR as a change to the plan of operations. Containment structures may be constructed from land base designated borrow sources as long as it does not create a shortage of material types required for other fill zones.

3.1.1.4 Effluent Discharge Back to the River

A system to allow effluent discharge back to the river shall be included in the plan of operations and will be subject to COR approval. The Contractor may use a pipeline, at grade ditch (containment on both sides), or below grade ditch. When at grade or below grade techniques are utilized, the ditch or site shall be returned to the pre-construction activity condition or its final required state if the system includes a project feature. Pervious material deposited in the return effluent systems, shall be removed and deposited in the appropriate fill zones per the requirements included in section, "Levee Construction and Earthwork". Effluent systems shall not cause erosion, undermine structures or area features, or conflict with or prevent land based operations. This operation shall be altered as

necessary to meet the requirements of the contract documents. Alterations shall first be approved by the COR prior to incorporation into the project as a change to the plan of operations.

3.1.1.5 Pervious Material Placement, Compaction, and Testing Requirements

In general, the dredged pervious materials shall be distributed within the fill zone in such a way as to produce a section of relatively uniform permeability. The Contractor shall take necessary precautions to prevent damage from discharge water or other causes. Lift thickness, compaction requirements, and testing of placed pervious material shall be as required for pervious material within the applicable fill zone as stated in section, "Levee Construction and Earthwork". The Contractor shall include in their plan of operations how the hydraulically placed dredged pervious material will be placed, compacted, and tested while at the same time maintaining an active hydraulic dredge operation.

3.1.1.6 Alternate Method of Placement

The Contractor may consider an alternate method of placement and it will be subject to the results of a test section. If the test section does not demonstrate satisfactory placement of pervious fill, the Contractor shall, at no additional cost to the Government, revert back to the requirements above in paragraph, "Pervious Material Placement, Compaction, and Testing Requirements". If the test section fails, the Contractor shall remove and replace the test section to meet the requirements of paragraph, "Pervious Material Placement, Compaction, and Testing Requirements" at no cost to the Government. The test section shall be constructed by having the hydraulic dredge pipeline discharge directly into the fill zone allowing the fill to free drain utilizing a downward seepage gradient to consolidate the placed pervious material. There will be no mechanical effort applied to the placed pervious material and traffic shall be limited to the minimal requirements to move the discharge pipe, shape the fill to the required limits, and place the impervious cap and/or topsoil. If the test section is accepted, the impervious cap and/or topsoil shall be placed by pushing the initial lift so the equipment is operated on the impervious cap and/or topsoil being placed instead of the already placed pervious material. Acceptance of the test section shall be based on the results of relative density testing performed within test pits. The number of test pit locations shall be a minimum of four with one within the levee embankment and the remaining three uniformly distributed throughout the width of the landside berm. Each test pit shall have multiple relative density tests performed with the exception of the landward most test pit whereas only one relative density test shall be performed at the midpoint of the fill thickness. The test pit at the levee section and the first test pit landward of the levee shall have three relative density tests performed--12 inches below the upper fill limit, the fill thickness half way point down, and 12 inches above the base of the fill. The test pit at the midpoint of the landside berm shall have 2 relative density tests performed--12 inches below the upper fill limit and 12 inches above the base of the fill. Relative density procedure and minimum requirements shall be as stated for the appropriate material type and fill zone of section, "Levee Construction and Earthwork". If the relative densities achieve the minimum requirements, then the placement procedure outlined herein may be utilized by the Contractor. If this procedure is approved by the COR and adopted by the Contractor, then test pits and relative densities shall be completed as indicated above for every (delete and replace) 4000 feet of levee or berm to receive hdraulic dredge fill. As directed by the COR, additional testing may be required at no expense to the Government if site, weather,

or placement conditions change. These testing sections shall be in addition to the test section.

3.1.1.7 Other Fill Zones and Areas Adjacent Dredging Operations

When the dredging operation is performed prior to the placement of impervious material, coincidental with impervious material, and/or simultaneous staging with impervious fill, preparation of the foundation under the impervious fill or preparation of the surface of the impervious fill placed and subject to additional impervious fill shall require complete pervious material removal, complete drainage, and complete saturated impervious material removal and replacement with compacted impervious material. Ponding on the embankment shall not be permitted. Complete drainage of the pervious material placed shall occur prior to placing the impervious material adjacent or above the pervious material placed. These efforts shall be completed at no additional cost to the Government prior to placement or continued placement of the impervious material.

3.1.1.8 Effluent Testing and River Testing

3.1.1.8.# General

Dredging and its associated operations shall be performed in a manner that will minimize increases in suspended solids and turbidity which may degrade water quality and damage aquatic life outside the immediate area of operation. Only clean, non-contaminating materials may be placed in the levee and berm fill areas in order to minimize turbidity of leaching fines and to preclude the entrance of deleterious and/or toxic materials to the waters of the United States by natural runoff or by leaching. The effluent Discharge water shall be returned to the river and shall be desilted to the extent that the percentage of silt is not greater than that of the river upstream of the dredging extraction area. Testing the effluent will be the responsibility of the Contractor. In addition, the municipalities with water intake facilities will conduct water sampling and quality testing.

3.1.1.8.# Effluent Testing

Effluent from the hydraulically excavated material shall be returned to the river as clear as, or clearer than, river water taken from a location upstream of the work. The upstream location will be selected by the COR. Bottle samples shall be taken daily during disposal operations and until drainage of the disposal area is completed. The sample shall be taken by the Contractor at effluent structures (means shall be incorporated in the effluent structures to allow these samples to be taken) and at the designated upstream location. Suspended solid concentration shall be reported in the Contractor's daily quality control report and utilized to determine if a longer effluent retention time is needed. If the effluent test fails, dredging operations shall be suspended until modifications to the Contractor's plan are complete and demonstrate satisfactory performance. Modifications to the Contractor's plan or general operations necessary for compliance per effluent testing shall be submitted to the COR and once approved shall be implemented by the Contractor at no expense to the Government.

3.1.1.8.# Water Quality Testing

Intakes providing Missouri River water for treatment in supply of municipal water consumption are located at Missouri River miles 370.5 (Kansas City,

Missouri--left bank) and 373.5 (Kansas City , Kansas--right bank). The Government's representative has obtained samples and performed testing to form a baseline. The minimum testing requirements for the baseline assessed volatile organic compounds (VOC's), synthetic organic compounds (SOC's), and inorganics. The minimum requirements in establishing the baseline was established by obtaining and testing a sample on weekly intervals at the Kansas City, Missouri water intake for a minimum of 1 year. Whenever dredging is being performed or there is discharge back into the Missouri River, a sample will be obtained and tested on a daily basis by the Government's representative. Frequency of sampling and testing may be reduced based on Contractor's proven performance. If the water quality at the intake during dredging is less than the established baseline, then all dredging shall cease as well as discharge into the Missouri River. Additional samples will be obtained and tested by the Government's representative at each of the water intake facilities and upstream of the L-385 construction activities. If the reduction in water quality is determined the result of the dredging operations or discharge into the Missouri River, then the Contractor will be responsible for all costs of additional water treatment (at the treatment plants), costs of additional water quality testing, and cost associated with modifying the Contractor's plan and general operations sufficient to meet water quality requirements. Modifications to the Contractor's plan or general operations necessary for compliance with water quality shall be submitted to the COR and once approved shall be implemented by the Contractor at no expense to the Government. If the reduction in the water quality is not attributed to the dredging operations or the Contractor's general operations, then an equitable adjustment will be made to Contractor for down time and efforts associated with the down time. The Contractor shall notify the COR a minimum of 5 working days prior to dredging operations or discharge into the Missouri River and shall continue to coordinate with advance notice, when reasonable, of non-dredge times. The Contractor will continue to coordinate with the COR as to the status of discharge into the Missouri River even after the dredging operations have ceased.

3.2 Permits and Special Conditions' Requirements

Operations that impact the waters of the United States are subject to the special conditions of the Section 404 Authorization and the special conditions of the National Pollutant Discharge Elimination System (NPDES). Both the Section 404 Authorization and the NPDES have been or are being obtained by the Government. Dredging, placement, and return waters back to the river impact the waters of the United States and will be subject to the special conditions cited and will be the responsibility of the Contractor for compliance. The Contractor shall coordinate with the COR for information on the special conditions.

3.3 Historical, Archeological, and Cultural Resources

The Contractor is referred to Paragraph 3.2, "Historical, Archaeological, and Cultural Resources" of Section 01354, "Environmental Protection for Civil Works" in regard to responsibilities to archeological finds.

-- End of Section --

02170

RELOCATIONS
03/02

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing all submittals, labor, equipment, plant, materials, and all efforts necessary to perform relocations as defined for this project. Relocations of identified structures, pipes, and other features shall be performed by the Contractor as defined herein to design, move, remove and replace, or general alteration as necessary to facilitate construction of the L-385 flood control project and ensure the integrity of the flood control project.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced or where the procedure or information is necessary for performance of the work. The publications are referred to in the text by basic designation only.

KANSAS CITY DISTRICT GUIDANCE AND CRITERIA

KCD GUIDANCE	Guidance for Work Proposed Near or Within a Federally Constructed Flood Control Project; http://www.nwk.usace.army.mil/local_protection/levees

U.S. ARMY CORPS OF ENGINEERS MANUALS/DOCUMENTS

TECH INFORMATION	TECHINFO; http://www.hnd.usace.army.mil/techinfo/index.htm

ENGINEERING MANUALS (EM)

EM 385-1-1	(1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.3 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section,01330 SUBMITTAL PROCEDURES:

SD-01 Data

Designs; GA-EC

The Contractor shall submit relocations' analysis and design. Where a relocation requires, the Contractor shall also provide a construction contingency plan to ensure safety and continued service.

SD-08 Statements

Plan of Operations; GA-EC

The Contractor shall submit a plan of operations identifying the sequencing of work for completion of all relocations. The plan of operations shall identify the relocations, Contractor responsibility, and the sequencing of activities to include those specific to the relocation and those necessary for construction of the flood control works project (L-385). The plan of operations shall also include a schedule of activities.

Architecture-Engineer Qualifications; GA-EC

The Contractor shall submit the qualifications of the Architecture-Engineer proposed to design the relocations.

1.4 COORDINATION

The Contractor shall coordinate with each relocation owner or operator to establish schedules for respective design and construction to ensure no delays. Immediately upon award the Contractor shall make contact with each know relocation owner to establish a schedule to include in the plan of operations.

1.5 IDENTIFICATION OF WORK

1.5.1 Relocation Schedule

A utility schedule is provided within plan sheet U-9. The Contractor shall refer to this schedule to determine relocation information. Relocations not listed in the utility schedule but identified within the construction documents shall be completed as directed herein.

1.5.2 Relocation Schedule Discrepancies

The Contractor shall verify and correct if necessary all relocation information provided within these construction documents.

1.5.3 Elimination of Relocations

The Contracting Officer reserves the right to not award all or individual relocations as indicated in the bid sheet. If a relocation is not awarded, the Contractor shall coordinate with the owner or operator of the relocation feature to ensure no work conflicts between the relocation and the L-385 construction or to work around the relocation not awarded with arrangements to return and complete the L-385 work as necessary (may be multiple steps) to facilitate the relocation. If a relocation is not awarded, the Contractor shall be responsible for the base L-385 work; work outside the fill and construction limits applicable to the L-385 construction, shall be the responsibility of the relocation owner. Work division limits shall be coordinated with the relocation owner by the Contractor. The Contractor is directed to the paragraph below for information on traverses. In the event a relocation is not awarded, all efforts associated with consequences of the decision shall be at no expense to the Government.

1.5.4 Relocation Schedule Omissions

Relocations discovered during the construction of the L-385 flood control project and not identified within these construction documents shall be brought to the attention of the Contracting Officer upon discovery. The Contractor shall plan their work to stay clear of the discovered relocations until the Contracting Officer provides further direction. An equitable adjustment in contract cost shall be provided to the Contractor if directed to perform a relocation for the discovered feature.

1.6 ARCHITECTURE-ENGINEER QUALIFICATIONS

The Contractor shall submit the qualifications of the Architecture-Engineer proposed to design the relocations. More than one Architecture-Engineering firm may be submitted to address the different design relocations. The Architecture-Engineer shall be a licensed Professional Engineer; have a minimum of 5 years experience with similar project designs for work within or adjacent a Kansas City District Federal urban flood control project with similar features as MRLS L-385; and has experience with the specific relocation such as pressure lines or sanitary sewer force mains.

1.7 POINTS OF CONTACT

The Contractor shall coordinate with the appropriate entities such as Missouri One Call to obtain the point of contact for each applicable relocation. Points of contact identified within these construction documents shall be verified and corrected if appropriate by the Contractor.

1.8 LIMITS OF WORK

Unless otherwise specificied within these construction documents, relocations shall be completed within the limits of the MRLS L-385 permanent right-of-way. Efforts outside the permanent right-of-way but within the construction right-of-way will be as necessary to perform the relocation within the permanent right-of-way.

1.9 LEVEE TRAVERSES

Plan Sheet U-4, "Miscellaneous Utility & Drainage Details" is provided for Contractor information and use where applicable. In addition and in the event others are performing the relocation, the Contractor shall use this detail for structuring their work to facilitate the applicable relocation routing.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL

In general, relocations shall be either design complete or design construct. These categories are applied to the schedule provided in the plan sheet. Design complete shall indicate design is completed and the construction work shall be completed by the Contractor or the Contractor's representative. Design build shall require both design and construction to be performed by the Contractor or the Contractor's representative.

3.2 DESIGN COMPLETE

Except where otherwise directed, the Contractor shall complete the relocation per the design requirements within the construction documents.

Submittals shall be per the requirements.

3.2.1 Removed, Abandoned, or Plugged/Filled Relocations

The Contractor shall submit a plan with any applicable design for required removal, abandonment, or plugging/filling of relocations. Submittals shall meet Federal Levee criteria as addressed within the KCD Guidance.

3.2.2 Relocations With Designs

Fence, guard rail, sign relocations, although already designed, shall require design and submittal for installation below grade and shall be in accordance with the KCD Guidance.

3.3 DESIGN-CONSTRUCT

Except where otherwise directed, the Contractor shall complete the relocation per the approved design. Designs shall be in accordance with Federal Levee criteria as found in the KCD Guidance and Tech Information references. Designs shall also meet the relocation owner requirements necessary to maintain the integrity of the service.

3.3.1 Federal Levee Guidance

Federal Levee guidance shall be in accordance with the references KCD Guidance and Tech Infomation. The review emphasis will be on those aspects impacting the flood control works.

3.3.2 Overhead Line Power Poles

Powerpoles' design shall include subsurface details, poles reinforcement, and location to avoid the flood control project and riverward locations (or provide design compensation for impact loads or redirecting river flows).

3.3.3 Electrical Service to Quindaro Pump Station

Quindaro Pump Station will require electrical service routed from a power source to the pump station. The routing will occur on public roads' easements, Phase I right-of-way, and Phase II right-of-way. The Phase II Contractor shall be responsible for coordinating with Kansas City Power and Light for this routing and ensuring both Kansas City Power and Light and Federal Levee criteria is met. The design shall be submitted for Contracting Officer's review. Within 45 days of Phase II award, the Phase II Contractor shall have coordinated with KCPL and the Phase I Contractor to establish a routing (buried or overhead) within the easements and rights-of-way indicated above. Within 30 days of notification, the Phase I Contractor shall complete Phase I construction sufficiently to allow the Phase II Contract route the electrical service.

3.3.4 Submittals

The Contractor shall make as many submittals as necessary to address all relocation owner or operator comments and Contracting Officers' review comments. Submittals shall be all inclusive with investigation, analysis (that includes a hydrostatic hydraulic grade line riverward to landward), design, plans, specifications, and plan of operations. Prior to providing a submittal, the Contractor shall ensure all pertinent aspects of Federal flood control criteria and prior comments have been addressed per

referenced guidance.

SECTION 02228

ROCKFILL
04/01

PART 1 GENERAL

This Section covers rockfill and field acceptance tests, complete.

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 basic designation only.

STANDARDS DEVELOPMENT ORGANIZATION (ACRONYM)

ACRONYM REF-ID (issue/revision date) Publication Title

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Plan of Operations; GA-RE.

SD-08 Statements

Aggregate Sources; FIO-RE

Written verification that stone for use in Rockfill will be produced from the sources listed in the SPECIAL PROVISIONS; identify specific source of all stone material.

Test Methods; GA-EC

Written, detailed descriptions of the method of conducting specified Truckload Gradation and In-place Gradation tests.

SD-09 Reports

Field Test Reports; GA-EC

Written results of all Truckload Gradation and in-place Gradation tests, including supporting computations.

Survey Data; FIO-RE

Field notes of surveys conducted prior to and following rockfill placement.

Weigh Bills: FIO-RE

Submit weigh bills for each truckload of Rockfill as it is delivered to the project site.

1.3 QUALITY CONTROL

1.3.1 Tests

Tests shall be performed for rockfill as specified below, and as directed, by the Contracting Officer, to determine if the rockfill material delivered to the job meets the gradation, elongation, and deleterious requirements specified herein. Tests for elongation shall be run on the plus 6-inch material only. The tests shall be coordinated to minimize interference with the construction progress. If the materials fail to meet the gradation, elongation, and deleterious materials limits specified, the Contractor shall adjust his operations as required to produce acceptable materials, or he shall propose another source of materials. Prior to placement of any materials, the Contractor shall submit for approval, in writing, the detailed methods of testing. The Contractor shall state in writing the method used in processing, loading and handling of materials for each test, and shall notify the Contracting Officer any time any production methods are changed. The field acceptance tests shall be performed on random loads selected by the Contracting Officer. Materials from load testing may be placed in the work if the materials meet specifications requirements.

1.3.1.1 Tests Required:

Type of Test	Min. Size of Test	Min. No. of Tests Required
Truckload Test	10 tons	one (1)
In-place Gradation	15' x 15'	one (1)

1.3.2 Surveys

The Contractor shall survey the area upon which rockfill is to be placed. The survey shall be completed before placing any rockfill. The Contractor shall again survey the completed rockfill layer. Cross-sections shall be taken as often as needed or as directed by the Contracting Officer, but not less than every fifty (50) feet. Points on the cross-section shall be taken at break points or as directed by the Contracting Officer, but not less than every twenty (20) feet. The indicated lines and grades on the drawings will be the basis for computation of quantities. Rockfill required to correct deviations from plan grade in excess of specified tolerances will be excluded from payment quantities.

PART 2 PRODUCTS

2.1 STONE

Stone for rockfill shall be sound, durable limestone, free from cracks, seams, partings, and overburden spoil. Stone shall be approximately rectangular in cross section, free from thin slabby pieces having an elongation ratio more than four, and the quantity of stone having an elongation ratio more than three shall not exceed 20 percent of weight. Deleterious substances which include soft friable particles, objectionable material, and other foreign matter, shall not exceed 10 percent by weight.

2.1.1 Gradation

The stone shall be graded from coarse to fine. The material shall have a maximum size of 700 pounds, with not more than 50 percent of the material smaller than 100 pounds. The material may contain up to a maximum of 25 percent fines (by weight) except that the outer 3 feet of the rock shell section shall not contain more than 15 percent fines (by weight). Fines are defined as material smaller than 3 inches in size.

2.1.2 Sources and Approval of Materials

Stone protection shall be produced from the sources listed in the SPECIAL CLAUSES or from any other source when approved in accordance with the SPECIAL CLAUSES and the requirements specified herein.

PART 3 EXECUTION

3.1 PLACEMENT

Except for rockfill materials placed against structures, and rockfill placed below the existing water surface, which may be placed in one lift, rockfill shall otherwise be placed in lifts not exceeding 3 feet in thickness. Care shall be taken in placing stone against pipes and other structures; stone placed within a distance of 1 foot from the exterior of pipes or structures shall be placed by hand; stone placed in the remainder of the area may be placed in one lift. At no time will the toe of the rockfill being placed be more than 50 feet from the toe of the excavation. The temporary earthcut (finished subgrade template) shall not be excavated more than 50 feet ahead of the placement of rockfill; the required general sequence for construction of the rockfill is specified in Section 02331 LEVEE CONSTRUCTION AND EARTHWORK . Transitions from the temporary earthcut section to the existing ground surface shall not exceed 100 feet in length. Bridging shall be broken down so that the resulting fill forms a fully stable mass. Any crust or concentrations of fines at the surface of the lift which, in the opinion of the Contracting Officer, will interfere with bonding, shall be broken up prior to adding the next lift. Dumping and spreading shall be controlled to obtain rock to rock contact without objectionable pockets of fines or concentrations of large pieces. Generally, the larger pieces of stone shall be placed near the riverside slope. A tolerance of plus 0.2-foot from the indicated lines and grades for rockfill will be permitted.

3.2 SCALES AND WEIGHHOUSE

Scales shall be standard truck scales of the beam type and of sufficient size and capacity to accommodate all trucks used in hauling material. Scales shall be tested, approved, and sealed by an inspector of the State Inspection Bureau charged with scales inspection within the State of Missouri, or by the Contracting Officer if the services of an official inspection bureau of the State are not available. Scales shall be recalibrated and resealed as often as necessary to ensure continuous accuracy. The number of standard weights necessary for testing the scales shall be on hand at all times.

3.3 MAINTENANCE

The contractor shall maintain the rock fill until the project is completed and any material displaced by any cause, except as provided in paragraph: DAMAGE TO WORK of the SPECIAL CLAUSES, shall be repaired to the lines and grades shown on the drawings as directed.

-- End of Section --

SECTION 02316

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS
11/97

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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 698	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.)
ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.2 DEGREE OF COMPACTION

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 698.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section, SUBMITTAL PROCEDURES:

SD-09 Reports
Field Density Tests; FIO-RE.
Testing of Backfill Materials; GA-RE.

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SM, SW-SM, SC, SW-SC, CL, and CH.

2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 3 inches. The Contracting Officer shall be notified of any contaminated materials.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials shall include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials shall include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM shall be identified as cohesionless only when the fines are nonplastic.

2.1.4 Unyielding Material

Unyielding material shall consist of rock and gravelly soils with stones greater than 3 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.

2.1.5 Unstable Material

Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

2.1.6 Select Granular Material

Select granular material shall consist of well-graded sand, gravel, crushed

gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve and no less than 95 percent by weight passing the l inch sieve. The maximum allowable aggregate size shall be 1 inches, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

2.1.7 Flowable Fill

Flowable fill shall be free of potentially expansive or corrosive materials, including chloride ions or calcium chloride. Use flowable fill mix as required in SECTION 02318 CONTROLLED LOW STRENGTH BACKFILL (FLOWABLE FILL).

2.2 PLASTIC MARKING TAPE

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone, Telegraph, Television, Police, and Fire Communications
Blue:	Water Systems
Green:	Sewer Systems

PART 3 EXECUTION

3.1 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

3.2 EXCAVATION

Excavation shall be performed to the lines and grades indicated. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 2 feet. Excavated material not required or not satisfactory for backfill shall be removed from the site. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating shall be removed to maintain the stability of the bottom and sides of the

excavation. Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Government.

3.2.1 Trench Excavation Requirements

The trench shall be excavated in accordance with section LEVEE CONSTRUCTION AND EARTHWORK, or as shown. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter and shall not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

3.2.1.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.2.1.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, such material shall be removed to a minimum of 4 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.1.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with impervious material or 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 resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

3.2.1.4 Excavation for Appurtenances

Excavation for manholes, catch-basins, inlets, or similar structures shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Loose disintegrated rock

and thin strata shall be removed. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.2.1.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.2.2 Stockpiles

Stockpiles of satisfactory materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government.

3.3 BACKFILLING AND COMPACTION

Backfill material shall generally consist of impervious material. Select granular material shall only be allowed outside the critical area (500 feet landward or 300 feet riverside of the centerline of the levee). Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to 70 percent relative density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

3.3.1 Trench Backfill

Trenches shall be backfilled to the grade shown. The trench shall be backfilled to 2 feet above the top of pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test.

3.3.1.1 Replacement of Unyielding Material

Unyielding material removed from the bottom of the trench shall be replaced with impervious material or with select granular material if outside of the critical area.

3.3.1.2 Replacement of Unstable Material

Unstable material removed from the bottom of the trench or excavation shall be replaced with impervious material or with select granular material, if

outside the critical area, and placed in layers not exceeding 6 inches loose thickness.

3.3.1.3 Backfill Around Pipes

Backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

3.3.1.4 Final Backfill

The remainder of the trench, except for special materials for roadways and railroads, shall be filled with satisfactory material, as specified in paragraph BACKFILLING AND COMPACTION. Backfill material shall be placed and compacted as follows:

a. Roadways and Railroads: Backfill shall be placed up to the subgrade elevation in accordance with the requirements in Section: LEVEE CONSTRUCTION AND EARTHWORK. Water flooding or jetting methods of compaction will not be permitted.

b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Backfill shall be deposited in layers of a maximum of 12 inch loose thickness, and compacted to 85 percent maximum density for cohesive soils and 70 percent relative density for cohesionless soils. Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.

3.3.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 3 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.4 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities to be relocated by the Contractor are as follows:

3.4.1 Gas Distribution

Trenches shall be excavated to a depth that will provide not less than 18 inches of cover in rock excavation and not less than 24 inches of cover in other excavation, unless otherwise shown.

3.4.2 Water Lines

Trenches shall be of a depth to provide a minimum cover of 4 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe, unless otherwise shown. For fire protection yard mains or piping, an additional 6 inches of cover is required.

3.4.3 Heat Distribution System

Backfill material shall be free of stones larger than 1/4 inch in any dimension.

3.4.4 Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise shown.

3.4.5 Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 3 feet below finished grade unless otherwise shown.

3.5 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

3.5.1 Testing Facilities

Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Contracting Officer. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the first inspection will be charged to the Contractor.

3.5.2 Testing of Backfill Materials

Characteristics of backfill materials shall be determined in accordance with particle size analysis of soils ASTM D 422 and moisture-density relations of soils ASTM D 698. A minimum of one particle size analysis and one moisture-density relation test shall be performed on each different type of material used for backfill.

3.5.3 Field Density Tests

Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one field density test per lift of backfill for every 200 feet of installation shall be performed. One moisture density relationship shall be determined for every 1500 cubic yards of material used. Field in-place density shall be determined in accordance with ASTM D 1556 or ASTM D 2167 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using the sand cone method as described in paragraph Calibration of the ASTM publication. 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. 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, at intervals as directed by the Contracting Officer. At least one field density test performed in accordance with ASTM D 1556 shall be made daily and used as a check of the results obtained with ASTM D 2922 or ASTM D 3017. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be furnished to the Contracting Officer. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government.

3.5.4 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to the finished grade surface, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 36 inches shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

-- End of Section --

SECTION 02318

CONTROLLED LOW STRENGTH BACKFILL (FLOWABLE FILL)
05/01

PART 1 GENERAL

1.1 General

CONTROLLED LOW STRENGTH BACKFILL (FLOWABLE FILL), BACKFILL CONCRETE, FLOWABLE FILL, and CONTROLLED LOW STRENGTH MATERIAL (CLSM) as specified or indicated is concrete used for structural backfilling applications. The concrete used for structural backfilling applications shall be referred to herein as Controlled Low Strength Material (CLSM). CLSM is a pumpable or flowable Portland cement concrete used for backfilling around structures, pipes, drains, and other important closures. CLSM shall conform to the requirements for concrete specified in SECTION: 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS, and as modified herein. CLSM may only be used where specified or indicated.

Nonshrink grout shall be used for filling small voids where use of CLSM is determined to be impractical. Nonshrink grout may only be used where specifically approved in writing.

Non-Structural Flowable Backfill (if used) may be permitted for use in non-structural applications for filling voids below the frost penetration depth and which will not be exposed to flowing water during service conditions. Non-structural flowable backfill shall not be used for termination of pipe penetrations and other penetration closures. Non-structural flowable backfill shall not be used in or under structures or embankments. Non-structural flowable backfill shall conform to the MISSOURI STANDARD SPECIFICATIONS for HIGHWAY CONSTRUCTION, SECTION 621 FLOWABLE BACKFILL. Non-structural flowable backfill may only be used where specifically approved in writing.

1.2 REFERENCES

The publications listed below and in SECTION: 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

ACI 229	(1994) Controlled Low Strength Materials (CLSM)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 94/C 94M	(2000) Ready-Mixed Concrete
ASTM C 260	(1986) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 494	(1992) Standard Specification for Chemical Admixtures for Concrete
ASTM C 1017/C 1017M	(1998) Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1107	(1999) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

MISSOURI STANDARD SPECIFICATIONS for HIGHWAY CONSTRUCTION, ENGLISH VERSION

SECTION 621	SECTION 621 FLOWABLE BACKFILL MISSOURI STANDARD SPECIFICATIONS for HIGHWAY CONSTRUCTION, ENGLISH VERSION, 1996 Edition. referred to herein as State Specifications.

1.3 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 Data

Installation Methods and Procedures; FIO-RE

The Contractor shall submit the proposed Methods, equipment and procedures for use in placing, curing, and protection of CLSM, nonshrink grout, or non-structural flowable backfill.

Grouting Specialist Qualifications; FIO-RE

The contractor shall submit evidence that the grouting specialist used for placements of CLSM, nonshrink grout, or non-structural flowable backfill has had experience within the last 3 years on similar projects.

Mixture Proportioning, GA-RE

CLSM, Nonshrink grout, and non-structural flowable backfill mixture proportions shall be determined by the Contractor and submitted for review. The mixture quantities of all ingredients per cubic yard and nominal maximum coarse aggregate size that will be used in the manufacture of each quality of concrete, grout, and flowable backfill shall be stated. Proportions shall indicate the mass of cement, pozzolan and ground granulated blast-furnace (GGBF) slag, and water; the mass of aggregates in a saturated surface-dry condition; and the quantities of admixtures. The submission shall be accompanied by test reports from a laboratory complying with ASTM C 1077 which show that proportions thus selected will produce mixtures of the qualities indicated. No substitution shall be made in the source or type of materials used in the work without additional tests to show that the quality of the new materials and concrete are satisfactory.

Curing and Protection; GA-RE

The curing medium and methods to be used shall be submitted for review and approval.

Cold-Weather Placing; FIO-RE

If CLSM, nonshrink grout, or non-structural flowable backfill is to be placed under cold-weather conditions, the proposed materials, methods, and protection shall be submitted for review.

Hot-Weather Placing; FIO-RE

If CLSM, nonshrink grout, or non-structural flowable backfill is to be placed under hot-weather conditions, the proposed materials and methods shall be submitted for review.

SD-09 Reports

Quality and Gradation of Aggregates; GA-RE

Aggregate quality and gradation tests shall be submitted at least 30 days prior to start of CLSM, nonshrink grout, or non-structural flowable backfill placement.

Tests and Inspections; GA-RE

Test results and inspection reports shall be submitted daily and weekly as required.

SD-13 Certificates

Cementitious Materials; GA-RE

Cementitious Materials, including Portland Cement, nonshrink grout cement, Pozzolan, and Ground Granulated Blast-Furnace (GGBF) Slag will be accepted on the basis of the manufacturer's certification of compliance, accompanied by mill test reports that materials meet the requirements of the specification under which they are furnished. Certification and mill test reports shall be from samples taken from the particular lot furnished. No cementitious materials shall be used until notice of acceptance has been given by the Contracting Officer. Cementitious materials will be subject to check testing from samples obtained at the source, at transfer points, or at the project site, as scheduled by the Contracting Officer, and such sampling will be by or under the supervision of the Government at its expense. Material not meeting specifications shall be promptly removed from the site of work.

Air-Entraining Admixture; GA-RE

Air-Entraining Admixture shall be certified for compliance with all specification requirements.

Other Chemical Admixtures; GA-RE

Other Chemical Admixtures shall be certified for compliance with all specification requirements.

Nonshrink Grout; GA-RE

Descriptive literature of the Nonshrink Grout proposed for use shall be furnished together with a certificate from the manufacturer stating that it is suitable for the application or exposure for which it is being considered.

Aggregates; GA-RE

Aggregates used in CLSM and nonshrink grout shall be tested and evaluated in accordance with the requirements for aggregates specified in SECTION: 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS.

Non-structural flowable backfill; GA-RE

Descriptive literature of the Non-structural flowable backfill proposed for use shall be furnished together with a certificate from the producer stating that it conforms the specified requirements, and is suitable for the application or exposure for which it is being considered. In addition a complete and detailed copy of the state specifications covering flowable backfill shall be furnished.

1.4 DESIGN REQUIREMENTS

1.4.1 CLSM Concrete Strength

Specified compressive strength f'c shall be as follows:
(3,500 psi) @ 28 days.....CLSM
Per ASTM C 1107.....Nonshrink grout

1.4.2 Maximum Water-Cement (W/C) Ratio

Maximum W/C shall be 0.4, by mass.

CLSM shall contain Portland cement in combination with GGBF Slag and Fly Ash. The water-cement ratio shall be determined in accordance with the requirements for concrete proportioning specified in SECTION: 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS.

The W/C ratio may cause higher strengths than that required by paragraph CONCRETE STRENGTH.

1.4.3 Flowable Backfill

Non-structural Flowable backfill design requirements shall conform to State Specifications.

1.5 TOLERANCES

Surface tolerances for CLSM, nonshrink grout, and non-structural flowable backfill placements shall conform to the requirements for concrete specified in SECTION: 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS.

PART 2 PRODUCTS

2.1 MATERIALS

All materials used in the work shall conform to the requirements of SECTION: 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS, except as otherwise specified or approved.

2.1.1 CLSM

Materials used in producing Controlled Low Strength Materials (CLSM), shall conform to the materials requirements for concrete specified in SECTION: 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS. High range reducing admixture and other admixtures proposed for use shall conform to ASTM C 494. Admixture used in producing flowable concrete shall conform to ASTM C 1017. CLSM shall be air entrained, air entraining admixture shall conform to ASTM C 260. CLSM required for filling drain and pipe penetrations where specified shall be formulated to provide a nonshrink concrete. The cement used to produce nonshrink CLSM shall conform to the requirements of ASTM C 1107. (The cement manufacturer's requirements on proportioning, mixing, and placing shall be submitted with the mix design for approval) (The mix design submittal shall include the nonshrink grout cement manufacturer's certification that the cement is suitable for use in this application.)

2.1.2 Nonshrink Grout

Nonshrink grout shall conform to the requirements of ASTM C 1107. Fine aggregate, if used, in nonshrink grout shall conform to the requirements for fine aggregates in SECTION: 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS, except that fine aggregates shall be produced from crushed Burlington limestone.

2.1.3 Flowable backfill

Materials used in producing Non-structural Flowable backfill shall conform to the MISSOURI STANDARD SPECIFICATIONS for HIGHWAY CONSTRUCTION, SECTION 621 FLOWABLE BACKFILL.

2.1.4 Aggregates

Aggregates in the project area have shown to pose a durability concern for concrete mixtures, specifically alkali-silica reactions, Durability "D" cracking, and pop-outs. Aggregates shall be tested and evaluated in accordance with SECTION: 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS.

2.2 MIX DESIGN and PROPORTIONING

CLSM - CLSM mix design and proportioning shall conform to the requirements for concrete mix design specified in SECTION: 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS.

Nonshrink Grout - Nonshrink grout mix design and proportioning shall conform to the grout manufacturer's recommendations.

Non-Structural Flowable Backfill - Non-structural flowable backfill mix design and proportioning shall conform to State Specifications.

2.2.1 Air Content (CLSM)

Air content as delivered to the forms and as determined by ASTM C 231 shall be between 4-1/2 and 7-1/2 percent.

2.2.2 Slump (CLSM)

The slump for CLSM shall be determined in accordance with ASTM C 143 and shall not exceed 8 inches.

PART 3 EXECUTION

3.1 INSTALLATION

CLSM and Nonshrink Grout - CLSM shall be used as backfill material for rolling gates Q1, Q3, R2, and other structural backfilling as specified or indicated on the drawings, or as directed.

Where CLSM concrete mixtures containing coarse aggregate are determined to be impractical for backfilling operations in small pipes and voids, the voids may be filled using nonshrink grout, where specifically approved in writing.

Non-Structural Flowable Backfill - Non-structural flowable backfill conforming to State Specifications may be used in filling other voids as specified, where specifically approved in writing.

3.2 EQUIPMENT AND METHODS

CLSM and Nonshrink Grout - Equipment and methods proposed for use in producing, placing, curing and protection of CLSM and nonshrink grout shall conform to the requirements for concrete and nonshrink grout as specified in SECTION: 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS.

Non-structural Flowable Backfill - Equipment and methods proposed for use in producing, placing, curing and protection of non-structural flowable backfill shall conform to State Specifications, except that equipment used in batching, mixing, transportation, and placing shall meet or exceed ASTM C 94.

3.3 PREPARATION FOR PLACING

CLSM and Nonshrink Grout - Surfaces to receive or otherwise to be in contact with CLSM and nonshrink grout shall conform to the requirements for concrete and nonshrink grout as specified in SECTION: 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS.

Non-structural Flowable Backfill - Surfaces to receive or otherwise to be in contact with non-structural flowable backfill shall conform to State Specifications.

3.4 TESTS AND INSPECTIONS

CLSM and Nonshrink Grout - Tests and inspections of CLSM and nonshrink grout shall conform to the requirements for concrete and nonshrink grout as specified in SECTION: 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS.

Non-structural Flowable Backfill - Tests and inspections of non-structural flowable backfill shall conform to State Specifications.

END OF SECTION

02331

LEVEE CONSTRUCTION AND EARTHWORK
3/02

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing all submittals, labor, equipment, plant, materials, and all efforts necessary to perform levee construction and general earthwork as defined for this project. In regard to earthwork whether it is excavation; handling; placement; work beneath, adjacent, or above a pipe; work beneath, adjacent, or above a structure; or earthwork in general, this section shall govern if there is disagreement with or between specification sections or plan sheets.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced or where the procedure or information is necessary for performance of the work. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 43	(1988; R 1995) Sizes of Aggregate for Road and Bridge Construction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33	(1999) Concrete Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 698	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
ASTM D 1140	(1997) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2216	(1998) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	(1994) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	(1996) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4253	(1993; R 1996) Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D 4254	(1991; R 1996) Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4643	(1993) Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
ASTM D 5195	(1991; R 1996) Density of Soil and Rock In-Place Below the Surface by Nuclear Methods

ENGINEERING MANUALS (EM)

EM 385-1-1	(1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.3 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Shoring, Sheeting, and Bracing; GA.

Submit a detailed shoring, sheeting and bracing plan 10 days prior to the beginning of any excavation so supported. The plan for shoring, sheeting and bracing shall be prepared and certified by licensed professional engineer. The plan shall include drawings and design computations of the proposed shoring, sheeting, and bracing, and documentation, showing details of the coordination and approval of shoring, sheeting, and bracing by the applicable parties. Approval of the detailed plan shall be obtained from the Contracting Officer's Representative (COR) prior to starting the work. If necessary, the plan shall be modified as required to meet field conditions, and the modifications shall be approved prior to use.

Excavation; GA.

Submit a written excavation plan 10 days prior to the beginning of any

excavation. Approval of the detailed plan shall be obtained from the Contracting Officer prior to starting the work. If necessary, the plan shall be modified as required to meet field conditions, and the modifications shall be approved prior to use. As a minimum, the plan shall contain, the following:

a. Proposed methods for preventing interference with, or damage to, existing underground or overhead utility lines, trees designated to remain and other man-made facilities or natural features designated to remain within or adjacent to the construction rights-of-way.

b. Provision for coordinating the work with other Contractors working in the construction rights-of-way or on facilities crossing or adjacent to this work.

c. The proposed methods for controlling surface and ground water in the borrow areas and required excavations.

d. Stockpiling plan for embankment material before it is transported to the project site showing locations, stockpile heights, slopes, limits, and drainage around the stockpile areas.

e. A complete listing of equipment used for excavation and to transport the excavated material.

f. The Contractor's proposed sequence of work for excavating the borrow areas with plan and cross sectional views showing starting and final work locations and clearing, grubbing and stripping limits.

g. The Contractor's proposed road pattern, and plan for implementing dust control measures.

Borrow Areas; GA.

Submit a written statement to the COR not later than 5 days after receipt of Notice to Proceed indicating the Contractor's intention to use the specified Government-furnished borrow area(s), dredged borrow areas, or a combination of these borrow areas.

Plan of Operations; GA.

Fifteen (15) days prior to commencement of haul road construction or placing embankment and backfill which ever is earlier, the contractor shall submit for approval a Plan of Operations for accomplishing all operations and for the location and construction of haul roads, as described in Par. 1.3.2. Approval of the detailed plan shall be obtained from the COR prior to starting the work.

Testing Laboratory; GA.

Approval of testing facilities shall be based on compliance with ASTM E548, and no work requiring testing will be permitted until the facilities have been inspected and approved by the COR.

Embankment and Backfill Materials; GA.

At least 5 days prior to placement of any material, the Contractor shall submit to the COR the results of all required testing necessary to classify

the material and necessary for determining if placement is in compliance with the requirements herein. In the event Missouri River dredge sands are intended as fill, the Contractor shall provide to the COR the results of all required tests necessary to classify the material and necessary for determining if placement is in compliance with the requirements herein within 2 days of the dredge equipment mobilized to the Missouri River.

Nuclear Density Testing Equipment Operator; GA.

Nuclear density testing equipment shall be used in accordance with ASTM D 2922 and ASTM D 3017. In addition, the following condition shall apply:

a. Prior to using the nuclear density testing equipment on the site, the Contractor shall submit to the Contracting Officer a certification that the operator has completed a training course approved by the nuclear density testing equipment manufacturer.

b. The nuclear density testing equipment shall be capable of extending a probe a minimum of 12 inches down into a hole.

SD-09 Reports

Survey Records; GA.

Submit a copy of the records of each compliance survey the next work day following the survey.

SD-18 Records

Test Results; GA.

Test results shall be furnished the COR within 24 hours of making the test.

SD-13 Certificates

Inspection and Test Results,; GA-RE.

Inspections and test results shall be certified by a registered Professional Civil Engineer. 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.

1.4 ACCESS, HAUL ROADS, ROUTING, AND STAGING

The Contractor shall refer to Section, "Special Scheduling" for construction site access and staging limits. In general and as a minimum, the Contractor shall be required to maintain the access, haul roads (permanent and temporary), routing, and staging areas to prevent dust, rutting, interference with normal traffic flow, litter, and general damage or deterioration. Where a new or existing levee needs to be traveresed, the Contractor is referred to Section, "Special Scheduling", Paragraphs, "Existing Levee" and "Tie-Back Levees". If levee breaching is not approved, then the Contractor shall construct ramps over the levee as

necessary such that the levee section is maintained and not reduced.

1.4.1 Temporary Haul Roads

Temporary haul roads shall be limited to within the project right-of-way as shown on the plans. The Contractor shall include as part of the general plan of operations submittal, the layout and sequencing of the temporary haul roads. Temporary haul roads shall be detailed and constructed according to intended use and shall be maintained in good condition throughout the duration of the construction contract or until the point of construction where the use is no longer required. Temporary haul roads shall not hinder surface run-off or ditch, stream, or river discharges. At the completion of the temporary haul road use, the haul road shall be removed and the area restored to its preconstruction condition or its intended construction condition as required by this construction contract. Temporary haul roads shall not be considered a separate pay item.

1.4.2 Permanent Roads Used as Haul Roads

Permanent roads used as haul roads shall be maintained throughout the duration of use and shall be restored to the pre-construction condition or the intended construction condition.

1.5 MAPPING AND FIELD SURVEYS

Topographic mapping is as indicated on the plan sheets. The Contractor is directed to Plan Sheet C-1B for mapping standards by area. Field surveys shall be completed as necessary and shall use the vertical and horizontal control identified within these construction documents.

1.5.1 Layout of Work

The Contractor shall lay out the work as indicated within these construction documents.

1.5.2 Surveys for Quantities

The Contractor shall complete surveys for the purpose of quantifying placed material or excavated materials per the pay items. Surveys shall also be completed to verify complete work to the lines, grades, and requirements specified. Levee overbuilds have been included for anticipated settlement. The Contractor shall plan operations to complete the surveys prior to settlement occurring to the degree of impacting survey results. The survey layout shall be as approved by the COR. Quantities shall be calculated per the average end area method. If the Contractor elects to utilize settlement devices to supplement field surveys, the Contractor shall provide a detailed submittal for COR review, comment, approval, and/or disapproval and shall address the technique, layout, detail drawings, the sequence of effort. There will be no payment for settlement devices.

1.5.3 Surveys for Hillside Borrow Operations

In the event the Contractor elects to use hillside borrow, the Contractor shall complete field surveys satisfactorily to allow quantification of excavated hillside. All breaks and site features shall be surveyed. Following the initial surveys, field surveys shall be completed at the end of each month that borrow occurs to provide intermediate quantities. Prior to conducting a field survey, the Contractor shall provide seven working days notice to the COR. Surveys may be witnessed by the property owner,

levee sponsor, and COR. Survey procedure and layout shall be coordinated and agreed to by the COR.

1.6 SOURCES OF FILL MATERIAL

1.6.1 Material Source Usage

A detailed plan of operations shall be submitted for COR review and approval addressing all aspects of material sources to include borrow operations, dredging, and required excavations. Material sources usage shall be planned to optimize available material types and ensure sufficient material for each of the defined fill zones. Proposed material usage and distribution shall be included within the plan of operations' submittal. Borrow activities shall not begin until the submittal has been approved by the COR. In general, sources of fill material have been identified for this project and include required excavations, foreshore borrow areas, hillside borrow area, and the Missouri River sands. Required excavation, foreshore borrow areas, and hillside borrow area are sources of impervious fill. The same material sources may serve as sources of random material but should be considered on a limited basis to supplement other random sources such as the Missouri River sands and as needed when materials encountered do not classify as impervious material. If the Contractor elects to use impervious classified material for random fill, the Contractor shall supplement as necessary additional impervious material necessary to meet the impervious fill zone quantity. The cost associated with supplementing impervious material shall be at no expense to the Government. The Contractor shall use the required excavation for fill with the exception of unacceptable material. In addition, the Contractor will be limited on the quantity of hillside material obtained for this construction. If the Contractor does not fully utilize all the available sources of fill material such that there is insufficient quantity for construction, the Contractor shall be responsible for supplementing material types. Material types supplmented by the Contractor shall be review and approved by the COR prior to use. The Contractor is referred below to the Paragraph, "Alternate Material Sources Proposed by the Contractor".

1.6.2

(Paragraph 1.6.2, Mixing of Materials eliminated)

1.6.3 Alternate Material Sources Proposed by the Contractor

The Contractor may submit for review and approval to the COR alternate material sources to supplement fill from required excavations and partial borrow or dredge operations of the identified material sources. The COR will make the final determination on approval of alternate borrow sources or sources. If the Contractor elects to submit an alternate material source or sources, the Contractor shall first coordinate with the COR to obtain Contractor requirements for addressing within the submittal the engineering properties, scheduling of work, impacts to the levee, proximity to the levee, environmental regulations, and cultural regulations. An incomplete material source submittal will be grounds for disapproval. If the initial submittal is disapproved, the Contractor shall not submit additional alternate material sources and shall utilize sources of fill identified within these construction documents. The Contractor may elect to obtain processed material, such as drainage material, and will be considered acceptable subject to meeting the requirements of the

construction documents.

1.6.4 Pervious Material Restrictions

In general, requirements for acquisition, handling, and placement of pervious material shall be as required within the construction documents. The Missouri River sands have been identified as a source of pervious material. Section, "Dredging Operations" applies only if the Contractor utilizes hydraulic pipeline dredge operations with placement at the point of discharge. If the Contractor elects to stockpile pervious material, use a different source of pervious material, and/or use a different dredge procedure such as mechanical dredge, the Contractor shall comply with the requirements for pervious material herein this section.

1.6.4.1 Alternate to Hydraulic Pipeline Dredge

If a method other than hydraulic pipeline dredge is proposed to be used to obtain sand from the Missouri River (such as mechanical dredge), then the Contractor shall prepare a detailed submittal for COR review, comment, and approval or disapproval. As a minimum the submittal shall include or address qualifications of the company and supervisor to perform the work; proposed equipment and layout; sequence of operations; placement of material; erosion protection; protection of other work; schedule; avoidance and protection of utilities, infrastructure, and navigation structures; avoidance of and coordination with other operations on the river and land associated with both this contract and other activities. Requirements for acquisition, monitoring, surveying, and river limits of Section, "Dredging Operations" shall apply to alternate Missouri River sand acquisition methods and shall be addressed within the submittal. Placement of pervious material shall be as required herein this section for pervious material.

1.6.4.2 Pervious Material Stockpiled or Not Placed at the Point of Discharge

Pervious material stockpiled for later use or not placed in the fill zone at the point of discharge from hydraulic pipeline dredge operations, shall be placed as required herein this section for pervious material.

1.6.5 Variability of Borrow and Required Excavation Properties

A plan shall be submitted to the COR for review and approval outlining borrow and required excavation extraction and placement within the appropriate fill zones. As a minimum the plan shall address excavation sequence; excavation during unfavorable seasons; segregation and protection of material types; adjustment of moisture content; additives to alter moisture content; efforts to minimize loss of available fill material; and measures to protect the available borrow and required excavation throughout the fill material extraction process. The Contractor shall review all available soils' information to develop an appreciation of the soil properties and the need for efforts to adjust soil properties to meet placement and compaction requirements. Of special concern are the moisture contents and the Contractor's proposed procedure for adjusting the moisture contents to an acceptable level while not wasting the available fill. The Contractor shall also be prepared to segregate material types, protect the various material types as necessary, and place within the appropriate fill zones. Provisions for adjusting soil properties are further addressed in Part 3, "Execution" of this section.

1.6.6 Required Excavation

Required excavation to be used for fill within the applicable fill zones includes the existing levee that is not within the random zone and/or landside berm of the new levee; the depth of 1 foot to 2.5 feet within the foreshore borrow areas; and excess material from the inspection trench.

1.6.7 Hillside Borrow

The hillside borrow is comprised of loess and is located in Riverside, Missouri at Northwood Road and Missouri State Highway 9. The Contractor will be limited to acquiring no more than 100,000 in place required density cubic yards. The material shall be obtained from the southernmost ridge of the 3 available ridges. This source of fill, up to the 100,000 in place required density cubic yards, will be provided to the Contractor without assessment of a royality fee.

1.7 SUBSURFACE INFORMATION

1.7.1 Available Subsurface Information

Striplogs with select soil laboratory test results are included within the construction plans along with the, "Legend of Logs of Borings". Complete drill and sample logs and laboratory test results may be examined at the Kansas City District Federal Building, Kansas City, Missouri by coordinating with the COR. A minimum of two days advance notice for scheduling purposes shall be provided to the COR.

1.7.1.1 Use of Subsurface Information

Drill, sample, and test results are an indication of the subsurface condition at the location of the boring and tests. Variations in subsurface condition may exist between boring and test locations. Soil moisture contents and groundwater levels are indication of that information at the time of the measurement, sample extraction, and/or testing. Soil moisture content and groundwater level may vary with time in response to seasonal precipitation and river stage variations. As a result, moisture contents and groundwater levels at the time of construction may differ from the data shown on the drawings.

1.8 SAMPLES FURNISHED TO THE GOVERNMENT

Upon request from the COR and within 4 hours of the COR request, the Contractor shall furnish samples from material sources, placed fill, ongoing construction, and/or completed construction. The specifics of sample acquisition to include method, conditions, quantity, container, and other requirements will be specified by the COR. Contractor shall perform this service at no cost to the Government.

1.9 EXISTING LEVEE

The Contractor is directed to Section, "Special Scheduling" for existing levee requirements. The existing levee shall not be stripped of vegetation until it is excavated or incorporated within the construction.

1.10 DRAINAGE AND DEWATERING

1.10.1 Surficial and Pipe Drainage

The Contractor shall address in their general plan of operations the methods of drainage control. The Contractor shall maintain natural

drainage patterns and/or designed drainage patterns. Temporary work, such as haul roads, shall be designed and constructed so as not to induce adverse flooding or backwater from general run-off and pipe, ditch, stream, or river discharge. The Contractor shall complete necessary efforts to divert run-off and pipe, ditch, stream, or river discharge away from excavations, fill areas, and general construction. The Contractor shall monitor and make adjustments as necessary.

1.10.2 Dewatering

Where excavation dewatering is necessary, the Contrator shall submit the dewatering plan for COR review that will include as minimum the dewatering design and the dewatering system layout.

1.11 PROTECTION OF EXISTING FEATURES AND ONGOING OR COMPLETED CONSTRUCTION

The Contractor shall plan and conduct operations to ensure the protection of existing features and ongoing and completed construction. Damages occurring during the course of this construction contract as a result of the Contractor's actions or negligence shall be repaired by the Contractor at no expense to the Government. Analyses, designs, details associated with the repairs shall be prepared by an approved design firm at no expense to the Government. The Contractor shall submit the designs for COR review and shall not begin work until the design has been approved. In some cases the repair may require an upgrade. If the upgrade is at the request of the Government, then the Contractor shall be responsible for the expense of the design in its entirety including the upgraded features. However, the Government will provide an equitable adjustment in cost to cover the expense of the construction associated with the upgrade.

1.11.1 Notification and Coordination

When work is to be completed on an existing feature, adjacent to an existing feature, or any time work is planned that may impact an existing feature or an area activity, the Contractor shall be responsible for coordinating with impacted parties to prevent complications with disrupting service or activity.

1.11.2 Ongoing and Completed Construction

In general, the Contractor shall complete the necessary efforts to protect ongoing and completed construction. Earth fill and exposed cuts shall be protected from construction activity and general erosion. Damages occurring shall be repaired by the Contractor at not expense to the Government. The Contractor shall be responsible for protecting against general erosion and repair thereof until the cover has been placed and in the instance of vegetative cover, until the vegetation has established to the point that erosion cannot occur.

1.11.3 Public Roads, Accesses, and Appurtenances

The Contractor shall plan and complete the necessary efforts to protect public roads, accesses, and appurtenances from damages associated with this construction project. The Contractor is directed to Clause 60, "Permits and Responsibilities" of the "Construction Contract Clauses". Contractor's activities shall not deter public use of the roads, accesses, and appurtenances. At locations where public roads, accesses, and/or appurtenances are damaged or destroyed because of the work required under this contract, the Contractor shall provide temporary facilities until a

permanent repair can be completed and the construction operations adjusted to prevent further damage. Temporary facilities shall be removed by the Contractor when the permanent repair is complete. Load limits on the existing roads and bridges shall be coordinated with the Department of Transportation or appropriate governing entity, and the Contractor shall comply with the load limits or complete approved modifications to allow for increased loads.

1.11.4 Environmental and Cultural

The Contractor is referred to and shall comply with the requirements of Section 01354, "Environmental Protection for Civil Works".

1.11.5 Blasting and Explosives' Storage

Blasting shall not be allowed for this construction project. Explosiives shall not be stored on site for any reason or for any length of time.

1.11.6 Impacts Outside Construction Right of Way

Contractor's work directly or indirectly impacting property not included within the project's construction right of way limits, shall be coordinated with the COR, and proof of Contractor acquired right of way or easements of the impacted real estate or facility shall be provided to the COR 30 days prior to impacting the real estate or facility. Right of way and easement acquisition shall be in accordance with Government practices as directed by the COR.

1.12 PERMITS

For the work within this construction contract the Contractor shall be responsible for coordinating and obtaining all permits required by Federal, state, and local entities other than those identified as already obtained by the Government. The Contractor is referred to Section, "Contstruction Contract Clauses", Paragraph, "Permits and Responsibilities" and to Section, "Special Scheduling", Paragraph, "Permits".

1.13

(Paragraph 1.13, Measurement and Payment elimnated)

PART 2 PRODUCTS

2.1 FILL MATERIALS

In general satisfactory materials for the respective fill zones shall consist of those material types defined hereinafter. Random material for the landward berms shall be further defined as material as pervious or more pervious than the soil it is being placed upon. Stabilizing agents, when approved by the COR, shall be considered acceptable material only for the purpose as approved by the COR. Material types defined hereinafter shall be placed in the appropriate fill zones as indicated on the plan sheets and herein these specifications. Unsatisfactory materials for the respective fill zones that do not meet the material types'requirements as defined shall be disposed offsite by the Contractor.

2.1.1 Impervious Material

Impervious material shall consist of fine-grained materials of low

permeability consisting of clays, silty clays, and/or silts. Impervious material shall be free of crushed rock, debris, plant growth, roots, and humus. The particle size of impervious material shall shall be such that a minimum of 50 percent of the soil particles pass a U.S. Standard No. 200 sieve. Acceptable impervious material will be CL, CH, and/or ML as classified in accordance with ASTM D 2487.

2.1.2 Pervious Material

Pervious material shall consist of free draining sand, gravely sand, sandy gravel, and/or gravel. Pervious material shall be sound durable particles and shall be free of plant growth, roots, humus, debris, and deleterious substances. The particle size of pervious material shall be such that not more than 5 percent of the materials pass the U.S. Standard No. 200 sieve as determined with a washed gradation test. Acceptable pervious material will be SW, SP, GW, and/or GP as classified in accordance with ASTM D 2487.

2.1.3 Drainage Material

Drainage material to facilitate seepage adjacent pipes and structures shall consist of free draining fine to medium sand. Drainage material shall be sound durable particles and shall be free of plant growth, roots, humus, debris, and deleterious substances. The particle size shall be such that 100 percent of the materials passes the U.S. Standard No. 10 sieve and not more than 5 percent of the materials pass the U.S. Standard No. 200 sieve as determined with a washed gradation test. Acceptable pervious material is SP as classified in accordance with ASTM D 2487.

2.1.4 Random Material

Random material shall consist of, as defined hereinbefore, impervious material, pervious material, drainage material, or any combination thereof.

2.1.5 Topsoil Material

In general, topsoil material shall be material organic in nature and capable of sustaining the specified vegetative growth. Topsoil material shall be the material stripped in preparation of the fill, excavation, or general construction. Stripped material is addressed within Section 02102, "Clearing, Grubbing, and Stripping". Topsoil from offsite sources, proposed by the Contractor and approved by the COR, shall be supplemented as necessary when there is insufficient acceptable on-site sources. Topsoil material shall be free from clay lumps, weeds, litter, brush, matted roots, toxic substances, or any material harmful to plant growth or which would hinder grading, planting, operation, or maintenance operations. Topsoil material shall not contain more than 5 percent by volume of stones or other such objects larger than 1 inch in any dimension. Topsoil material shall be such that a minimum of 50 percent of the soil particles pass a U.S. Standard No. 200 sieve.

2.1.6 Aggregate Surfacing

Aggregate surfacing shall conform to Section, "Aggregate Surface Course".

2.1.7 Riprap

Riprap shall conform to Section, "Stone Protection".

2.1.7 Bedding

Bedding shall conform to Section, "Stone Protection".

PART 3 EXECUTION

3.1 GENERAL

All work shall be in compliance with the requirements of the construction documents including approved submittals.

3.1.1 Dewatering and Run-off Control

Where dewatering and/or run-off control is necessary, the Contractor shall submit all design and plans for COR review. Surface and groundwater control shall be accomplished as necessary in coordination with the required excavation and embankment construction. Run-off control shall also include control of discharges from pipes either currently discharging or discharging as a result of being severed. Surface water and/or groundwater control may necessitate the use of temporary diversion ditches, cofferdams, and/or pumping from wells, well points, and/or sumps.

3.1.2 SHORING, SHEETING, AND BRACING

Where excavation or fill support is necessary to support earth, protect adjacent features, or maintain worker safety, the support system shall be designed in accordance with Federal levee criteria and submitted for COR approval. Reference Section, "Special Scheduling" for Federal levee criteria. Design shall be completed by a registered professional engineer with experience in this kind of work. In addition to Federal levee criteria, the design shall be in compliance with EM 385-1-1. Shoring, sheeting and bracing shall not be used in lieu of the required excavation slopes where there is sufficient space for cut back slopes. The design and submittal shall also address removal of the excavation or fill support. All shoring, sheeting and bracing shall be removed as embankment and backfill operations progress and the void filled by a COR approved method.

3.1.3 Q2 StopLog Gap

Q2 stoplog gap shall be constructed per the requirements of the construction documents. Earthwork associated with construction of Q2 stoplog gap shall be in accordance with the requirements herein this section. In general and except where fill requirements are noted on the drawings that preclude the use of the excavated material for backfill, selective excavation and backfill may be practiced such that the pre-construction soil stratification is maintained during backfill. Excavation shall selectively excavate, stockpile, and protect soil by material type. Backfill shall maintain the pre-excavation stratification, and compaction shall comply with the requirements for the fill type being placed. Soil placed as fill above the pre-construction ground surface shall be in compliance with levee and berm fill. Compaction shall be as required for the material type and fill zone.

3.1.4 Sanitary Lagoon

The Contractor is directed to the requirements of Section, "Special Scheduling", plan sheets, and herein this section for the Intercontinental Engineering-Manufacturing Corporation sanitary lagoon disposition and preparation for earthwork.

3.1.5 Free Board Gages

Free board gages shall be constructed per the schedule and to the details included within the plan sheets. Earthwork shall follow the detail and note requirements on the plan sheets.

3.2 BORROW OPERATIONS

Sources of fill material as pertains to borrow operations are identified in Part 1, "General" of this Section. Excavation for borrow operations shall not be considered a separate pay item. Borrow operations shall be completed to the lines, grades, and requirements in accordance with the construction documents and approved submittals. Approved submittals shall be altered as necessary to meet conditions encountered on site as the work progresses. Submittal changes shall first be approved by the COR prior to implementing the changes. Excavation shall not occur until utilities have been located.

3.2.1 Foreshore Borrow Areas

Foreshore borrow areas identified within the drawings and located between the Missouri River and the new levee have been set aside as a source of impervious material for this construction. Material types encountered other than impervious material shall be placed in the appropriate fill zone.

3.2.1.1 Layout of Borrow Areas

Borrow Areas' horizontal limits shall be in accordance with coordinates indicated on the plans. Layout shall maximize the available acreage. Field adjustments of the horizontal limits shall be completed as necessary to meet the following requirements:

1. Maintain a minimum of 300 feet from the new levee centerline.
2. Maintain a minimum of 125 feet landward of the Missouri River bank. When in question, the river bank shall be determined by the COR.
3. Ensure no encroachment into the tree line adjacent the Missouri River bank. Borrow activities shall maintain a minimum of 20 feet between the excavation and the tree line. Discharge ditches shall be located to minimize impact to the tree line.
4. Maintain a minimum of 100 feet of undisturbed traverse between borrow areas.
5. Maintain a minimum of 50 feet from an utility.

3.2.1.2 Lower Limit of Borrow Area Excavation

As a minimum, the Contractor shall excavate the borrow areas to the required depth as stated within the requirements of required excavation. Material types encountered throughout the required depth shall be used in the appropriate fill zones. Excavation may occur deeper than the required excavation depth subject to the availability of impervious material and the limitations stated hereinafter. The Contractor shall excavate test pits to supplement subsurface information included on the plan sheets. A minimum of two test pits shall be excavated within each borrow bay at Contractor proposed and COR approved locations. The Contractor shall maintain a minimum of 2 feet of undisturbed impervious material below the required excavation depth. If impervious material is not found below or if there is less than 2 feet of impervious material remaining below the required excavation depth, then the required excavation depth shall be the lower limit of the borrow area bay excavation. In addition, the borrow bays

shall not be excavated below a depth established at 5 feet above the Construction Reference Plane (CRP). The following are approximate CRP elevations for a specific river mile (river miles are shown on drawings C-86 through C-88) and additional information on CRP elevations may be obtained by requesting of the COR access to Missouri River Hydrographic Survey:

River Mile	CRP Elevation
371	725.8
372	726.9
373	727.9
374	728.9
375	729.9
376	730.9

3.2.1.3 Drainage of Borrow Areas

The Contractor shall be responsible for drainage of borrow areas. Drainage ditches shall be constructed as shown on the plan sheets for the selected borrow areas. Drainage ditch alignment shall be adjusted as necessary to avoid or minimize damage or removal of trees. The Contractor shall propose a method of draining all borrow area. Drainage ditches shall have a 4 feet wide base and 1 vertical on 3 horizontal laid back cut slopes. At the completion of borrow activities, the ditches shall be filled to an elevation 2 feet higher than the highest point within the respective borrow bay.

3.2.2 Hillside Borrow

For the most part, hillside borrow has been cleared, grubbed, and stripped. The Contractor may have to complete some minor stripping prior to excavation of material. Excavation shall be completed such that the entire south ridge surface area is excavated maintaining a relatively flat surface with only a slight slope for drainage. Drainage shall be in the direction of natural slope and where erosion structures are in place. Existing erosion structures shall be maintained by the Contractor and any necessary additional erosion structures shall be be constructed and maintained by the Contractor. At the completion of borrow excavation, the site shall be left in a stable state with all necessary erosion structures left in-place. Re-seeding of the hillside borrow is not a part of this contract.

3.2.3 Clearing, Grubbing, Stripping of Borrow Areas

Clearing, grubbing, and stripping for borrow areas shall be in accordance with the Section, "Clearing, Grubbing, and Stripping". The Contractor is directed to the paragraph referencing stripping of borrow areas and use as topsoil.

3.2.4 Variability of Borrow and Required Excavation Material Properties

The Contractor shall review all available soil information to develop an appreciation of the material variablity and the necessity to adjust soil properties especially with respect to the material types and high moisture contents. Variable material types shall require classification, segregation, stockpile, and placement within the appropriate fill zone. High moisture contents shall require the Contractor to complete efforts to adjust the moisture contents to within an accepatable range. In addition, the hillside borrow area is a loess material and will be sensitive to wetting. Compaction curves for the loess may demonstrate a narrow band to

achieve compaction and therefore necessitating the need for tight moisture control requirements. The Contractor shall submit a detailed plan to the COR for review of how the observations identified above as well as other issues associated with material acquisition and placement will be addressed during construction. The plan shall propose procedures that minimize wasting of material.

3.2.4.1 Moisture Content Adjustment--General

The Contractor shall develop a plan for adjusting moisture contents of the available fill material to achieve the proper placement and compaction. Pervious material shall be 100 percent saturated during placement and compaction. Moisture contents for impervious material may require air drying or additives for moisture content reduction or sprinkling and mixing to increase the moisture content. Contractor may propose alternative methods to adjust moisture contents. The submittal shall include in detail the planned procedures. Adjustement of moisture content shall not be an added expense to the Government.

3.2.4.2 Moisture Content Adjustment--Air Dry

The Contractor may reduce the moisture content by staging operations to allow spreading of material and disking the soil to expose it to air and sun. The submittal shall address such tasks as efforts to acquire the wet material from the borrow area, borrow sequencing, location of spreading, procedure to avoid crusting of the spread soil or exposed borrow, plan to avoid introduction of moisture from rainfall, continuous aeration, seasonal complications, and transfer of material to the fill zone. The submittal shall also address in detail staging, equipment, and anticipated results. The excavation of wet material from borrow areas shall be limited to those techniques that do not create an adverse condition in the borrow area, such as would be the case if equipment became bogged down within the borrow area or if the borrow area condition between successive excavations did not promote surface runoff.

3.2.4.3 Moisture Content Adjustment--Admixtures

The Contractor may reduce the moisure content by mixing additives within the wet soil. The submittal shall address in detail as a minimum the procedure, equipment, mixture, and case studies where used before (under similar circumstances). Applicable requirements considered within the air dry option shall also be included within this submittal. The use of fly ash or other drying agents, approved by the COR, may be proposed by the Contractor. The submittal shall also include moisture-density curves developed for the material types and admixture percentage. The moisture-density curve for the fill with the admixture (drying agent) shall be used to establish the maximum dry density and optimum moisture content for the fill type with the drying agent incorporated. Adjustments in the drying agent will constitute a different fill material type and will be subjected to the rquired testing.

3.2.5 Frozen Material

Frozen material shall be considered unacceptable for borrow material. Frozen material shall either be removed and used at a later date when thawed and the moisture content sufficiently adjusted or shall be thawed and the moisture content adjusted to within the acceptable range prior to use as fill.

3.3 MISSOURI RIVER OPERATIONS

The Contractor has the option of obtaining pervious material from the Missouri River. If the Contractor elects to obtain pervious material from the Missouri River, the work shall conform to Section, "Dredging Operations" and the requirements herein this section. The Contractor is directed to Part 1, "General" of this Section if the Contractor elects to use a means other than hydraulic pipeline dredge.

3.4 EXCAVATION OPERATIONS

Excavation shall consist of removal to the lines and grades shown on the plan sheets and as directed herein and the handling to include stockpiling, loading, hauling, and/or placement as required. Exacavations shall be maintained free of debris of any sort or deposited material. Excavations shall be protected from surface runoff. Excavation drainage and dewatering shall be coordinated as required by these construction documents to include approved submittals. Excavation shall not be initiated until utilities have been cleared.

3.4.1 Clearing, Grubbing, and Stripping

Clearing, grubbing, and stripping shall conform to Section, "Clearing, Grubbing, and Stripping".

3.4.2 Required Excavations

Material from required excavation available for fill shall be placed and compacted within the appropriate fill zone per the requirements for placement. The use of the existing levee is addressed within Section, "Special Scheduling".

3.4.3 Inspection Trench

The inspection trench shown within the plan sheets is a required excavation. The inspection trench shall be required throughout the length of the levee and shall be excavated to the lines and grades shown on the drawings. Prior to beginning work, the Contractor shall submit a plan of operations addressing trench excavation layout, staged limits, sequencing, methods of maintaining a dry excavation, and backfill operations. A coordination plan for other operations such as dredging, layout of utility and other subsurface features' locations, procedures for excavating, discovering, and documenting unknown utilities or subsurface features, and segregation of excavation and backfill plan shall be included. Work shall not begin until the plan of operations has been approved by the Contracting Officer. The inspection trench shall be excavated in such a fashion as to prevent damage to utilities and other subsurface features. Excavated materials shall be selectively separated by material classification and protected. Once the inspection trench has been inspected by the Contractor and the Contracting Officer, it shall be backfilled with impervious material in accordance with the requirements herein. Material excavated that is not classified as impervious shall be utilized in construction within the appropriate zone. Excavated materials and items that are unacceptable for re-use on this project shall be the responsibility of the Contractor and removed from the site.

3.4.4 Excavation for Structures and Pipes

Excavations for structures shall conform to the dimensions and elevations

indicated for each structure and footing, except as specified hereinafter, and shall include trenching for utility and foundation drainage systems. Excavations for structures shall conform to SECTION 02316: "EXCAVATION, TRENCHING, BACKFILLING FOR UTILITIES SYSTEMS, AND STRUCTURES". Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Satisfactory material removed below the depths indicated without specific direction of the Contracting Officer shall be replaced at no additional cost to the Government and filled in accordance with the requirements herein. Over excavation below required invert elevations or bottoms of footings shall be backfilled with satisfactory material compacted to the density of the surrounding undisturbed material at no additional cost to the Government. No footings shall be constructed on unsatisfactory material as determined by the COR. Excessively wet and/or soft material in subgrades resulting from water ponding in footing excavations shall be removed and replaced with satisfactory material compacted to the density of the surrounding undisturbed material.

3.4.5 Excavations for Relocations

In general excavations for relocations shall conform to Sections, "Excavation, Trenching, Backfilling for Utilities Systems, And Structures" and "Special Scheduluing" and as required herein these specifications and plan sheets. Pipe placement shall be completed such that the fill is placed to an elevation and then shaped for the pipe diameter such that 60% of the horizontal pipe diameter is bedded into the shaped fill. The practice may be labor intensive especially when occurring in impervious materials. The Contractor shall demonstrate satisfactory completion. Shaped fill and pipe placement shall be inspected by the COR prior to continued backfill operations. Additional shaping shall be required where irregularities occur such as pipe joints and connections. The sanitary lagoon at Intercontinental Engineering-Manufacturing Corporation shall be leveled in-place after satisfactorily removal and disposal of its contents per the requirements of these construction documents. The leveling of the lagoon shall be completed so as to eliminate ponding capbility and to promote drainage away from the levee.

3.4.6 Excavation for Bedding and Riprap

Excavations for bedding and riprap shall be completed to the layout, lines, and grades shown in the plan sheets.

3.4.7 Excavation for Ditching

Excavation for drainage ditches shall be to the layout, lines, and grades shown in the plan sheets or as directed herein.

3.4.8 Excavation Slopes and Surcharges

Excavation slopes shall be to the grades shown on the plan sheets or as directed herein. Under no circumstances, temporary or permanent, shall the slopes be steeper than the slopes required. Some excavations shall require the Contractor to construct a bench within the slope. The Contractor shall not surcharge the excavation with excavated or stockpiled material, construction equipment, or general loading. Slides or other adverse consequences caused by failure of the Contractor to comply or in general perform operations in a reasonable manner shall be considered the responsibility of the Contractor and repaired by the Contractor as approved by the COR at no additional expense to the Government. If the slide or

other adverse consequence is due to no fault of the Contractor, the repair shall be completed as approved by the COR and an equitable adjustment in the contract price will be made for the repair in accordance with the Construction Contract Clause, "Changes".

3.4.9 Over Excavations

3.4.9.1 Over Excavations Outside the Limits of the Levee and Berm Foundation

Over excavation outside the limits of the foundation of the levee and/or berm (or structure or pipe within the levee alignment) shall be backfilled to grade with similar materials or a COR approved alternate material and compacted to a density of at least that of the surrounding undisturbed material or if an alternate material is approved, to the density required for that material type.

3.4.9.2 Over Excavations Within the Limits of the Levee and Berm Foundation

Over excavation within the limits of the foundation of the levee and/or berm (or structure or pipe within the levee alignment) shall be backfilled to grade with impervious material in accordance with the compaction requirements herein.

3.4.10 Excavation Tolerances

A tolerance of 6 inches above or below the prescribed grade will be allowed in the excavation for ditches, inspection trenches, excavations for bedding and riprap. Excavation tolerances shall not be allowed where excavation is for a structure or pipe.

3.4.11 Stockpiles for Excavated Material

Where excavated material is to be used for fill of the construction of this project, the Contractor shall either place and compact as the material is being excavated or stockpile the material until ready for use. Stockpiled material shall be placed such that any part of the stockpile is no closer to the excavation than a distance equal to the depth of the excavation. Stockpiled material placed the minimum distance from the excavation shall not be higher than the adjacent excavation depth and shall maintain the slope of the excavation. The slope of stockpiled material placed a stable distance from the excavation as approved by the COR shall be no steeper than that what is allowed in the EM 385-1-1. Stockpiles shall be protected from contamination of differing materials, natural occurrences, and general construction activities.

3.5 FILL OPERATIONS

In general, fill operations shall conform to the requirements herein these construction documents and approved submittals. The methodology shall primarily be a procedural specification with specific material properties maintained within a specified range or limit. However, specified testing shall be required to verify the specified ranges or limits are met and to verify adequacy of the procedure. If the specified ranges and limits are met and the procedure doesn't deliver the defined compaction results, then an adjustment in the procedure may be specified and an equitable adjustment made in the price to the Contractor or in lieu of this, the COR may adjust the compaction values. If the specified ranges and limits and/or procedure are not met, then the Contractor shall adjust the operations for compliance and the fill reworked at no additional cost to the Government.

3.5.1 Limits of Fill Operations

Fill shall be placed to the lines and grades and within the appropriate fill zone as indicated within the plans and as stated herein this section. Only approved materials as defined herein shall be placed in the appropriate fill zones. Topsoil shall be placed within the fill lines indicated on the plan sheets per the requirements herein. Unsatisfactory materials shall be the responsibility of the Contractor for disposition. The Contractor shall place fill in such a manner as to prevent mixing of material types especially at the fill zones' interfaces.

3.5.2 Surface Preparation for Fill Placement

Clearing, grubbing, stripping, and/or general excavation shall be completed as required prior to any fill operations. Fill shall not be placed on the embankment foundation until the area to receive the fill has been inspected and approved by the COR. Surfaces subjected to fill to include prepared ground surface and the previous placed lift shall be thoroughly scarified to a depth of 3 inches. Scarified surfaces compacted prior to placement of the subsequent lift shall be re-scarified. Fill shall be placed in layers and compacted in accordance with the provisions for the specific material type required herein. Where necessary the moisture content shall be adjusted for the scarified soil or the fill to be placed. Surfaces shall be graded to drain.

3.5.2.1 Proof Rolling and Grubbed Areas

Once a site is cleared, grubbed, stripped, and/or excavated, the site shall be proof rolled to locate loose, saturated, or soft zones. Loose and soft zones shall be removed and disposed. Cuts such as grubbed areas or topography that is abrupt with steepened sides shall be excavated to flatten the steepened sides. Surfaces subjected to fill shall be thoroughly scarified prior to placing fill.

3.5.2.2 Removal of Unsatisfactory Materials

Prior to placement of fill, materials within the surface to receive fill that do not meet the material requirements as specified herein or have been subjected to conditions such as saturating rain or freeze conditions, shall be removed prior to placement of fill.

3.5.2.3 Benching

When fill is to be placed against an embankment such as the existing levee or placed fill, the Contractor shall bench into the embankment to facilitate fill placement. The vertical face of the bench shall be approximately the compacted lift thickness of the adjacent fill.

3.5.2.4 Sanitary Lagoon

The sanitary lagoon located within Intercontinental Engineering-Manufacturing Corporation shall be eliminated and the area it occupies shall be subjected to the fill limits indicated on the plans. Section, "Special Scheduling" addresses removal of the contents. Once the contents have been satisfactorily removed, the lagoon remnants shall be leveled and graded to drain prior to placement of the levee embankment and berm. Once the lagoon is leveled, it shall be slightly sloped to drain away from the levee. Material disturbed as part of the leveling process

shall be placed and compacted in accordance with the requirements herein for the material encountered.

3.5.3 Placement of Fill

In general, placement of fill shall be in accordance with the requirements of the specifications and to the lines and grades shown on the drawings. Where vegetative cover is scheduled, topsoil shall be placed within the limits of the lines and grades of the plan sheets but not to exceed the specified topsoil fill thickness indicated hereinafter. The Contractor shall note zone call outs in the drawings for specific material types and shall have topsoil within the finish fill lines where vegetative cover is scheduled.

3.5.3.1 LEVEE RANDOM FILL VARIATION

In general, when varying approved material types are placed within a levee embankment fill zone, the fill shall be placed as a spectrum with the least pervious at the riverward extent of the fill zone and the most pervious at the landward extent of the fill zone. Placement practices throughout each fill zone of the levee shall be such that the embankment will be free from lenses, pockets, streaks, and layers of material differing substantially in texture, gradation, or classification from surrounding material of the same material type. If within the same material type lenses, pockets, streaks, or layers are encountered, the Contractor shall spread and mix the materials by a COR approved method in order to form a blend of the materials.

3.5.3.2 Fill Tolerances

Fill areas shall be constructed to the grades, lines, and cross sections shown on the plan sheets and as directed herein. At all points, a tolerance of 4 inches above or below the prescribed fill elevation will be permitted provided the grade prevents ponding on the embankment or fill and there are no humps, depressions, or abrupt changes in grade other than those indicated in the plan sheet details. Fill tolerances shall not be allowed where fill is required to support a structure or pipe.

3.5.3.3 Impervious Material

Impervious material to be placed in an impervious fill zone shall be placed and spread in a layer not more than an 8 inch loose lift thickness, except the loose lift thickness shall be reduced to 6 inches when within 4 feet of a structure or pipe or when placing within an area is inaccessible to large equipment. To the extent possible, layers should encompass the entire impervious fill zone section and should be carried substantially horizontal and parallel to the levee centerline with slight grade to provide satisfactory drainage during construction.

3.5.3.4 Pervious Material

Pervious material to be placed in a pervious fill zone shall be placed and spread in a layer not more than an 8 inch loose lift thickness, except the loose lift thickness shall be reduced to 6 inches when within 4 feet of a structure or pipe or when placing within an area inaccessible to large equipment. The landside underseepage berm shall be comprised of random fill and topsoil as required herein these construction documents. Pervious material to be placed within the pervious fill limits of the landside underseepage berm, may be placed in a 12 inch loose lift thickness.

Sequencing of work shall provide for placement of the required lift thickness throughout the limits of the fill section and provide for lift thickness complete saturation while at the same time allow for drainage with time. Layers should be carried substantially horizontal and parallel to the levee centerline with sufficient features to facilitate drainage during construction without violating the levee section requirements.

3.5.3.5 Drainage Material

Drainage material to be placed in the fill zone adjacent to a pipe or structure to facilitate controlled seepage, shall be placed and spread in a layer not more than a 6 inch loose lift thickness. Drainge material shall be placed to ensure complete placement and compaction below, adjacent, and above the pipe or structure.

3.5.3.6 Random Material

Random material to be placed in a random fill zone shall be placed in accordance to the material the random is comprised of--impervious or pervious.

3.5.3.7 Topsoil Material

Topsoil material to be placed within the outer face of the appropriate fill surface and shall be placed as follows: fill zones comprised of pervious material shall have 12 inches of topsoil placed to the finish grade shown on the plan sheets. Fill zones comprised of impervious material shall have 6 inches of topsoil placed to the finish grade shown on the plan sheets. Topsoil shall only be placed where vegetative cover is scheduled. Topsoil shall not be placed in more than an 8 inch loose lift thickness.

3.5.3.8 Aggregate Surfacing, Bedding Rock, and Riprap

Aggregate surfacing, bedding rock, and riprap shall be placed in accordance with Sections, "Aggregate Surface Courses" and "Stone Protection".

3.5.3.9 Fill Placement Adjacent to a Structure or Pipe

Fill shall not be placed on or against concrete less than 7 days after concrete placement or when the concrete is less than 70 percent of the design strength. Placement of fill against structures and pipes shall conform to SECTION 02316, "EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS AND STRUCTURES". Crawler-type tractors, vibratory equipment and other similar compaction equipment shall not be used within 4 feet of any completed or partially completed structure or pipe. Compaction within 4 feet of completed or partially completed structures and pipes shall be accomplished by the use of mechanical hand tampers, vibrating plates, or other approved methods and equipment. The Contractor shall ensure that compaction operations do not damage any existing utility, structure, or pipe. Any damage caused by the Contractor's operation shall be repaired at no additional cost to the Government.

3.5.4 Compaction Requirements

In general, compaction shall be a procedural requirement with testing requirements for verification and field adjustments. In some instances, compaction requirements shall be an end product thus producing a specified minimum density. An example is, required minimum densities specified shall be achieved for compaction below, adjacent, and above a pipe or structure

regardless of compaction procedure.

3.5.4.1 Impervious Material Within Levee Slopes Projected

Impervious material placed within the levee embankment slopes projected shall be compacted as required herein. With the specified loose lift thickness and moisture content, each lift shall be compacted with a minimum of 6 complete passes of an approved tamping roller. The rolling shall be completed parallel to the levee centerline, pipe, or structure. Compaction testing shall be completed as required hereinafter and a minimum of 95% of the Standard Proctor maxium dry density shall be achieved. If the minimum compaction is not achieved, placement shall be discontinuted until the COR makes a determination. If the dumped impervious material requires breaking up, then the Contractor shall propose a procedure and shall be approved subject to satisfactory demonstration of effectiveness. In areas inaccessible to large construction equipment or below, adjacent, or above a structure or pipe, placement and moisture content shall be as indicated herein these specifications, and compaction shall achieve 95% of the Standard Proctor maximum dry density.

3.5.4.2 Impervious Material Outside Levee Slopes Projected

Impervious material placed outside the levee embankment slopes projected (such as the riverside berm) shall be compacted as required herein. With the specified loose lift thickness and moisture content, each lift shall be compacted with a minimum of 4 complete passes of an approved tamping roller. The rolling shall be completed parallel to the levee centerline, pipe, or structure. Compaction testing shall be completed as required hereinafter and a minimum of 90% of the Standard Proctor maxium dry density should be achieved. If the minimum compaction is not achieved, placement shall be discontinued until the COR makes a determination. If the dumped impervious material requires breaking up, then the Contractor shall propose a procedure and shall be approved subject to satisfactory demonstration of effectiveness. In areas inaccessible to large construction equipment or below, adjacent, or above a structure or pipe, placement and moisture content shall be as indicated herein these specifications, and compaction shall achieve 95% of the Standard Proctor maximum dry density.

3.5.4.3 Pervious Material

Pervious material placed as part of this construction contract shall be compacted as specified herein. With the specified loose thickness and percent saturation, each lift shall be be compacted with 4 complete passes of an approved vibratory roller or plate compactor. The roller or plate compactor shall be applied parallel to the levee centerline, pipe, or structure. Compaction testing shall be completed as required hereinafter and a minimum of 50% relative density should be achieved. If the minimum compaction is not achieved, placement shall be discontinued until the COR makes a determination. In areas inaccessible to large construction equipment or zones below, adjacent, or above a structures or pipe, placement and percent saturation shall be as indicated herein these specifications, and compaction shall achieve a minimum of 50% relative density.

3.5.4.4 Random Material

If Random material consists of impervious materials, then compaction shall conform to requirements for impervious material. If random material consists of pervious material, then compaction shall conform to

requirements for pervious material.

3.5.4.5 Drainage Material

Drainge material compaction shall comply with the requirements for pervious material.

3.5.4.6 Topsoil Material

Topsoil shall be compacted by one pass over each 8 inch loose lift thicknes with a cultipacker, roller, or other approved equipment weighing 100 to 160 pounds per linear foot of roller.

3.5.4.7 Aggregate Surface, Rock Bedding, and Riprap

Placement and compaction requirements, when applicable, for aggregate surfacing, rock bedding, and riprap shall be in accordance with Sections, "Aggregate Surface Courses" and "Stone Protection".

3.5.5 Moisture Control

Materials being placed as fill shall be within the moisture content limits for the respective material type. Materials that are not within the specified moisture content limits either before or after compaction shall be reworked and the moisture content adjusted to obtain a moisture content within the specified range. Surfaces to receive fill shall be monitored for moisture content. Whenever the surface to receive fill is either too dry or too wet, the moisture content of the surface shall be appropriately adjusted prior to placing the next fill lift.

3.5.5.1 Impervious Material

The moisture content for impervious material to be placed in a fill zone shall be within the range of 3 percentage points above optimum moisture content to 2 percentage points below Optimum moisture content. Moisture content shall be determined per ASTM D 698.

3.5.5.2 Pervious Material

The moisture content for pervious material to be placed in a fill zone shall be fully saturated. The Contractor shall take the measures necessary to assure complete saturation.

3.5.5.3 Random Material

The moisture content for random material to be placed in a fill zone shall be in accordance to the random material per its classification--Impervious or Pervious.

3.5.5.4 Topsoil Material

The moisture content for the topsoil material to be placed shall be such that compactive effort is kept to a minimum yet sufficient to hold the soil together and support vegetative cover.

3.6 EARTHWORK CONSTRUCTION EQUIPMENT

Earthwork construction equipment intended for the tasks identified hereinafter shall comply with the requirements specified.

3.6.1 Compaction Equipment

3.6.1.1 Towed Tamping Rollers

Towed tamping rollers shall be used for compaction of impervious material. Tamping rollers shall consist of a heavy duty double drum unit, with a drum diameter not less than 60 inches, and an individual drum length of not less than 60 inches. The drums shall be capable of being ballasted with water or a combination of sand and water. Each drum shall have staggered feet uniformly spaced over the cylindrical surface such as to provide approximately three tamping feet for each two square feet of drum surface. The tamping feet shall be 7 to 9 inches in clear projection from the cylindrical surface of the roller and shall have a face area of not less than 5 square inches nor more than 7 square inches. The roller shall be equipped with cleaning fingers, so designed and attached as to prevent the accumulation of material between the tamping feet, and these cleaning fingers shall be maintained at their full length throughout the periods of use of the roller. The weight of the roller shall not be less than 3500 pounds per foot of linear drum length weighted, and shall not be more than 2000 pounds per foot of drum length empty. The two drums comprising one roller unit shall be yoked such that they will oscillate when traversing uneven surfaces. The design and operation of the tamping roller shall be subject to the approval of the COR who shall have the right at any time during the prosecution of the work to direct such repairs to the tamping feet, minor alterations in the roller and variations in the weight as may be found necessary to secure optimum compaction of the earth fill materials. The Contractor may be required to add ballast to the roller to the maximum capacity specified by the manufacturer of the roller. The roller shall be drawn by a crawler-type or a rubber-tired tractor at a speed not to exceed 3.5 miles per hour. The use of the rubber-tired tractor shall be discontinued if the tires leave ruts that prevent uniform compaction by the tamping roller. If tamping rollers are used in tandem, not more than two rollers in tandem will be permitted and in such case, one trip of the tandem rollers over any surface will be considered as two passes. When tamping rollers are used in tandem, the tamper foot spacing shall be offset so that the circumferential rows on the rear drums are in line with the mid-point of the circumferential rows on the forward drums.

3.6.1.2 Self-Propelled Tamping Rollers

Self-propelled tamping rollers may be used in lieu of towed tamping rollers provided the foot pressure on the tamping feet of the self-propelled roller are approximately the same as the foot pressure on the towed roller. For self-propelled rollers steered with rubber-tired wheels, the tire pressure shall not exceed 40 pounds per square inch. Self-propelled rollers shall be operated at speeds not exceeding 3.5 miles per hour. The Contracting Officer has the authority to limit or eliminate the use of self-propelled rollers if they are found to cause shearing or laminations of the compacted fill.

3.6.1.3 Vibratory Rollers

Vibratory rollers shall be used for compacting pervious materials in random fill, drainage fill, and aggregate surfacing. Vibratory rollers shall be equipped with a smooth steel compaction drum and shall be operated at a frequency of vibration during compaction operations between 1100 and 1500 vpm. Vibratory rollers may be either towed or self-propelled and shall have an unsprung drum weight that is a minimum of 60 percent of the

rollers' static weight. Towed rollers shall have at least 90 percent of their weight transmitted to the ground through the compaction drum when the roller is standing in a level position hitched to the towing vehicle. Rollers for compacting rockfill, sand and gravel fills, or filter and drainage layers shall have a minimum static weight of 20,000 pounds, a minimum dynamic force of 40,000 pounds when operating at 1400 vpm, and an applied force not less than 9,000 pounds per foot of compaction drum length. Rollers for compacting sand and gravel fills or filter and drainage layers shall have a minimum static weight of 8,000 pounds, a minimum dynamic force of 16,000 pounds when operating at 1400 vpm, and an applied force not less than 5,000 pounds nor greater than 9,000 pounds per foot of compaction drum length. The level of amplitude and vibration frequency during compaction will be maintained uniform throughout the embankment zone within which it is operating. Rollers shall be operated at speeds not to exceed 1.5 mph. The equipment manufacturer shall furnish sufficient data, drawings, and computation for verification of the above specifications, and the character and efficiency of this equipment shall be subject to approval by the COR.

3.6.1.4 Hand Operated Power Tampers

In areas where large equipment is not allowed or it is impracticable to use a roller, compaction shall be performed by the use of approved hand operated power tampers. Hand operated power tampers shall be used for compaction impervious materials and shall be capable of compacting material in a confined area. The compactors shall be either an internal combustion or pneumatic activated tamper. Tampers shall have sufficient weight and striking power to produce the specified compaction. The character and efficiency of this equipment shall be subject to the approval of the COR. Where hand operated equipment is used, compaction shall be a performance specification achieving the minimum compaction requirements.

3.6.1.5 Hand Operated Vibratory Plate

In areas where large equipment is not allowed or it is impracticable to use a vibratory roller, compaction shall be performed by the use of an approved hand operated vibratory plate. Hand operated vibratory plates shall be used for compaction of pervious materials and shall be capable of compacting material in a confined area. Hand operated vibratory plates shall utilize the oscillating cam principal and shall deliver an impact of not less than 2000 pounds and be rated to deliver 2000 impulses per minute. The character and efficiency of this equipment shall be subject to the approval of the COR. Where hand operated equipment is used, compaction shall be a performance specification achieving the minimum compaction requirements.

3.6.1.6 Crawler Type Equipment

Crawler type equipment shall only be used for compaction if there is continuous successful demonstration of achieving compaction requirements. Crawler equipment shall weigh not less than 20,000 pounds and shall exert a unit tread pressure of not less than 6 pounds per square inch. Speeds shall not exceed 3.5 miles per hour.

3.6.2 Wetting Equipment

Wetting equipment shall consist of tank trucks, pressure distributors or other equipment designed to apply water uniformly and in controlled quantities and rates to variable surface widths. Wetting equipment

approval shall be based on demonstration of satisfactory performance. Wetting equipment types and operations shall not compact or excessively wet the material to receive the moisture and shall not result in standing water within the material to be wetted or areas adjacent the staging or construction areas.

3.6.3 Materials' Manipulation Equipment

Scarifiers, discs, spring-tooth or spike-tooth harrows, spreaders, and other equipment shall be suitable for use in manipulating materials in preparation of use in construction. Equipment shall be subject to approval by the COR and shall be based on demonstration of satisfactory performance. Equipment used for blending materials shall be capable of penetrating the full thickness or capable of processing the full thickness of the material. Satisfactory performance shall be based on consistent complete and thorough processing of the material or materials.

3.6.4 Other Earthwork Equipment

Other Equipment not mentioned such as equipment for earthwork extraction and handling shall be subject to COR approval, and approval shall be based on continued satisfactory performance. When conditions change, equipment changes may be required. The Contractor shall be made aware of conditions specific to a flood plain with a fluctuating river adjacent to the work. The Contractor shall consider operational (or trafficability) problems such as, but not limited to, pumping of water and materials to the surface by moving equipment as well as bogging of equipment in soft, wet ground. Selection and proposal of equipment in the plan of operations shall account for ground conditions associated with floodplains near a fluctuating river.

3.6.5 Missouri River Material Extraction Equipment

The Contractor is directed to Section, "Dredging Operations" and the requirements herein this Section for equipment requirements.

3.7 MATERIALS' TESTING

In general, the requirements specified herein are the minimum requirements. Additional testing shall be required when there is question on the material or fill placed or change of conditions occurring that may impact the material or placed fill. Additional testing shall be performed by the Contractor at no additional expense to the Government.

3.7.1 Classification Testing

Soil classification tests shall be performed in accordance with ASTM D 2487. One classification test shall be required for each representative type of material to be used as fill and for each material type encountered within a borrow area or required excavation. Each foreshore borrow bay is considered a separate borrow area. As prescribed in ASTM D 2487, grain size analyses in accordance with ASTM D 422 and Atterberg limits in accordance with ASTM D 4318 shall be performed on each different type of material to be used and for each borrow area. The Contractor shall perform additional tests at the request of the COR. Soil classification tests shall be performed on foundation material as required to determine the acceptability of the in-situ soils. Additional tests shall be required if noticeable changes in the material are observed.

3.7.2 Impervious Material

In general testing frequency specified is applicable for embankment fill and sources of material. When fill is to be placed below, adjacent, or above a pipe or structure, testing shall be completed for every other lift thickness and a minimum of every 500 feet of fill placement.

3.7.2.1 Moisture-Density Test

The moisture-density relationship for each type of impervious material encountered within each of the borrow areas or required excavations shall be determined in accordance with ASTM D 698. Prior to placing any impervious fill material, a (5) five-point (minimum) compaction test shall be performed on the representative samples of the material to be used as fill. Additional tests shall be required each time a new material is encountered. The moisture-density curves shall be compiled to form a family of curves which will be utilized to estimate optimum properties (maximum dry density and optimum moisture content) to be used with field density test.

3.7.2.2 Moisture Content Test

Determination of moisture content shall be performed in accordance with ASTM D 2216. One moisture content test shall be performed for each 1000 cubic yards of material placed or each lift of material whichever is less. Backfill and fills not meeting the required specifications for moisture content shall be retested after corrective measures have been applied. When conditions exist throughout the placement process such as drying winds or sun or wetting from precipitation, additional testing shall be completed throughout the placement process to ensure proper moisture content. The COR shall determine the frequency of additional testing.

3.7.2.3 In-Place Density Test

Impervious fill in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, ASTM D 2922. At least one (1) in-place density test shall be performed on each lift of material or every 1000 cubic yards of completed fill whichever is more frequent with the horizontal locations randomly staggered in the fill. The results of the five-point compaction test and the moisture content test will be utilized to obtain the optimum properties to compare to the results of the in-place density test. Placed fill not meeting the required specifications for in-place density shall be retested after additional compaction has been completed. When the nuclear method is used for in-place density testing according to ASTM D 2922 and ASTM D 3017, the first test and every tenth test thereafter for each material type shall include a sand cone correlation test in accordance with ASTM D 1556. The sand cone test shall be performed at the location of the nuclear test and should sample the same location that the nuclear probe and detector tested, ie as close a distance as possible between the probe and the detector. The sand cone test shall include a nominal 6 inch diameter sand cone, and shall include a minimum wet soil weight of 6 pounds extracted from the hole. Nuclear density testing equipment shall not be used during rain. The density correlations shall be submitted with test results. Each transmittal including density test data shall include a summary of all density correlations for the job prepared on a summary sheet including as a minimum:

Meter serial number and operators initials.
Standard Count for each test.
Material type.

Probe depth.
Moisture content by each test method and deviation.
Wet density by each test method and the deviation.

3.7.3 Pervious Material

In general testing frequency specified is applicable for embankment fill and sources of material. When fill is to be placed below, adjacent, or above a pipe or structure, testing shall be completed for every other lift thickness and a minimum of every 500 feet of fill placement.

3.7.3.1 Relative Density Test

(deleted sentence and replaced)The Contractor shall complete not less than one relative density test for each pervious fill type and source in accordance with ASTM D 4253 and ASTM D 4254.

3.7.3.2 In-Place Relative Density Test

The in-place density of the pervious materials shall be determined in accordance with ASTM D 1556, ASTM D 2167, ASTM D 2922, or ASTM D 5195. The Contractor shall run not less than one (1) field in-place density test each day pervious material is placed. As directed by the COR, additional in-place density testing shall be completed at no expense to the Government if site, weather, or placement conditions change throughout the placement process each day. (delete sentences and replace) When nuclear method is used for in-place density testing according to ASTM D 2922 and ASTM D 3017, the first test and every tenth test thereafter for each material type shall include a sand cone correlation test in accordance with ASTM D 1556. The sand cone test shall be performed at the location of the nuclear test and should sample the same location that the nuclear probe and detector tested, ie as close of a distance as possible between the probe and the detector. The sand cone test shall include a nominal 6 inch diameter sand cone, and shall include a minimum wet soil weight of6 pounds extracted from the hole. The density correlations shall be submitted with test results. Each transmittal including density test data shall include a summary of all density correlations for the job prepared on a summary sheet including as a minimum:

Meter serial number and operator's initials.
Standard count for each test.
Material type.
Probe depth.
Moisture content by each test method and the deviation.
Wet density by each test method and the deviation.

3.8 CONTRACTOR QUALITY CONTROL

Contractor quality control in support of the earthwork shall include all efforts to ensure compliance with these construction documents to include support of Government efforts as part of quality assurance. The Contractor shall immediately report to the COR in writing all conditions identified in the field as a change. The Contractor efforts in support of Contractor earthwork quality control shall include but not be limited to the items indicated hereinafter.

3.8.1 Excavation

The Contractor shall complete all efforts to ensure compliance with the

construction documents in support of excavation requirements for required excavation and excavation in support of non-pay items such as borrow areas. Contractor efforts shall include but not be limited to the following:

Maintain records and complete as-built drawings and submit to the COR as required.
Complete all surveys to ensure excavations to all specified lines and grades within specified tolerances.
Complete utility location prior to excavations and documenting the utilities as required.
Use only approved equipment for work and modify as necessary and as approved by the COR.
Complete segregation of materials to include testing, stockpile, placement, removal offsite and provide for protection of segregated materials.
Complete operations to ensure protection of excavation and stockpile from run-off and discharges.
Complete operations to ensure stability of excavation and stockpiled material.

3.8.2 Fill

The Contractor shall complete all efforts to ensure compliance with the construction documents in support of fill operations' requirements for emankment, berms, pipe, and structure backfill. Contractor efforts shall include but not be limited to the following:

Maintain records, test results, and complete as-built drawings and submit to the COR as required.
Use only approved equipment for work and modify as necessary and as approved by the COR.
Complete all surveys to include survey control, grade stakes, survey sections to ensure proper project layout and that fill limits are met to include fill zones and overall fill.
Complete all proper surface preparation to receive fill.

Complete all testing of materials and fill placed to ensure compliance with the contstruction requirements.
Properly place and compact appropriate materials and protect partially and completed fill operations.

3.8.3 Miscellaneous

The Contractor shall also complete all efforts to ensure compliance with the construction documents in support of all other opertions required such as construction of the free board gages. Contractor shall perform all work in accordance with the construction documents and approved submittals. All necessary surveys shall be completed as well as maintaining all records and complete as-built drawings and submit to the COR as required.

3.8.4 Testing and Reporting

The Contractor shall complete all testing in accordance with the requirements of these construction documents. Testing specified shall be considered the minimum requirement. When there is question of the material or the fill placed or conditions occurring in the field that may impact the material or fill placed properties, the COR may require additional testing, and the Contractor shall complete the additional testing at no additional cost to the Government. As part of quality assurance, the Government may

perform testing. The Contractor shall provide the samples for Government testing and when the testing is to be performed in the field, the Contractor shall provide the testing equipment at no additional cost to the Government. The Contractor shall furnish records, test results, and related documentation to the COR in accordance with the requirements of these construction documents.

3.9 EQUIPMENT TRAFFIC ON FOUNDATION AND FILL ZONES

Equipment traffic shall be routed to distribute the compactive effort as much as practicable. Ruts formed in the a surface to receive fill material shall be filled before that material is compacted. Surfaces made smooth prior to recieving shall be scarified. Equipment traffic on pervious fill shall only be as absolutly necessary for placement and compaction.

3.10 COMPLETED AND PARTIALLY PLACED FILL

Fill placed, completly or partially, shall be shaped to drain from the fill and graded to drain away from the fill. The Contractor shall protect the fill from erosion until the specified cover is established. Erosion occurring during the interim shall be the Contractor's responsibility to repair at no additional cost to the Government. Slides or other adverse consequences caused by failure of the Contractor to comply with the requirements of this contract or in general, failure by the Contractor to perform operations in a reasonable manner shall be considered the responsibility of the Contractor and repaired by the Contractor as approved by the COR at not additional expense to the Government.

3.11 FROZEN MATERIAL

Frozen material shall not placed in fill zones nor shall material be placed on frozen areas whether undisturbed foundation, prepared foundation, or recently placed fill. All material or zones that freeze or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to nights, holidays, weekends, or winter shutdowns of earthwork operations, shall be removed to a depth that is acceptable to the Contracting Officer and replaced with new material. Alternatively, the material shall be thawed, dried (to optimum), reworked, and recompacted to the specified criteria before additional material is placed. The Contracting Officer will determine when placement of fill shall cease due to cold weather. The Contracting Officer may elect to use average daily air temperatures, and/or physical observation of the soils for the determination. Levee embankment material shall not contain frozen clumps of soil, snow or ice.

SECTION 02370

SOIL SURFACE EROSION 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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4355	(1992) Deterioration of Geotextiles From Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4972	(2001) Standard Test Method for pH of Soils
ASTM D 5035	(2000) Standard Guide for Development of ASTM Standards Relating to Recycling and Use of Recycled Plastics
ASTM D 5261	(1992, R1996) Measuring Mass per Unit Area of Geotextiles
ASTM D 5268	(1996) Topsoil Used for Landscaping Purposes
ASTM D 6459	(1999) Determination of Erosion Control Blanket (ECB) Performance in Protecting Hillslopes from Rain-Induced Erosion
ASTM D 6460	(1999) Determination of Erosion Control Blanket (ECB) Performance in Protecting Earthen Channels for Stormwater-Induced Erosion
ASTM D 6524	(2000) Standard Test Method for Measuring the Resiliency of Turf Reinforcement Mats (TRFs)

EROSION CONTROL TECHNOLOGY COUNCIL (ECTC)

ECTC	(January 1997) ECTC Technical Guidance Manual (available at http://www.ectc.com)

1.2 DESCRIPTION OF WORK

The work shall consist of furnishing and installing rolled, permanent soil surface erosion control blanket , including fine grading, blanketing, stapling, mulching and miscellaneous related work, within project limits

and in areas outside the project limits where the soil surface is disturbed from work under this contract at the designated locations. This work shall include all necessary materials, labor, supervision and equipment for installation of a complete system. This section shall be coordinated with the requirements of Section 02331 LEVEE CONSTRUCTION AND EARTHWORK and Section 02921 SEEDING.

1.3 SUBMITTALS

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

SD-04 Drawings

Layout; GA-EC
Erosion Control Details; GA-EC
Obstructions Below Ground; GA-RE

Scale drawings defining areas to receive recommended materials, define required work, and/or identify features as required by this specification section and as required by federal, state or local regulations.

SD-01 Data

Erosion Control Blanket ; GA-EC

Manufacturer's literature including physical characteristics, application, and installation instructions.

Equipment; FIO.

A listing of equipment to be used for the application of rolled erosion control blanket .

SD-09 Reports

Erosion Control Blanket ; GA-RE

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Tests methods used and compliance with recognized test standards shall be described.

SD-13 Certificates

Erosion Control Blanket ; GA-RE

Prior to delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

For items listed in the section,

a. Certification of recycled content or,

b. Statement of recycled content or,

c. Certification of origin including the name, address and telephone number of manufacturer.

Construction Work Sequence ; GA-EC

The Contractor shall prepare a plan defining the proposed sequence of erosion control system construction as described in this specification section.

Installer's Qualification ; GA-RE

The installer's company name and address; training and experience and/or certification.

SD-14 Samples

Materials ; GA-RE

Erosion Control Blanket; one square yard.

SD-19 Operation and Maintenance Manuals

Maintenance Record; FIO
Maintenance Instructions; FIO

Report on maintenance work performed by the Contractor prior to contract completion and instruction for year-round care of installed material. The Contractor shall include manufacturer supplied spare parts.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

Materials shall be stored in designated areas and as recommended by the manufacturer protected from the elements, direct exposure, and damage. Containers shall not be dropped from trucks. Material shall be free of defects that would void required performance or warranty.

a. All Erosion Control Blanket rolls shall be sound and free of defects that would interfere with the proper placing of the material or impair the strength or permanence of the construction.

b. Seed shall be inspected upon arrival at the jobsite for conformity to species and quality as specified in section 02921 SEEDING.

1.5 SUBSTITUTIONS

Substitutions will not be allowed without written request and approval from the Contracting Officer.

1.6 INSTALLER'S QUALIFICATION

The installer shall be certified by the manufacturer for training and experience installing the material.

1.7 WARRANTY

The Erosion Control Blanket (ECB) shall have a warranty for use and durable condition for project specific installations. Permanent ECB shall

carry a minimum three year warranty.

1.8 MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for work covered under this Section and all costs shall be included in the contract unit or lump sum price for the item of work to which the materials and work is incidental.

PART 2 PRODUCTS

2.1 EROSION CONTROL BLANKET (ECB)

A synthetic rolled ECB shall be installed by the Contractor in areas as shown on the drawings. The ECBshall consist of Composite Reinforcement Mat, for example, Series P550 as manufactured by the North American Green Corporation or the equivalent as approved by the Contracting Officer. The composite reinforcement mat shall be a machine produced matting of 100% UV stabilized polypropylene fiber matrix incorporated into a permanent three-dimensional netting structure.

The permanent ECB shall possess the following physical and performance properties:

Physical Properties

Min. Tensile Strength	2.66 kN/m (182.26 lbs/ft)	ASTM D 5035
UV Stability	90%	ASTM D 4355 (1000 hr exposure)
Resiliency (% thickness retained)	80%	ASTM D 6524

Performance Properties

Allowable Shear Stress	383 Pa (8.00 psf)	ECTC or ASTM D 6459 and ASTM D 6460

2.2 WATER

Unless otherwise directed, water shall be the responsibility of the Contractor. Water shall be potable or supplied by an existing irrigation system.

PART 3 EXECUTION

3.1 CONDITIONS

The Contractor shall submit a construction work sequence schedule, with the approved erosion control plan a minimum of 30 days prior to start of construction. The work schedule shall coordinate the timing of land disturbing activities with the provision of erosion control measures. Erosion control operations shall be performed under favorable weather conditions; when excessive moisture, frozen ground or other unsatisfactory conditions prevail, the work shall be stopped as directed. When special conditions warrant a variance to earthwork operations, a revised construction schedule shall be submitted for approval. ECB shall not be applied during adverse weather conditions which could affect performance.

3.1.1 Finished Grade

The Contractor shall verify that finished grades are as indicated on the drawings; finish grading and compaction shall be completed in accordance with Section 02331 LEVEE CONSTRUCTION AND EARTHWORK, prior to the commencement of the work. The location of underground utilities and facilities in the area of the work shall be verified and marked. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.2 SITE PREPARATION

3.2.1 Soil Test

Soil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size and mechanical analysis. Sample collection onsite shall be random over the entire site. The test shall determine the soil particle size as compatible for the specified material.

3.2.2 Layout

ECB locations may be adjusted to meet field conditions. When soil tests result in unacceptable particle sizes, a shop drawing shall be submitted indicating the Contractor's proposed corrective measures for approval.

3.2.3 Protecting Existing Vegetation

When there are established lawns in the work area, the turf shall be covered and/or protected or replaced after construction operations. Existing trees, shrubs, and plant beds that are to be preserved shall be barricaded along the dripline. Damage to existing trees shall be mitigated by the Contractor at no additional cost to the Government. Damage shall be assessed by a state certified arborist or other approved professional using the National Arborist Association's tree valuation guideline.

3.2.4 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments to placement of erosion control material shall be submitted by the Contractor for approval.

3.3 INSTALLATION

3.3.1 Seeding

When seeding is required prior to installing mulch on ECB, the Contractor shall verify that seeding will be completed in accordance with Sections 02331 LEVEE CONSTRUCTION AND EARTHWORK and 02921 SEEDING.

3.3.2 ECB

ECB shall be anchored in accordance with the manufacturer's recommendations.

3.3.3 ECB Seeding

Seed shall be installed in accordance with Section 02921 SEEDING and according to the ECB manufacturer's recommendations.

3.4 CLEAN-UP

Excess material, debris, and waste materials shall be disposed offsite at an approved landfill or recycling center. Adjacent paved areas shall be cleared.

3.5 WATERING SEED

Watering shall be started immediately after installing ECB . Water shall be applied to supplement rainfall at a sufficient rate to ensure moist soil conditions to a minimum 1 inch) depth. Run-off and puddling shall be prevented. Watering trucks shall not be driven over turf areas or ECB-covered areas unless otherwise directed. Watering of other adjacent areas or plant material shall be prevented.

3.6 MAINTENANCE RECORD

A record shall be furnished describing the maintenance work performed, record of measurements and findings for product failure, recommendations for repair, and products replaced.

3.6.1 Maintenance

Maintenance shall include eradicating weeds; protecting embankments and ditches from surface erosion; maintaining the performance of the erosion control materials and mulch; protecting installed areas from traffic.

3.6.1.1 Maintenance Instructions

Written instructions containing drawings and other necessary information shall be furnished, describing the care of the installed material; including when and where maintenance should occur and procedures for ECB replacement.

3.6.1.2 Patching and Replacement

Unless otherwise directed, ECB shall be placed, seamed or patched as recommended by the manufacturer. ECB not meeting the required performance as a result of placement, seaming or patching shall be removed from the site. The Contractor shall replace the unacceptable material at no additional cost to the Government.

3.7 SATISFACTORY STAND OF GRASS PLANTS

After ECB has been installed, the grass plants shall be evaluated for species and health when the grass plants are a minimum 1 inch high. A satisfactory stand of grass shall be as defined in Section 02921 SEEDING. The total bare spots shall not exceed the limitations of Section 02921 SEEDING.

-- End of Document --

SECTION 02380

STONE 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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33	(1999) Concrete Aggregates
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 4791	(1995) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(1997) NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices

1.2 STANDARD UNIT PRICES STANDARDS FOR LUMP SUM ITEMS

1.2.1 Bedding Layer

1.2.1.1 Payment

Payment for gravel, crushed stone, and sand placed for bedding material will be made at the applicable contract unit prices for bedding. Price(s) and payment(s) shall include all costs of furnishing, hauling, placing and maintaining the bedding material until placement of the riprap cover is completed and accepted. Preparation of the base will not be paid for separately and all costs incidental thereto shall be included in contract prices for other items for which payment will be made. No payment will be made for excess thickness of bedding material, nor for material required to replace subgrade material lost by rain wash, wind erosion, overexcavation or otherwise.

1.2.1.2 Measurement

Material placed for bedding layers will be measured for payment by the ton. Quantities will be computed to the nearest whole ton. Bedding material will be measured for payment, in the presence of the Contracting Officer, by weighing on approved, accurately calibrated scales furnished by and at the expense of the Contractor. The scales shall be capable of printing a weight ticket including time, date, truck number, and weight. Weight certificates furnished by a public weighmaster will be acceptable.

1.2.1.3 Unit of Measure

Unit of measure: tons

1.2.2 Riprap

1.2.2.1 Payment

Payment for riprap satisfactorily placed will be made at the applicable contract unit price for TON Riprap. Price(s) and payment(s) shall constitute full compensation for furnishing, hauling, handling, placing, and maintaining the riprap until final acceptance by the Government. No separate payment will be made for the stockpiling of stones, and all cost in connection with stockpiling shall be included in the contract unit price for riprap.

1.2.2.2 Measurement

Riprap will be measured for payment by the ton as determined by weighing the truckload on approved scales meeting the requirements of paragraph TRUCKLOAD.

a. Truckload. Each truck load will be weighed to the nearest 0.1 ton and the final quantity rounded to the nearest whole ton. Stones will be measured for payment by weighing on approved scales before being placed in the work. Scales shall be of sufficient length to permit simultaneous weighing of all axle loads and shall have an accuracy within 0.2 percent throughout the range of the scales. The scale's accuracy shall conform to the applicable requirements of NIST HB 44 and shall be certified by an inspector of the State Inspection Bureau charged with scales inspection within the state of Missouri prior to weighing any riprap. The scales shall be capable of printing a weight ticket including time, date, truck number, and weight. If commercial scales are readily available in close proximity of site of work, documentation shall be submitted certifying that the scales meet the requirements of the specification. The Contractor shall furnish the scales and shall weigh the riprap in the presence of the Contracting Officer,who will certify the correctness thereof. The Contracting Officer may elect to accept certified weight certificates furnished by a public weighmaster in lieu of scale weights at the jobsite. Scales will be checked and certified before hauling riprap.

b. Stockpiled Stones. If the Contractor elects to stockpile stones on the worksite or offsite, he shall weigh the stones immediately before placement by the method described above. Stones placed in temporary storage on the worksite as specified in paragraph WORKSITE STOCKPILE

will not be required to be re-weighed prior to placement.

1.2.2.3 Unit of Measure

Unit of measure: tons

1.3 TESTING

1.3.1 Stone

1.3.1.1 General

All stone shall be durable material as approved by the Contracting Officer. Stone shall be of a suitable quality to ensure permanence in the structure and in the climate in which it is to be used. It shall be free from cracks, blast fractures, bedding, seams and other defects that would tend to increase its deterioration from natural causes. Inspections for cracks, fractures, seams and defects shall be made by visual examination. If, by visual examination, it is determined that 10 percent or more of the stone produced contains hairline cracks, then all stone produced by the means and measures which caused the fractures shall be rejected. A hairline crack that is defined as being detrimental shall have a minimum width of 4 mil and shall be continuous for one-third the dimension of at least two sides of the stone. The stone shall be clean and adequately free from all foreign matter. Any foreign material adhering to or combined with the stone as a result of stockpiling shall be removed prior to placement.

1.3.1.2 Sources

Stone shall be furnished from any of the sources listed in Section 01100: GENERAL.

1.4 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Riprap; GA-EC.
Bedding Material; GA-EC.

Submit the source for materials used in riprap and bedding.

SD-09 Reports

Gradation Test; GA-RE.

Submit the gradation tests for riprap and bedding.

SD-13 Certificates

Stone; FIO. Bedding Material; FIO.

Submit certificates of compliance attesting that the materials meet specification requirements.

Laboratory; GA-RE.

Submit a copy of the documents, provided by the Materials Testing Center (MTC) at CEWES or other governmental agency, that validates that the laboratory can perform the required tests. The individual tests shall be listed for which the validation covers along with the date of the inspection.

Weigh Scale Certification; FIO.

Submit a copy of the certification from the regulation agency attesting to the scale's accuracy.

Certified Weight Scale Tickets; FIO.

Submit a copy of each certified weight scale ticket 5 working day(s) after weighing.

1.5 CONSTRUCTION TOLERANCES

The finished surface and stone layer thickness shall not deviate from the lines and grades shown by more than the tolerances listed below. Tolerances are measured perpendicular to the indicated neat lines. Extreme limits of the tolerances given shall not be continuous in any direction for more than the nominal stone dimension nor for an area greater than 100 square feet of the structure surface.

NEATLINE TOLERANCES

MATERIAL	ABOVE NEATLINE inches	BELOW NEATLINE inches
Bedding	1	1
Riprap	5	2

The intention is that the work shall be built generally to the required elevations, slope and grade and that the outer surfaces shall be even and present a neat appearance. Placed material not meeting these limits shall be removed or reworked as directed by the Contracting Officer. Payment will not be made for excess material which the Contracting Officer permits to remain in place.

PART 2 PRODUCTS

2.1 BEDDING MATERIAL

2.1.1 General

Bedding s material shall consist of a washed gravel or crushed stone.

2.1.2 Material

Bedding material shall be composed of tough, durable particles, adequately free from thin, flat and elongated pieces, and shall contain no organic matter nor soft, friable particles in quantities considered objectionable by the Contracting Officer. The aggregates shall meet the quality requirements of ASTM C 33. Gradation shall conform to the following requirements:

BEDDING

U.S. STANDARD SIEVE	PERMISSIBLE LIMITS PERCENT BY WEIGHT, PASSING
6 in.	100
3 in.	75-95
1 in.	40-60
1/4 in.	5-25

The bedding material shall be well-graded between the limits shown. At least one test shall be performed on each 1000 tons placed for each specified gradation in accordance with ASTM C 136. All points on individual grading curves obtained from representative samples of bedding material shall lie between the boundary limits as defined by smooth curves drawn through the tabulated gradation limits plotted on ENG FORM 2087, attached at the end of this section. The individual gradation curves within these limits shall not exhibit abrupt changes in slope denoting either gap grading or scalping of certain sizes or other irregularities which would be detrimental to the proper functioning of the bedding layers.

2.2 STONE

2.2.1 General

2.2.1.1 Gradation Test

The Contractor shall perform at the quarry gradation testing on the stone. The sample shall be taken by the Contractor from the truck in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer not less than 3 days in advance of each test. In the event of unavailability of the Contracting Office, the Contractor shall perform the tests and certify to the Contracting Officer that the stone complies with the specifications. At least one gradation test(s) shall be performed per 50,000 tons of each size of riprap, or stone, but not less than one test shall be performed. The sample shall consist of not less than 10 tons of stone and shall be collected in a random manner to provide a sample which accurately reflects the actual gradation arriving at the jobsite. Failure of the test on the initial sample and on an additional sample will be considered cause for rejection of the quarry and/or quarry process, and all stone represented by the failed tests shall be set aside and not

incorporated into the work. Any additional tests required because of the failure of an initial test sample will not be considered as one of the other required tests. Each truckload shall be representative of the gradation requirements. If the gradation test fails, additional gradation tests will be required at the Contractor's expense to delineate the limits of unacceptable stone within the quarry face(s). The additional gradation tests shall not count as part of the minimum number of gradation tests required. The unacceptable stone shall either be reworked to bring the stone within the specified gradation or the stone shall not be shipped to or shall be removed from the project site as appropriate and as determined by the Contracting Officer. The Contracting Officer may direct this testing under the Contract Clause INSPECTION OF CONSTRUCTION. The Contractor shall provide all necessary screens, scales and other equipment, and operating personnel, and shall grade the sample. Certification and test results shall represent riprap, stone, and related material shipped from the quarry. Certification and tests results must be received by the Contracting Officer at the jobsite before the stone is used in the work.

2.2.1.2 Proportional Dimension Limitations

A maximum of 3 percent flat and elongated pieces by weight will be acceptable. A flat and elongated piece of riprap is defined as having a ratio of width to thickness or length to width greater than 3:1. ASTM D 4791 shall be used as a guide to perform the test.

2.2.1.3 Stockpile

Storage of stone at the worksite is not to be confused with off-site stockpiling of stone. If the Contractor elects to provide off-site stockpiling areas, the Contracting Officer shall be notified by the Contractor of all such areas. The first layer shall be a maximum of 6 feet high. After being stockpiled stone which has become contaminated with soil or refuse shall not be put into the work unless the contaminating material has been removed from the stone prior to placement.

a. Worksite Stockpile

Temporary storage of stone at the worksite will be allowed, provided the stockpile toe of the stone be no closer than 100 linear feet from the closest edge of the top slope, and the amount shall not exceed 200 T.

b. Off-site Stockpile

In areas where stone is stockpiled for placement, the area shall have excess rock removed prior to completion of work. All rock and spalls greater than 3 inches in diameter shall be removed. Where rocks may have become buried due to soft ground or operation of the equipment, the rock shall be put in a disposal area. After the rock has been removed, the storage area shall be graded, dressed, and filled to return the ground surface as near as practical to the condition that existed prior to construction.

2.2.2 Riprap

Only quarried stone shall be used. Stone shall be well graded and shall conform to the table(s) below

18-INCH RIPRAP
(Minimum Layer Thickness))

PERCENT LIGHTER BY WEIGHT (SSD)	LIMITS OF STONE WEIGHT, LB.
100	300
85-95	200
30-50	75
0-15	10

PART 3 EXECUTION

3.1 BASE PREPARATION

Areas on which bedding material and riprap are to be placed shall be graded and/or dressed to conform to cross sections shown on the contract drawings within an allowable tolerance of plus 1 inche and minus 2 inches from the theoretical lines and grades. The prepared base shall be approved by the Contracting Officer. Where such areas are below the allowable minus tolerance limit they shall be brought to grade by fill with earth similar to the adjacent material and then compacted to a density equal to the adjacent in place material. Immediately prior to placing the bedding layers the prepared base will be inspected by the Contracting Officer and no material shall be placed thereon until that area has been approved.

3.3 PLACEMENT OF BEDDING

Bedding shall be spread uniformly on the prepared base to the slope lines, grades, and thickness indicated on the drawings. Placing of material by methods which tend to segregate particle sizes will not be permitted. Any damage to the underlying surface during placement shall be repaired before proceeding with the work. Compaction of the layer will not be required, but it shall be finished to a reasonably smooth surface.

3.2 PLACEMENT OF RIPRAP

3.2.1 General

Riprap shall be placed within the limits shown on the contract drawings.

3.2.2 Placement

3.2.2.1 Riprap placed

Riprap shall be placed in a manner which will produce a well-graded mass of rock with the minimum practicable percentage of voids, and shall be constructed, within the specified tolerances, to the lines and grades shown

on the contract drawings or staked in the field. A tolerance of plus 4 inches and minus 2 inches from the slope lines and grades shown on the contract drawings will be allowed in the finished surface of the riprap, except that the extreme of this tolerance shall not be continuous over an area greater than 200 square feet. The average tolerance of the entire job shall have no more than 50 percent of the tolerances specified above. Riprap shall be placed by means of truck, crane operated skip-pan (box), dragline bucket, clamshell, rock-bucket, hydraulic excavator ("Gradall"), trackhoe, or other approved equipment. The use of tractor loaders or other equipment commonly referred to as front end loaders shall not be permitted. Pneumatic tired front end loaders may be used provided that in the opinion of the Contracting Officer no degradation of the rock occurs. Riprap shall be placed to its full course thickness in one operation and in such manner as to avoid displacing the bedding material. The large stones shall be well distributed and the entire mass of stones in their final position shall be graded to conform to the gradation specified in paragraph RIPRAP, subparagraph GENERAL. Placement shall begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. Placing riprap in layers will not be permitted. Placing riprap by dumping it into chutes, or by similar methods likely to cause segregation of the various sizes, shall not be permitted. Placing riprap by dumping it at the top of the slope and pushing it down the slope shall not be permitted. No equipment shall be operated directly on the completed stone protection system. The desired distribution of the various sizes of stones throughout the mass shall be obtained by selective loading of the material at the quarry or other source; by controlled dumping of successive loads during final placing; or by other methods of placement which will produce the specified results. Each truckload shall be representative of the gradation requirements. All dump trucks used in placing the riprap shall be equipped with bottom hinged tailgates. The gate releasing mechanism shall be arranged so that it may be operated only from, at, or near the front of the truck. Rearranging of individual stones shall be required to the extent necessary to obtain a well-graded distribution of stone sizes as specified above. However, manipulating stone by means of dozers or other blade equipment shall not be permitted. Unless otherwise authorized by the Contracting Officer, riprap shall be placed in conjunction with the construction of the embankment and with only sufficient lag in construction of the stone protection as may be necessary to prevent mixing of embankment and stone protection materials. The Contractor shall maintain the stone protection until accepted by the Contracting Officer and any material displaced prior to acceptance and due to the Contractor's negligence shall be replaced at his expense and to the lines and grades shown on the contract drawings.

-- END OF SECTION--

SECTION 02431

PIPE JACKING CONCRETE PIPE

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 basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API RP 13B-1	(1997) Standard Procedure for Field Testing Water-Based Drilling Fluids
API RP 13B-2	(1998) Field Testing Oil-Based Drilling Fluids

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 74	(1998) Cast Iron Soil Pipe and Fittings
ASTM A 123/A 123M	(1997a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM C 14	(1995) Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 14M	(1995) Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)
ASTM C 33	(1993) Concrete Aggregates
ASTM C 76	(1998) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 94	(1998) Ready-Mixed Concrete
ASTM C 150	(1997) Portland Cement
ASTM C 260	(1998) Air-Entraining Admixtures for Concrete
ASTM C 270	(1997ael) Mortar for Unit Masonry
ASTM C 443	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

ASTM C 443M	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric)
ASTM C 564	(1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 828	(1998) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 924	(1989; R 1997) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C 972	(1995) Compression-Recovery of Tape Sealant
ASTM D 412	(1998a) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 624	(1991; R 1998) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

ENGINEERING MANUALS (EM)

EM 385-1-1	(1992) U.S. Army Corps of Engineers Safety and Health Requirements Manual

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA Manual	(1999) Manual for Railway Engineering (4 Vol.)

1.2 GENERAL REQUIREMENTS

No earth displacement or settlement greater than 1/8" is allowed under road earth or pavement locations. The Contractor will be required to repair any settlement effects to the roads.

The construction required herein shall include minor appurtenant structures. Excavation and backfilling is specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the concrete 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.

This section describes the equipment, materials, and procedures to perform concrete pipe and pipe jacking work.

1.2.1 JACKING:

1.2.1.1 General:

Where indicated on the drawings, a combination of jacking and excavation shall be used to install pipe. Excavation shall be any approved method. Excavation without concurrent jacking will not be permitted. The trenches in the side slopes of the road embankment at the limits of the jacked portion of the pipe shall be sheeted and braced to protect against caving. Road traffic shall not be interrupted.

1.2.1.2 Schedule of Operations:

The Contractor shall submit his schedule of operations and methods of installation for approval prior to jacked, commencement of jacking operations.

1.2.2 GEOTECHNICAL SITE CONDITIONS

1.2.2.1 Exploratory Borings

Subsurface exploratory borings were advanced in the immediate area of, but not specifically at the pipe jacking site. Locations of the area borings are shown on the plans and the logs of those borings which fall close to the area of this contract are included in drawings for the convenience of the Contractor. The Government assumes no responsibility for interpretation or deductions made by the Contractor from the logs and borings. Local minor variations in the subsurface materials are to be expected and, if encountered, will not be considered as being materially different within the purview of this work. Soils classifications shown on the logs are the result of field visual classifications in accordance with the Unified Soils Classification System.

1.2.3 PERFORMANCE REQUIREMENTS

The Government may perform quality assurance testing on the controlled low strength material, concrete pipe and pipe jacking and backfill materials using the laboratory and equipment furnished by the Contractor. The Government testing will in no way relieve the Contractor of the responsibility of performing tests necessary to meet the construction requirements. The Contractor shall provide the equipment and laboratory space to government personnel on demand and these services shall be considered a subsidiary obligation of the construction. All routine testing procedures being conducted by the Contractor shall be available for inspection by the Contracting Officer at any time.

1.2.4 DEFINITIONS

The terms used in this section are defined as follows:

1.2.4.1 Concrete Pipe and Pipe Jacking

The pipe jacking is a method to place concrete pipe through the existing

ground or prepared working surface using the concrete pipe and pipe jacking method of excavation and backfilled with a specified mixture of soil.

1.2.4.2 Concrete Pipe and Pipe Jacking Specialist

A concrete pipe and pipe jacking specialist is an individual who has had two years of experience in concrete pipe and pipe jacking construction and has knowledge in all aspects of concrete pipe and pipe jacking construction which includes but is not limited to:

Trench excavation and backfill procedures; and,

A thorough knowledge of construction equipment and material testing required for concrete pipe and pipe jacking construction.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Concrete Pipe and Pipe Jacking Construction; FIO-RE.

The layout of operations for the construction of the concrete pipe and pipe jacking shall include but is not limited to drawings depicting controlled low strength material storage area, concrete pipe and pipe jacking preparation area, hydration pond(s) concrete pipe and pipe jacking storage area, backfill storage and mixing area, location and sizes of all stationary equipment, water storage tanks, pumps, valves, lines, hoses, and materials, and waste areas.

SD-01 Data.

Equipment; FIO-RE

The Contractor shall submit data on the equipment to be used in the construction concrete pipe and pipe jacking work and, equipment to be used in the Contractor's quality control testing.

Controlled Low Strength Material; FIO-RE.

The Contractor shall submit mix design for controlled low strength material backfill, including all supporting test data on composition, strength, permeability and density.

SD-09 Reports

Tests; FIO-RE.

The Contractor shall submit the results of all Contractor Quality Control tests and measurements.

Drilling Operations; FIO-RE.
Pressure Washing and Pressure Testing Operations; FIO-RE.
Cement and controlled low strength material Grouting Operations; FIO.

The Contractor shall submit in duplicate records of all grout hole and drain hole drilling operations, all pressure washing and pressure testing operations and all cement and controlled low strength material grouting operations. The originals of all such records shall be submitted to the Contracting Officer before final payment is made.

SD-13 Certificates

Qualifications; FIO-RE.

The Contractor shall submit evidence that the controlled low strength material grouting specialist or grouting foreman has had at least 3 years experience within the past 5 years on similar grouting type projects.

Grouting Equipment; GA-RE.

A plan of the proposed controlled low strength material grouting equipment types and layout shall be submitted for approval.

Grout Application; GA-RE.

The Contractor shall submit the method to be used in applying the controlled low strength material grout.

Qualifications; FIO-RE.

The Contractor shall submit evidence that he or his subcontractor is competent in concrete pipe and pipe jacking construction; and, the credentials of the concrete pipe and pipe jacking specialist shall be submitted eight weeks prior to the start of the concrete pipe and pipe jacking construction. This evidence will insure that the Contractor or his subcontractor will have sufficient competent personnel to carry out the operations specified and such personnel shall have experience in this type of construction. In particular, a concrete pipe and pipe jacking specialist shall be employed by the Contractor.

Concrete Pipe and Pipe Jacking Construction; FIO-RE.

The Contractor shall submit the methods to be used in the concrete pipe and pipe jacking construction.

Samples of Impervious Stratum; FIO-RE.

The Contractor shall submit procedures to obtain impervious stratum samples.

Tests; FIO-RE.

The Contractor shall submit the procedures to be used in quality control testing.

Portland Cement; GA-RE.

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and other precast parts.

Joints; GA-RE.

Certificates of compliance stating that the fittings or gaskets used for waste drains or lines designated on the plans as required are oil resistant.

Backfill; FIO-RE.

The Contractor shall submit the gradation of all imported borrow material which includes borrow area or commercial sources, laboratory certification of the physical characteristics of the soil including grain size analysis and Atterberg limits.

Concrete Pipe and Pipe Jacking Specialist; FIO-RE

Qualifications for the concrete pipe and pipe jacking specialist shall provide supervision and control of composition, mixing, placing, cleaning, and maintenance of the concrete pipe and pipe jacking specialist shall be on site at all times during trenching and backfilling operations.

1.3.1 REGULATORY REQUIREMENTS

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

U.S. ARMY CORPS OF ENGINEERS' ENGINEERING MANUALS (EM)

EM 1110-2-2901	(Sep 1978; Ch 1, Feb 1982) Tunnels and Shafts in Rock

1.4 JACKING PIPE

Concrete pipe shall be used for jacking and shall be tongue and groove design. The tongue shall be at the downstream end. Jacking frames shall be so constructed as to avoid breaking the pipe or out of alignment. The pipe shall preferably be jacked upgrade in order to provide drainage during excavation. Satisfactory means shall be provided for maintaining the lead pipe at the correct line and grade.

The pipe shall be installed according to specially prepared construction plans and specifications by the Contractor. The Contractor shall use a registered Engineer in the State of Missouri to create the documents. The Contractor set forth the construction procedure, extra pipe reinforcement and jack shield (if required) jacking pit location and shoring, and other special features for the safe and satisfactory he work. The Contractors Engineer shall submit plans prepared by the contractor giving the

construction details for review by the Engineer.

The Contractor shall grout the voids created by excavation during jacking operations if determined necessary by the Contracting Officer. Grout locations shall be recorded and a copy provided to the Contracting Officer upon completion of the work.

The contractor crew must continually monitor elevation and alignment of the road above during procedures. Jacking must be stopped and any problems corrected if road movement is detected.

The contractor shall set forth the construction plans and other necessary details and submit them for review by the Engineer.

The pipe can be pushed forward immediately after the soil is excavated, providing a completed tunnel liner for protection of workers and equipment.

1.5 PROCEDURE

General procedures for jacking concrete pipe sequence for tunneling and jacking concrete pipe are as follows:

Excavate jacking pits or shafts, construct jacking abutments or thrust blocks, and install jacks, jacking frame and guide rails.

Begin tunnel excavation by machine, or hand, depending on conditions.

Lower first section of pipe, position jacks and jacking frame, and jack pipe forward.

Continue excavation, remove soil through pipe, insert succeeding sections of pipe between the lead pipe and jacks and jack forward.

Repeat sequence, excavation, soil removal, pipe insertion and jacking, until the operation is complete.

1.6 Measurement and Payment

No separate measurement or payment will be made for work covered under this Section and all costs shall be included in the contract unit or lump sum price for the item of work to which the materials and work is incidental.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Concrete Pipe

Push concrete pipe shall be reinforced and conform to ASTM C 76, Class III

(THREE) or greater. Pipe shall be tongue and groove type, or modified tongue and groove type.

2.1.2 Portland Cement For Concrete Pipe and Fittings

Portland cement shall conform to ASTM C 150, Type III for concrete used in concrete pipe, concrete pipe fittings. Air-entraining admixture conforming to ASTM C 260 shall be used with Type V cement.

2.2 REQUIREMENTS FOR FITTINGS

Fittings shall be compatible with the pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and other requirements specified below.

2.2.1 Fittings for Concrete Pipe

ASTM C 76 for pipe.

2.3 JOINTS

Joints installation shall comply with the manufacturer's instructions. Fittings and gaskets utilized for waste drains or industrial waste lines shall be certified by the manufacturer as oil resistant.

2.3.1 Concrete Pipe Jointing

Joints and gaskets shall conform to ASTM C 443.

2.4 CEMENT MORTAR

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.5 PORTLAND CEMENT CONCRETE

Portland cement concrete shall conform to ASTM C 94. Concrete used for cradle and encasement shall have a compressive strength of 4000 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days. ASTM C 33 for Concrete Aggregates

2.6 OTHER MATERIALS

The requirements for the materials to be utilized in the concrete pipe and pipe jacking construction are as follows:

2.6.1 Water

The Contractor shall supply all water required for mixing with controlled low strength material to produce slurry. The water shall be clean, fresh, and comply with the standards specified below:

a. A pH equal to 7.0 plus or minus 1.0 .

b. Total dissolved solids not greater than 500 parts per million.

c. Oil, organics, acids, alkali, or other deleterious substances not greater than 50 parts per million each.

d. Hardness less than or equal to 50 ppm.

The Contractor shall furnish water quality test results for water used for mixing the controlled low strength material concrete pipe and pipe jacking to assure conformance with the above limits.

2.6.2 Additives

Admixtures of the types used in the control of oil field drilling muds such as thinners, dispersants, and flocculants may be used to control standard properties of the slurry for the concrete pipe and pipe jacking such as apparent viscosity and filtration characteristics subject to approval. Peptizing or bulking agents shall not be mixed with the slurry.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Jacking Pipe Through Fills

Methods of operation and installation for jacking pipe through fills shall conform to requirements specified in Volume 1, Chapter 1, Part 4 of AREMA Manual.

3.1.2 Pipe Laying

a. Pipe shall be protected during handling against impact shocks and free fall; the pipe interior shall be free of extraneous material.

b. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the sewer has a uniform invert. As the work progresses, the interior of the sewer shall be cleared of all superfluous materials.

c. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints shall then be placed, fitted, joined, and adjusted to obtain the degree of water tightness required.

3.1.2.1 Trenches

Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for as long a period as required. When work is not in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.

3.1.2.2 Backfill

As soon as possible after the joint is made, sufficient backfill material shall be placed along the pipe to prevent pipe movement off line or grade.

3.1.2.3 Width of Trench

If the maximum width of the trench at the top of the pipe, as specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, is exceeded for any reason other than by direction, the Contractor shall install, at no additional cost to the Government, concrete cradling, pipe encasement, or other bedding required to support the added load of the backfill.

3.1.2.4 Jointing

Joints between different pipe materials shall be made as specified, using approved jointing materials.

3.1.2.5 Handling and Storage

Pipe, fittings and joint material shall be handled and stored in accordance with the manufacturer's recommendations.

3.2 CONCRETE CRADLE AND ENCASEMENT

The pipe shall be supported on a concrete cradle or encased in concrete where day lighted on both ends. It shall run from the day lighted end to three foot after the first joint which is fully entombed by the embankment two foot from top pipe to grade line. The day lighted end shall also have a one foot thick cast in place cutoff wall from one foot top of pipe to three feet below grade line at bottom of pipe. The cut off wall shall extend twenty four inches on each side of the pipe. The full total height is six feet plus the pipe wall thickness. The full width is four feet plus the pipe wall thickness. The contractor shall design the 4000 psi at 28 days concrete design mix, concrete reinforcement and footing by a Professional Engineer in the State of Missouri.

3.3 WASTE WATER and GROUT

Grout that cannot be placed or injected prior to initial set or maximum specified time limit shall be wasted. During the progress of the work, the Contractor shall provide for adequate disposal of all wash and waste water and remove all waste grout, on a daily basis if necessary, to maintain a safe and effective grouting operation.

3.4 RECORDS

The Contractor shall prepare on a daily basis records of all controlled low strength material grout hole and drain hole drilling operations, all pressure washing and pressure testing operations and all cement and controlled low strength material grouting operations. These records shall include: driller's logs of all controlled low strength material grout

holes, drain holes, and exploratory holes; pressure washing information and pressure testing results; grouting data including time of each change of operation, rate of pumping, grouting pressures, changes in water-cement ratio, changes in proportions of additives such as fluidifier, accelerator, or sand, and amounts of various materials injected ; and other data considered necessary as determined by the Government Representative. Blank report forms of the type to be used are attached at the end of this specification.

3.5 CONTRACTOR QUALITY CONTROL

In accordance with Section 01451 CONTRACTOR QUALITY CONTROL, quality control shall be established and maintained which shall specifically include, but not be limited by, inspections to assure that:

a. The specified qualification requirements are met.

b. Drilling and grouting equipment is provided as specified and maintained in satisfactory condition.

c. The required amount of cement is kept on hand during grouting operations.

d. Grouting is performed in the presence of a Government Representative.

e. Required records are kept and submitted as specified.

f. Accurate cement grout mixture proportions are maintained as recommended by the manufacturer or supplier.

g. Materials are properly protected from moisture and contamination after delivery and transportation to the site.

h. Only approved materials are used.

i. The quantity of bulk materials used equals the computed amount.

3.6 PREPARATION

3.6.1 Equipment

The Contractor shall furnish all necessary plant and equipment for efficiently stripping, cutting, and/or filling to form the slurry-mixing and equipment-operating surface; excavating the trench; mixing and placement of backfill; disposal of undesirable excavated material in accordance with other provisions of this contract; and, preparation for and placement of the final cap on the completed trench, and for quality control testing of the materials used in such process.

3.6.1.1 Trench Excavation

Equipment for excavating the trench shall be any type of earth moving or drilling equipment capable of performing the indicated work on the drawings

and/or as specified. The equipment shall be that which reduces live-load surcharge to a level that will produce no significant contribution to the instability of the trench. Regardless of the equipment type used, it shall be capable of excavating the required work.

3.6.1.2 Mixing and Placing concrete pipe and pipe jacking

Concrete pipe and pipe jacking mixing and placing equipment will be approved by the Contracting Officer. The concrete pipe and pipe jacking mixing plant shall be equipped with a high-speed/high-shear, colloidal mixer or a high-velocity/high pressure venturi jet mixer used in conjunction with a high-speed/high-shear centrifugal pump. The plant shall be equipped with a mechanically or hydraulically agitated sump and shall include pumps, valves, hoses, supply lines, tools, and other equipment and materials required to prepare the concrete pipe and pipe jacking and deliver it in a continuous supply from the hydration location to the concrete pipe and pipe jacking operations. The Contractor shall have sufficient ponds and pits for storage of hydrated controlled low strength material slurry. The ponds and pits shall be mechanically or hydraulically agitated.

3.6.1.3 Cleaning of concrete pipe and pipe jacking

Concrete pipe and pipe jacking cleaning equipment shall include but not be limited to a vibratory shaker screen, centrifugal sand separator, and/or stilling ponds.

3.7 CONTROLLED LOW STRENGTH MATERIAL CONSTRUCTION

3.7.1 General

The concrete pipe and pipe jacking shall be constructed to the elevations, lines, grades, and cross-sections shown and in accordance with these specifications, unless otherwise directed. The Government may modify the dimensions and quantities of the work as determined necessary. The Contractor shall submit a general work sequence schedule and layout plan of operations for approval, a minimum of four weeks prior to the start of construction.

3.7.2 Placement of concrete pipe and pipe jacking

Concrete pipe and pipe jacking shall be introduced into the trench at the time excavation begins. The level of the concrete pipe and pipe jacking in open trenches shall be at all times maintained a minimum of 2 feet above ground water level and no more than 1 foot below the working surface until the placement of backfill material is complete. The Contractor shall have sufficient personnel, equipment, concrete pipe and pipe jacking storage areas, and stored concrete pipe and pipe jacking materials ready to raise the concrete pipe and pipe jacking level at all times in the excavated trench during construction within the limitations specified and subparagraphs thereof. To this end, the Contractor shall have personnel on call to raise the concrete pipe and pipe jacking level at any time this occurs, weekends and/or holidays included. Dilution of concrete pipe and pipe jacking by surface waters shall be prevented. The quality of the

concrete pipe and pipe jacking shall be maintained at all times, including periods of work stoppage, in a condition which meets the requirements set forth.

3.7.3 Excavated Material

Material excavated from the trench (meeting the requirements of BACKFILL, shall be used in the backfill. Material to be used in the backfill shall be stockpiled for subsequent processing in approved areas. Upon completion of waste operations, the waste areas shall be seeded in accordance with Section SEEDING.

3.7.4 Backfilling Trench in Case of High Water

In the event the ground water rises or is expected to rise to within 1 foot of the top of the working surface, the Contracting Officer reserves the right to require the Contractor to stop excavation and to begin continuous operations to either dike around the open trenches and raise the concrete pipe and pipe jacking levels or to fill all or part of the open trenches with concrete pipe and pipe jacking backfill mixed and placed as specified in the specifications. Continuous operations shall consist of expeditiously performing the required operations twenty-four hours per day until the operations are completed or the water level falls to a depth of more than 1 foot below the top of the working surface.

3.7.5 Cleanup

Removal of all excavation spoil, unused backfill, and concrete pipe and pipe jacking shall be accomplished following completion of final backfilling and trench site compacting and grading. These materials will be disposed of offsite. During final disposal of the slurry, the material shall be flocculated to separate the controlled low strength material from the water. The flocculated controlled low strength material material shall be placed in the designated disposal areas and the water shall be disposed of in an approved manner.

3.8 TESTS

The Contractor shall be responsible for project quality control records. Observation, measurements, and tests described in these specifications shall be performed for quality control. All quality control records, routine testing procedures, observations, and measurements shall be available for inspection at any time.

3.8.1 Not Used.

3.8.2 Records

Records shall be maintained by the Contractor for all testing, measurements, and inspections performed to ascertain that the concrete pipe and pipe jacking construction meets the specifications. Required reports, records, and documentation shall be furnished to the Government daily. The Contractor's required records are outlined below.

3.8.2.1 As-Built Profile

An as-built profile of the trench bottom, backfill slopes including descriptions of materials encountered in the trench bottom shall be continuously maintained by the Contractor. This profile shall indicate extent of excavation.

3.8.2.2 Results

The results of all construction control testing required in these specifications, including water tests, concrete pipe and pipe jacking tests, and backfill tests shall be furnished by the Contractor. The Contractor shall furnish records of all observations, measurements, and tests performed, identified with the location and time of testing. These records shall be furnished no later than 48 hours after the tests, measurements, and/or observations were made.

3.8.2.3 Construction Log

The Contractor shall maintain a construction log of daily activities which shall include delays encountered during construction, causes of delays, locations of affected areas, and extent of delays. The log shall also record unusual conditions or problems encountered, and the dispositions made.

-- End of Section --

SECTION 02456

STEEL H-PILES
02/98

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

1.1.1 Section 02331 LEVEE CONSTRUCTION AND EARTHWORK

1.1.2 Section 02316 EXCAVATION, TRENCING, AND BACKFILLING FOR UTILITIES SYSTEMS AND STRUCTURES

1.2 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 572/A 572M	(1999) High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality
ASTM D 1143	(1981; R 1994e1) Piles Under Static Axial Compressive Load
ASTM D 3689	(1990) Individual Piles Under Static Axial Tensile Load
ASTM D 3966	(1990) Piles Under Lateral Loads

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1998) Structural Welding Code - Steel

1.3 STANDARD UNIT PRICE BREAK DOWN

(1) Furnishing and Delivering Steel H-Piles

a. Payment will be made for costs associated with furnishing and delivering the required lengths of permanent piles to the work site. No payment will be made for piles damaged during delivery, storage, handling, or driving to the extent that they are determined by the Contracting Officer to be unsuitable for the work.

b. Furnishing and delivering permanent piles will be measured for payment by the linear foot of piles required below the cutoff elevation as indicated, plus an additional length of five feet per pile to allow for cutoffs etc.

c. Unit of measure: linear foot.

(2) Driving Steel H-Piles

a. Payment will be made for costs associated with driving permanent piles, which includes costs of handling, driving, measuring pile heave, re-driving heaved piles, cutting off piles at the cutoff elevation and removing cutoffs from the work site, furnishing and installing pile seismic anchors, compiling and submitting pile driving records, backfilling voids around piles, and any other items incidental to driving piles. No payment will be made for misplaced piles or piles exceeding the maximum limits for rotation, lateral deviation, and variation in alignment. No payment will be made for piles impaired during driving as the result of Contractor negligence to the extent that they are determined by the Contracting Officer to be unsuitable for the work.

b. Permanent piles will be measured for payment for driving on the basis of lengths, to the nearest tenth of a linear foot, along the axis of each pile acceptably in place below the grade shown on the drawings.

c. Unit of measure: linear foot.

(3) Steel H-Pile Compressive Load Tests

a. Payment will be made for costs associated with steel H-pile compressive load tests, including material and labor for fabricating and furnishing load frames; furnishing, fabricating, and mounting of telltales; calibrating load cells, hydraulic jacks, and gages; furnishing specified test equipment; placing and removing test loads and test equipment; recording, reducing, and submitting test data; and compiling and submitting pile load test reports. No payment will be made for rejected pile compressive load tests.

b. Steel H-pile compressive load tests will be measured for payment on the basis of the number of compressive load tests required.

c. Unit of measure: each.

(4) Steel H-Pile Tensile Load Tests

a. Payment will be made for costs associated with steel H-pile tensile load tests, including material and labor for fabricating and furnishing load frames; furnishing, fabricating, and mounting of telltales; calibrating load cells, hydraulic jacks, and gages; furnishing specified test equipment; placing and removing test loads and test equipment; recording, reducing, and submitting test data; and compiling and submitting pile load test reports. No payment will be made for rejected pile tensile load tests.

b. Steel H-pile tensile load tests will be measured for payment on the basis of the number of tensile load tests required.

c. Unit of measure: each.

(5) Steel H-Pile Lateral Load Tests

a. Payment will be made for costs associated with lateral load

tests on a pair of steel H-piles, including material and labor for fabricating and furnishing load frames; calibrating load cells, hydraulic jacks, and gages; furnishing specified test equipment; placing and removing test loads and test equipment; recording, reducing, and submitting test data; and compiling and submitting pile load test reports. No payment will be made for rejected pile lateral load tests.

b. Steel H-pile lateral load tests will be measured for payment on the basis of the number of lateral load tests required.

c. Unit of measure: lump sum.

(6) Steel H-Pile Splices

a. Payment will be made for costs associated with steel H-pile splices, including all plant, labor, and material required to make the splice.

No separate measurement or payment will be made for work covered under this Section and all costs shall be included in the contract unit or lump sum price for the item of work to which the materials and work is incidental.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation. Submittals having an "FIO" designation are for information only. When used, a designation following the "GA" 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 Data

Pile Driving Equipment; GA-GL.

Descriptions of pile driving equipment shall be submitted for approval at least 30 days prior to commencement of work. The equipment submittal shall include results of the Contractor's WEAP analysis in support of the equipment's viability in meeting the requirements of this contract action as described in paragraph 3.2 PILE DRIVING EQUIPMENT of this specification section.

Pile Testing Subcontractor; GA-EC

The proposed Pile Testing Subcontractor along with appropriate resumes shall be submitted for approval at least 30 days prior to commencement of work.

Pile Driving Records; GA-RE

The proposed forms and database for compiling pile driving records shall be submitted for approval 30 days prior to commencement of work.

Delivery, Storage and Handling; GA-GL

Delivery, storage and handling plans for piles shall be submitted for

approval at least 30 days prior to delivery of piles to the job site.

Pile Tests; GA-GL

Pile load test plan shall be submitted for approval at least 30 days prior to installing any test piles. Approval of the plan shall not relieve the Contractor of the responsibility for structural and operational adequacies of the testing system.

SD-04 Drawings

Pile Splices; GA-EC

Detail drawings of pile splices must be submitted and approved 30 days prior to pile installation.

Pile Placement; GA-GL

Pile placement plan shall be submitted for approval at least 30 days prior to delivery of piles to the job site.

SD-09 Reports

Mill Inspection; GA-EC

The mill inspection report shall be submitted for approval 30 days prior to rolling of any piles for the project.

Pile Driving Tests; GA-GL

Pile driving test data shall be submitted for approval within 1 day after each test is completed.

Pile Load Tests; GA-GL

Four copies of the load test report for each pile tested shall be submitted within 10 days after the load test is completed. Fax copies to: Kansas City District, Local Protection Section, (816) 426-3690. Typed formal reports shall be submitted within 5 days after completion of all test piles at each structure location. The Load Test Report shall, at a minimum, contain all information listed herein plus as listed in paragraph 8 of ASTM D 1143 for compressive pile tests, paragraph 9 of ASTM D 3689 for tensile load tests, and paragraph 9 of ASTM D 3966 for lateral load tests.

SD-18 Records

Pile Driving Records; GA-GL.

Fully completed pile driving records shall be submitted daily.

1.5 DELIVERY, STORAGE, AND HANDLING

Delivery, storage and handling of materials shall conform to the requirements specified herein and in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS. Plans for the delivery, storage and handling of piles shall be developed and submitted for approval.
DELETED

1.5.1 Delivery and Storage

Piles shall be stacked during delivery and storage so that each pile is maintained in a straight position and is supported along its length, ends inclusive, per the approved submittal, to prevent exceeding the maximum pile camber or sweep. Piles shall not be stacked more than 5 feet high unless approved by the Contracting Officer.

1.5.2 Handling

Point pick-up devices shall be of the type that clamp to both pile flanges at each pick-up point. Holes may be burned in the flanges or webs of piles above the cutoff location for lifting piles into the leads provided it does not lead to damage of the pile during driving. Piles shall not be dragged across the ground. The Contractor shall inspect piles for excessive camber and sweep and for damages before transporting them from the storage area to the driving area and immediately prior to placement in the driving leads. Camber, curvature in the pile in the direction normal to the pile flanges, shall be measured with the pile flange base laying on a flat surface and shall be the distance between the flange base at the mid-length of the pile and the flat surface. Sweep, curvature in the pile in the direction parallel to the pile flanges, shall be measured with the pile flange tips laying on a flat surface and shall be the distance between the flange tips at the mid-length of the pile and the flat surface. The maximum permissible camber and/or sweep shall be

3/8 in. + [1/8 in. x ([total length ft. - 45]/10)]

over the length of the pile. Piles having excessive camber or sweep will be rejected.

1.6 PERSONNEL

1.6.1 General

The Contractor shall engage the services of a specialized pile testing subcontractor to perform all aspects of the required pile testing program. This subcontractor must be specialized in the field of pile testing and shall have proven expertise to perform all pile testing herein specified.

1.6.2 Qualifications

The pile testing subcontractor shall provide a field engineer who shall be on site full time during the pile driving activities for the project. This field engineer shall, at a minimum, have a Bachelor of Science Degree in Civil Engineering with a minimum of three years experience devoted to the monitoring of foundation pile installations. The field engineer shall be experienced in the performance of pile load tests. The field engineer shall be a Registered Professional Engineer. A second engineer with the same qualifications will be required if the testing operation requires multi-shifts. In addition, the pile testing subcontractor shall identify a pile testing supervisor who shall be a principal of the firm with at least ten years experience in geotechnical engineering, of which at least five years experience has been devoted to the design and testing of pile foundations for major construction projects. The Contractor shall submit the name of the proposed pile testing subcontractor within 10 days of the date of contract award. The Contractor shall, in his submittal, outline the experience of the subcontractor and name the proposed field engineer, the proposed supervisor, and shall provide

detailed resumes for each. If the subcontractor and individuals meet the Government's approval, the Contractor shall be so notified within 30 days after receipt of the qualifications.

1.6.3 Responsibility

The pile testing subcontractor shall be responsible for the performance of all pile testing specified herein. This includes the compressive, tensile, lateral, and pile driving tests. The pile testing subcontractor shall be responsible for preparation of all submittals related to pile testing and of reports showing the results of all tests performed. The reports shall include an analysis of the data and a presentation of conclusions.

PART 2 PRODUCTS

2.1 MATERIALS

Material orders, materials lists, and materials shipping bills shall conform to the requirements of Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

2.1.1 Steel

Steel for H-piles and splice plates shall conform to ASTM A 572/A 572M, grade 50.

2.1.2 H-Piles

H-piles shall be of the shape and sections shown on the drawings (HP14 x 102) and shall have standard square ends unless otherwise directed. Lengths of piles shall be as determined by pile testing as specified herein.

2.2 FABRICATION

Fabrication shall conform to the requirements shown on the drawings and specified herein and in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

2.2.1 Pile Splices

Detail drawings of pile splices shall be submitted for approval.

PART 3 EXECUTION

3.1 SITE PREPARATION

All pile driving sites included in this contract action shall be prepared by the Contractor per Specification Section 02331 LEVEE CONSTRUCTION AND EARTHWORK and Section 02316 EXCAVATION, TRENCING, AND BACKFILLING FOR UTILITIES SYSTEMS AND STRUCTURES.

3.2 PILE DRIVING EQUIPMENT

The Contractor shall select the proposed pile driving equipment, including hammers and other required items, and submit complete descriptions of the proposed equipment for approval including all information listed in

paragraph 3.2.1.1. The Contractor shall perform a wave equation analysis using a current version of Wave Equation Analysis for Piles (WEAP) program, or other approved computer program, on the proposed driving system prior to submittal to verify the system's ability to successfully meet project requirements. The results of the analysis must be included in the pile driving equipment submittal. The pile driving system must be capable of developing the required maximum ultimate load without exceeding 10 blows per inch and 90% of the specified yield stress of the pile. The pile driving equipment must be capable of re-driving piles if there is an interruption in driving. The contractor should be aware that there may be significant soil set-up if driving of a pile is not continuous. Final approval of the proposed equipment is subject to the satisfactory completion and approval of pile tests. Changes in the selected pile driving equipment will not be allowed after the equipment has been approved by the Contracting Officer except as specified herein and directed by the Contracting Officer. No additional contract time will be allowed for Contractor-proposed changes in the equipment.

3.2.1 Pile Driving Hammers

Pile driving hammers shall be of the impact type.

3.2.1.1 Impact Hammers

Impact hammers shall be steam, air, hydraulic, or diesel hammers of the single acting, double-acting, or differential acting type. The size or capacity of hammers shall be determined by the Contractor as specified in paragraph 3.1. Hammers shall be capable of driving to 20 blows per inch. Boiler, compressor, or engine capacity shall be sufficient to operate hammers continuously at the full rated speed. Hammers shall have a gage to monitor hammer bounce chamber pressure for closed-top diesel hammers or pressure at the hammer supply line for air and steam hammers. This gage shall be continuously operated during the driving of piles and shall be mounted in an accessible location for monitoring by the Contractor and by the Contracting Officer. Two spare operational bounce chamber read out units shall be available on site. The Contractor shall provide bounce chamber pressure gage correction tables and charts for the type and length of hose to be used with the pressure gage to the Contracting Officer. The hammer must be clearly marked at all times to identify the magnitude of the rated stroke and manufacturer's recommended position of the stroke. The Contractor shall arrange for a representative of the hammer manufacturer to visit the site during initial test pile driving to inspect and verify that the hammer is operating to the manufacturer's specifications. The manufacturer's representative shall provide a letter report of his findings to the Contracting Officer. The Contractor shall submit the following information for each impact hammer proposed:

a. Make and model;

b. Ram weight (pounds);

c. Anvil weight (pounds);

d. Rated stroke and range of stroke for variable stroke hammers(inches);

e. Rated energy range (foot-pounds);

f. Rated speed (blows per minute), chart of speed vs. stroke for

open-top diesel hammers;

g. Steam or air pressure, hammer, and boiler and/or compressor (pounds per square inch);

h. Rated energy vs. bounce chamber pressure curves or charts, including pressure correction chart for type and length of hose used with pressure gage (pounds per square inch);

i. Pile driving cap, make, dimensions, and weight (pounds);

j. Cushion block dimensions and material type, modulus of elasticity, coefficient of restitution, and supporting test data;

k. Power pack description and specifications;

l. Hammer Operation Manual;

m. Hammer Maintenance/Parts Manual; and,

n. Identify any modifications that have been made to the hammer that make it different from the manufacturers standard.

3.2.2 Pile Driving Leads

Hammers shall be supported and guided with fixed leads supporting at a minimum of 2 points during driving. At least one intermediate support for the pile in the leads shall be provided to reduce the unbraced length of the pile during driving. The leads shall be longer than the pile being driven.

3.2.3 Jetting

Jetting of piles is not permitted.

3.3 INSTALLATION

3.3.1 Lengths of Permanent Piles

The estimated quantities of piles listed in the unit price schedule are given for bidding purposes only. After completion of pile load testing and pile driving testing, the Contractor shall evaluate the results and submit a schedule showing the proposed lengths of piles. The proposed length shall be measured from estimated tip to cutoff elevation plus an additional five feet. All piles shall be driven to the minimum embedment (possess the minimum length) as determined by load testing and have the minimum design capacities as listed in the table below.

Pile Rows	Estimated Design Number of Piles	Required Design Embedment Depth1 (ft.)	Required Design Compress. Capacity (kips)	Required Design Tensile Capacity (kips)	Lateral Capacity (kips)	Load Tests Required
1	14	40	127	34	47	CTL
2	11	50	127	34	47	---

Pile Rows	Estimated Design Number of Piles	Required Design Embedment Depth1 (ft.)	Required Design Compress. Capacity (kips)	Required Design Tensile Capacity (kips)	Lateral Capacity (kips)	Load Tests Required
3	11	50	127	34	47	---

C - Compressive Load Test Required
T - Tension Test Required
L - Lateral Load Test Required

The Contractor shall base his bid on the assumption that the driving criteria for all piles may be that required to obtain design compressive and tensile capacities as listed in the above table. The proposed lengths shall be submitted for individual monoliths after all load test are complete and the driving tests are completed. The piles may not be ordered until the lengths of permanent piles are approved by the Contracting Officer.

3.3.2 Pile Driving Records

The Contractor shall develop a form for compiling pile driving records which must be submitted to and approved by the Contracting Officer. Complete and accurate records of the pile driving operations shall be compiled on the approved forms and submitted daily. Driving records for each pile shall include: date driven; name of inspector; pile identification number; location; pile dimensions; furnished and driven length; ground elevation, final tip elevation, and final cutoff pile length; rig number; description of hammer used; recommended and actual blow rate; recommended and actual stroke; indication of stroke position; required and actual boiler, compressor, or bounce chamber pressure; number of blows required for each foot of penetration throughout the entire length of the pile and for each inch of penetration in the last foot of penetration; final rate of penetration; time of the start and finish of driving and total driving time in minutes and seconds; and, any other pertinent information as required or requested by the Contracting Officer such as unusual driving conditions, interruptions or delays during driving, damage to pile resulting from driving, heave in adjacent piles, splice location, length of additional splice pile, depth of additional driving, and depth and description of voids formed adjacent to the pile. All information for each pile shall be put on a one page record. Each pile shall have a separate record. A summary report shall also be prepared for each shift for each rig. The report shall summarize important information for every pile driven by that rig during a shift. The report shall contain: the date; rig number; hammer identification; inspectors name; time of day; pile identification; furnished length; boiler, compressor, or bounce chamber pressure; hammer speed; final penetration rate; penetrated length; ground elevation; cutoff length; and notes identifying any interruptions, delays, damage, rejections, down time, or any other pertinent information. The Contractor shall also develop a computer database using PC-compatible software, in which all of the information from the daily driving records are entered on a daily basis. An updated database shall be furnished to the Government on a weekly basis.

3.3.3 Pile Placement

A pile placement plan which shows the installation sequence and the methods

proposed for controlling the location and alignment of piles shall be developed and submitted for approval. The plan shall identify each pile with an unique designation. Foundation preparation shall be completed according to Section 02331 LEVEE CONSTRUCTION AND EARTHWORK and Section 02316 EXCAVATION, TRENCING, AND BACKFILLING FOR UTILITIES SYSTEMS AND STRUCTURES prior to the placement of piles for driving. Piles shall be placed accurately in the correct location and alignments, both laterally and longitudinally, and to the vertical lines indicated. The Contractor shall establish a permanent base line to provide for inspection of pile placement by the Contracting Officer during pile driving operations. The base line shall be established prior to driving permanent piles and shall be maintained during the installation of the permanent piles. A stake shall be placed at the location of each pile with the pile designation clearly marked. A final lateral deviation from the correct location at the cutoff elevation of not more than 3 inches will be permitted for piles. A final variation in alignment of not more then 1/4 inch per foot of longitudinal axis will be permitted. A final variation in rotation of the pile about the center line of the web of not more than 7.5 degrees will be permitted. A vertical deviation from the correct cut off elevations shown on the drawing of not more than 0-inches above to 2-inches below will be permitted. The correct relative position of all piles shall be maintained. Piles not located properly or exceeding the maximum limits for rotation, lateral deviation, and/or variation in alignment shall be rejected and no payment will be made for this pile. Replacements for such rejected piles shall be installed at locations directed by the Contracting Officer.

3.3.4 Pile Penetration Criteria

The piles are estimated to require driving to 40-foot embedment depth for pile line 1 and 50-feet for remaining pile lines. The production pile tip elevation, pile lengths, and the required final blow count shall be as determined from load testing. It is the responsibility of the Contractor to provide a pile driving system that will efficiently drive the piles to the required depth and blow count. The controlling depth of penetration and blow count (number of blows required to attain the final inch of penetration) for permanent piles will be determined subsequent to the analysis of pile tests as specified in paragraph 3.4 PILE TESTS. If a pile reaches the required final blow count prior to the minimum penetration, driving of the pile shall continue until the pile is driven to refusal (20 blows per inch for 3 inches) or 40 feet for pile line 1 or 50-feet for lines 2 and 3. The Contracting Officer must approve any pile that does not have the computed penetration for inclusion in the permanent work. The Contracting Officer may at this time direct that a boring be performed to evaluate the subsurface conditions at this location. Any pile that has been driven to grade without reaching the required blow count shall be spliced and driven until the required blow count is obtained. The Contractor should be aware that re-driving of piles after any interruption may be difficult due to the potential for soil setup.

3.3.5 Pile Driving

The Contracting Officer shall be notified 30 days prior to the date pile driving is to begin. Piles shall not be driven within 100 feet of concrete less than 7 days old unless otherwise authorized. Permanent and test piles shall be driven with hammers of the same model and manufacturer, same energy and efficiency, and using the same driving system. Hammers shall be operated at the speed and under the conditions recommended by the manufacturer subject to the approval of the Contracting Officer. All piles shall be clearly marked in 1 foot increments and 1 inch increments within

5-feet of design tip elevation as appropriate, prior to driving. Where heave is anticipated, the sequence of installation shall be such that pile heave is minimized. Prior to driving and with the pile top seated in the drive head, each pile shall be checked to ensure that it has been aligned correctly and that the orientation of the web about the centerline is as shown on the drawings. Once pile driving has begun, conditions such as alignment shall be kept constant. Each pile shall be driven continuously and without interruption until the required depth of penetration and required blow count has been attained. Deviation from this procedure may be cause for rejection of the pile. A pile that cannot be driven to the required depth because of an obstruction, as indicated by a sudden unexplained change in blow count and/or drifting, shall be cut off and abandoned and replaced. If the Contracting Officer determines that the replacement was required from no fault of the Contractor, approval for payment for both piles will be made. After piles are driven, they shall be cut off square to the finished groundline at the indicated cutoff elevation. The piles shall be marked prior to cutoff in such a manner that a legible footage mark remains after cutoff. Also, each pile shall have its designation clearly marked on the pile. Any voids developed around the piles as a result of driving shall be backfilled with dry, powdered bentonite and rodded to completely fill the void to the ground surface elevation. Field hydration of the bentonite is not required.

3.3.5.1 Splicing Piles

Full length piles must be used. Only a pile that has not reached the required blow count when the pile has been driven to grade may be spliced and driven to a sufficient depth to develop the required blow count. Piles with more than one splice will not be permitted. A complete penetration groove-weld splice shall be used per AWS D1.1. The H-pile splice shall be capable of developing the equivalent yield strength and modulus of elasticity of the unspliced pile cross-section in bending, compression, and tension. Ends of the piles to be spliced shall be square so that full contact can be made between the abutting flanges and webs. Squaring, when required, shall be done by sawcutting or flame cutting with a strait edge. Field welding materials and workmanship for all piling shall conform to AWS D1.1. All welders shall be certified as specified in Section 05055.

3.3.5.2 Heaved Piles

When driving piles, measurements shall be accomplished by the Contractor to detect heave of adjacent piles. If heave exceeds 1/4 inch, the pile shall be backdriven to original depth of penetration without additional cost to the Government.

3.3.5.3 Pile Cutoffs

Lengths of cutoffs will be determined by subtracting the actual length driven below cutoff elevation and the length indicated on the drawings or as directed. Fifty percent allowance will be made for cutoffs.

3.4 PILE TESTS

Pile load tests shall be performed as specified herein or as directed by the Contracting Officer. The pile testing subcontractor shall perform all pile load tests, and shall then develop the correlation between pile driving resistance, pile length, and pile capacity for the selected pile driving system. A report shall be prepared recommending pile lengths and blow counts required to obtain the design capacities of the piles. The

report shall contain all of the data from the pile load tests, all assumptions, calculations, and analyses. The Davisson Criteria shall be used to determine the ultimate capacities from the load test data. The report shall be submitted to the Contracting Officer for approval of the required blow counts and lengths of permanent piles required to achieve the specified design capacities for compression, tension, and lateral loads.

Changes in the approved pile driving system during or after completion of tests will not be allowed unless additional tests are performed as directed by the Contracting Officer to establish the correlation between driving resistance, length and pile capacity for the proposed changed system. For changes in the approved pile driving system proposed by the Contractor, required additional pile driving tests and pile load tests shall be performed at the Contractor's expense and no additional contract time will be allowed.

3.4.1 Piles for Testing

Test and reaction piles for compression, tension, and lateral load tests shall be 40-feet in length. Test and reaction piles utilized in load testing shall be vertically driven to the tolerances denoted in this specification section for production piles and shall be incorporated into the permanent work after the completion of the load testing program. Test piles shall be driven in the locations identified by the Contracting Officer. Test piles shall be driven with the same equipment specified in paragraph 3.2 PILE DRIVING EQUIPMENT and in the same manner specified in paragraph 3.3 INSTALLATION, subparagraph 3.3.5 PILE DRIVING. Pile driving data shall be recorded for each test pile driven as specified in paragraph 3.3 INSTALLATION, subparagraph 3.3.2 PILE DRIVING RECORDS. Test piles will be paid for under the same unit prices as the production piling. Test and reaction piles shall be included as part of permanent piling under this contract action.

3.4.2 Pile Load Tests

Pile load tests shall be performed under the supervision of the pile testing subcontractor. One each, compressive, tensile, and lateral load test shall be performed. The exact location of the tests shall be determined by the Contracting Officer. The test piles shall be driven to a final embedment depth as indicated in paragraph 3.4.1, PILES FOR TESTING. All piles to be load tested shall be driven at least 30 days prior to testing. The loading equipment shall be of sufficient capacity to apply two-hundred percent (200%) of the minimum design capacities as presented in paragraph 3.3.1 LENGTHS OF PERMANENT PILES of this specification section. Loading of each test pile shall be started when directed by the Contracting Officer. The Contractor shall be responsible for the application of loads. The magnitude of applied loads shall be accurately determined and controlled using a calibrated load cell and readout device. The hydraulic gate shall be separately serviced and calibrated. The jack and the hydraulic gage shall then be calibrated as a unit. Any pile load test not accomplished in accordance with this specification will be rejected. A new pile load test shall be conducted for each rejected pile load test. The pile testing subcontractor shall compile a report for each pile load test which shall include, as a minimum, all applicable information required by the ASTM specified test. Compressive and tensile load tests may not be performed on the same pile. A telltale to the pile tip shall be installed on all compressive and tensile test piles. The pile testing subcontractor shall develop and submit for approval a detailed pile load test plan which

shall include drawings as appropriate and contain the following information:

a. Method of reacting static test loads.

b. Method of shading (from the sun) the test pile and measuring systems.

c. Method of supporting reference beams.

d. Method of attaching and supporting dial gages for measuring pile movements.

e. Method and rate of applying static test load to piles.

f. Method of setup of secondary measurement system (surveyor's level, wire-scale-mirror, laser beam, etc.).

g. Details of loading frame and reaction systems design, including design computations and fabrication details.

h. Calibration curves for the load cell and readout device.

i. Details of telltale installation.

j. Location with specific pile designations of load test piles.

k. Copies of all load test data recording forms, tables, etc.

Approval of the plan shall not relieve the Contractor of the responsibility for structural and operational adequacies of the testing system.

3.4.2.1 Compressive Load Test

The Contractor shall perform one (1) pile compressive load test in accordance with ASTM D 1143 STANDARD TEST METHOD FOR PILES UNDER STATIC AXIAL COMPRESSIVE LOAD, as modified herein. The testing frame and measuring equipment shall be capable of applying a compressive load of 200% of the MINIMUM DESIGN COMPRESSIVE CAPACITY as indicated in paragraph 3.3.1 of this specification section. Loads shall be applied in accordance with paragraph 5.6 QUICK LOAD TEST of ASTM D 1143. Unloading shall be done with a minimum of 5 decrements.

3.4.2.2 Tensile Load Test

The Contractor shall perform one (1) pile tensile load test in accordance with ASTM D 3689 STANDARD TEST METHOD FOR INDIVIDUAL PILES UNDER STATIC AXIAL TENSILE LOAD, as modified herein. The testing frame and measuring equipment shall be capable of applying a compressive load of 200% of the MINIMUM DESIGN TENSILE CAPACITY as indicated in paragraph 3.3.1 of this specification section. Loads shall be applied in accordance with paragraph 7.7 QUICK LOAD TEST of ASTM D 3689. Unloading shall be done with a minimum of 5 decrements.

3.4.2.3 Lateral Load Test

The Contractor shall perform one (1) pile lateral load tests in accordance with ASTM D 3966 STANDARD TEST METHOD FOR PILES UNDER LATERAL LOADS, as modified herein. Each lateral load test shall consist of jacking two piles apart with a hydraulic jack, with one pile serving as the reaction pile for

the other. The test arrangement and measuring equipment shall be capable of applying a load of 200% of the MINIMUM DESIGN TENSILE CAPACITY as indicated in paragraph 3.3.1 of this specification section. The measuring devices shall allow the determination of deflection contribution of both the test and reaction pile separately. The loads shall be applied in accordance with paragraph 6.1 STANDARD LOADING PROCEDURES of ASTM D 3966. Required movement readings shall be made and recorded for each pile.

3.4.2.4 Additional Tests

If the number of tests are adjusted during pile installation, an equitable adjustment in contract price will be made as discussed in the Construction Clauses.

-- End of Section --

SECTION 02464

METAL SHEET PILING
05/92

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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 6/A 6M	(1995b) General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A 328/A 328M	(1993a) Steel Sheet Piling
ASTM A 572/A 572M	(1994c) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 690/A 690M	(1994) High-Strength Low-Alloy Steel H-Piles and Sheet Piling for Use in Marine Environments
ASTM A 857/A 857M	(1993a) Steel Sheet Piling, Cold Formed, Light Gage
ASTM B 221	(1995a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM B 221M	(1995a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)
ASTM B 308/B 308M	(1995a) Aluminum-Alloy 6061-T6 Standard Structural Shapes
ASTM A992/A992M	(1998) Steel for Structural Shapes for Use in Building Framing

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1993) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1	(1996) Structural Welding Code - Steel

1.2 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section, SUBMITTAL

PROCEDURES:

SD-01 Data

Layout, Design Drawings, and Calculations; GA-RE

Signed and sealed layout, design drawings and calculations for an excavation support system and other data prepared by, or under the supervision of, a qualified Professional Engineer registered in the State of Missouri. System design and calculations must be acceptable to local authorities having jurisdiction. Information shall be submitted 30 days prior to construction.

A Professional Engineer registered in the State of Missouri, legally authorized to practice in the jurisdiction where the project is located, and experienced in providing successful engineering services for systems similar in the extent required for this project is required.

SD-04 Drawings

Metal Sheet Piling; GA-RE.

Detail drawings for sheet piling including fabricated sections shall show complete piling dimensions and details, driving sequence and location of installed piling. Detail drawings shall include details and dimensions of templates and other temporary guide structures for installing piling. Detail drawings shall provide details of the method of handling piling to prevent permanent deflection, distortion or damage to piling interlocks.

APPURTENANT METAL MATERIALS; GA-RE.

SD-07 Schedules

Pile Driving Equipment; GA-RE.

Complete descriptions of sheet piling driving equipment including hammers, extractors, protection caps and other installation appurtenances shall be submitted for approval 30 days prior to commencement of work.

SD-08 Statements

Pulling and Redriving; GA-RE.

The proposed method of pulling sheet piling shall be submitted and approved prior to pulling any piling.

Materials Tests; FIO-RE.

Certified materials tests reports showing that sheet piling and appurtenant metal materials meet the specified requirements shall be submitted for each shipment and identified with specific lots prior to installing materials. Material test reports shall meet the requirements of ASTM A 6/A 6M.

SD-13 Certificates

Welder Qualifications; GA-RE.

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.1.

SD-18 Records

Driving; FIO-RE.

Records of the sheet piling driving operations shall be submitted after driving is completed. These records shall provide a system of identification which shows the disposition of approved piling in the work, driving equipment performance data, piling penetration rate data, piling dimensions and top and bottom elevations of installed piling.

1.3 DELIVERY, STORAGE AND HANDLING

Materials delivered to the site shall be new and undamaged and shall be accompanied by certified test reports. The manufacturer's logo and mill identification mark shall be provided on the sheet piling as required by the referenced specifications. Sheet piling shall be stored and handled in the manner recommended by the manufacturer to prevent permanent deflection, distortion or damage to the interlocks. Storage of sheet piling should also facilitate required inspection activities. Sheet piling over 80 feet in length shall be handled using a minimum of two pickup points.

1.4 QUALITY ASSURANCE

1.4.1 Engineer Qualifications

A Professional Engineer registered in the State of Missouri, legally authorized to practice in the jurisdiction where the project is located, and experienced in providing successful engineering services for excavation support systems similar in the extent required for this project is required.

1.4.2 Supervision

The Contractor shall engage and assign supervision of the excavation support system to a qualified Professional Engineer foundation consultant, registered in the State of Missouri.

The Contractor shall submit the name of the engaged consultant and qualifying technical experience to the Contracting Officer's Representative (COR).

1.4.3 Regulations

The Contractor shall comply with all codes and ordinances of the governing authorities having jurisdiction.

PART 2 PRODUCTS

2.1 METAL SHEET PILING

Layout, Design Drawings, and Calculations for fabrication systems which are designed by the Contractor for Metal sheet piling and APPURTENANT METAL MATERIALS shall be provided. Also Welder Qualifications for all welds.

Metal sheet piling shall be hot-rolled steel sections conforming to ASTM A 328/A 328M or 39 ksi unless otherwise noted, interlocked joint strength in tension as shown. Cold-formed steel sections shall be formed from hot-rolled steel meeting the chemical and mechanical requirements of ASTM A

328/A 328M. The interlocks of sheet piling shall be free-sliding, provide a swing angle suitable for the intended installation but not less than 5 degrees when interlocked, and maintain continuous interlocking when installed. Sheet piling shall be full-length sections of the dimensions shown. Fabricated sections shall conform to the requirement and the piling manufacturer's recommendations for fabricated sections. Sheet piling shall be provided with standard pulling holes. Metalwork fabrication for sheet piling studs shall be as specified and in Section, METALWORK FABRICATION, MACHINE WORK, AND MISCELLANEOUS PROVISIONS.

2.2 APPURTENANT METAL MATERIALS

Metal plates, shapes, bolts, nuts, rivets and other appurtenant fabrication and installation materials shall conform to manufacturer's standards and to the requirements specified in the respective sheet piling standards and in Section, MISCELLANEOUS METAL MATERIALS, STANDARD ARTICLES, AND SHOP FABRICATED ITEMS.

2.3 Steel Wales

Steel Wales shall meet ASTM A 572/A 572M or ASTM A992/A992M requirements.

2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

Requirements for material tests, workmanship and other measures for quality assurance shall be as specified and in Section, METALWORK FABRICATION, MACHINE WORK, AND MISCELLANEOUS PROVISIONS.

2.4.1 Materials Tests

Materials tests shall conform to the following requirements. Sheet piling and appurtenant materials shall be tested and certified by the manufacturer to meet the specified chemical, mechanical and section property requirements prior to delivery to the site. Testing of sheet piling for mechanical properties shall be performed after the completion of all rolling and forming operations. Testing of sheet piling shall meet the requirements of ASTM A 6/A 6M.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Pile Driving Equipment

Pile driving equipment shall conform to the following requirements.

3.1.1.1 Driving Hammers

Hammers shall be steam, air, or diesel drop, single-acting, double-acting, differential-acting type. The driving energy of the hammers shall be between 8,750 and 16,000 foot pounds as recommended by the manufacturer for the piling weights and subsurface materials to be encountered.

3.1.1.2 Jetting Equipment

Jetting equipment shall not be used.

3.1.2 Placing and Driving

3.1.2.1 Placing

Any excavation required within the area where sheet pilings are to be installed shall be completed prior to placing sheet pilings. Pilings shall be carefully located as shown. Pilings shall be placed plumb with out-of-plumbness not exceeding 1/8 inch per foot of length and true to line. Temporary wales, templates, master pilings or guide structures shall be provided to insure that the pilings are placed and driven to the correct alignment. At least two templates shall be used in placing each piling and the maximum spacing of templates shall not exceed 20 feet. Master pilings shall be used to maintain plumbness and proper configuration in placing cofferdam cells over 90 feet in height in water flowing at a velocity of more than four feet per second. Pilings properly placed and driven shall be interlocked throughout their length with adjacent pilings to form a continuous diaphragm throughout the length or run of piling wall.

3.1.2.2 Driving

Prior to driving pilings in water a horizontal line shall be painted on both sides of each piling at a fixed distance from the bottom so that it shall be visible above the water line after installation. This line shall indicate the profile of the bottom elevation of installed pilings and potential problem areas can be identified by abrupt changes in its elevation. Pilings shall be driven with the proper size hammer and by approved methods so as not to subject the pilings to damage and to ensure proper interlocking throughout their lengths. Driving hammers shall be maintained in proper alignment during driving operations by use of leads or guides attached to the hammer. A protecting cap shall be employed in driving when using impact hammers to prevent damage to the tops of pilings. Pilings damaged during driving or driven out of interlock shall be removed and replaced at the Contractor's expense. Pilings shall be driven without the aid of a water jet. Adequate precautions shall be taken to insure that pilings are driven plumb. If at any time the forward or leading edge of the piling wall is found to be out-of-plumb in the plane of the wall the piling being driven shall be driven to the required depth and tapered pilings shall be provided and driven to interlock with the out-of-plumb leading edge or other approved corrective measures shall be taken to insure the plumbness of succeeding pilings. The maximum permissible taper for any tapered piling shall be 1/8 inch per foot of length. Pilings in each run or continuous length of piling wall shall be driven alternately in increments of depth to the required depth or elevation. No piling shall be driven to a lower elevation than those behind it in the same run except when the pilings behind it cannot be driven deeper. If the piling next to the one being driven tends to follow below final elevation it may be pinned to the next adjacent piling. If obstructions restrict driving a piling to the specified penetration the obstructions shall be removed or penetrated with a chisel beam. If the Contractor demonstrates that removal or penetration is impractical the Contractor shall make changes in the design alignment of the piling structure as directed to insure the adequacy and stability of the structure. Pilings shall be driven to depths shown and shall extend up to the elevation indicated for the top of pilings. Piling driven to rock shall be seated individually on the rock. A tolerance of 1/8 inches above the indicated top elevation will be permitted. Pilings shall not be driven within 100 feet of concrete less than 7 days old.

3.1.3 Cutting-Off and Splicing

Pilings driven to refusal or to the point where additional penetration

cannot be attained and are extending above the required top elevation in excess of the specified tolerance shall be cut off to the required elevation. Pilings driven below the required top elevation and pilings damaged by driving and cut off to permit further driving shall be extended as required to reach the top elevation by splicing when directed at no additional cost to the Government. If directed pilings shall be spliced as required to drive them to depths greater than shown and extend them up to the required top elevation. Pilings adjoining spliced pilings shall be full length unless otherwise approved. If splices are allowed in adjoining pilings the splices must be spaced at least fivefeet apart in elevation. Splicing of pilings shall be as indicated. Ends of pilings to be spliced shall be squared before splicing to eliminate dips or camber. Pilings shall be spliced together with concentric alignment of the interlocks so that there are no discontinuities, dips or camber at the abutting interlocks. Spliced pilings shall be free sliding and able to obtain the maximum swing with contiguous pilings. The tops of pilings excessively battered during driving shall be trimmed when directed at no cost to the Government. Piling cut-offs shall become the property of the Contractor and shall be removed from the site. The Contractor shall cut holes in pilings for bolts, rods, drains or utilities as shown or as directed. All cutting shall be done in a neat and workmanlike manner. A straight edge shall be used in cuts made by burning to avoid abrupt nicks. Bolt holes in steel piling shall be drilled or may be burned and reamed by approved methods which will not damage the surrounding metal. Holes other than bolt holes shall be reasonably smooth and the proper size for rods and other items to be inserted.

3.1.4 Inspection of Driven Piling

The Contractor shall inspect the interlocked joints of driven pilings extending above ground. Pilings found to be out of interlock shall be removed and replaced at the Contractor's expense.

3.1.5 Pulling and Redriving

In the pulling and redriving of piles as directed, the Contractor shall pull selected pilings after driving to determine the condition of the underground portions of pilings. Any piling so pulled and found to be damaged to the extent that its usefulness in the structure is impaired shall be removed and replaced at the Contractor's expense. Pilings pulled and found to be in satisfactory condition shall be redriven when directed.

3.2 REMOVAL

The removal of sheet pilings shall consist of pulling, sorting, cleaning the interlocks, inventorying and storing previously installed sheet pilings as shown and directed.

3.2.1 Pulling

The method of pulling piling must be approved. Pulling holes shall be provided in pilings as required. Extractors shall be of suitable type and size. Care shall be exercised during pulling of pilings to avoid damaging piling interlocks and adjacent construction. If the Contracting Officer determines that adjacent permanent construction has been damaged during pulling the Contractor will be required to repair this construction at no cost to the Government. Pilings shall be pulled one sheet at a time. Pilings fused together shall be separated prior to pulling unless the Contractor demonstrates to the satisfaction of the Contracting Officer that

the pilings cannot be separated. Any voids left after pulling shall be grouted with cement/bentonite mix. The Contractor will not be paid for the removal of pilings damaged beyond structural use due to proper care not being exercised during pulling.

3.2.2 Sorting, Cleaning, Inventorying and Storing

Pulled pilings shall be sorted, cleaned, inventoried and stored by type into groups as:

a. Piling usable without reconditioning.

b. Piling requiring reconditioning.

c. Piling damaged beyond structural use.

-- End of Section --

SECTION 02630

STORM-DRAINAGE SYSTEM
03/00

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 basic designation only.

ACI INTERNATIONAL (ACI)

ACI 346/346R	(1990) Standard Specification for Cast-in-Place Nonreinforced Concrete Pipe and Recommendations

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-16	(1996) Standard Specifications for Highway Bridges
AASHTO M 167	(1994) Corrugated Steel Structural Plate, Zinc Coated, for Field Bolted Pipe
AASHTO M 190	(1995) Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches
AASHTO M 198	(1998) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
AASHTO M 219	(1992; R 1995) Aluminum Alloy Structural Plate for Field Bolted Conduits
AASHTO M 243	(1996) Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches
AASHTO M 294	(1998) Corrugated Polyethylene Pipe, 300- to 1200- mm Diameter
AASHTO MP7	(1997) Corrugated Polyethylene Pipe, 1350 and 1500 mm Diameter

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA Manual	(1999) Manual for Railway Engineering (4 Vol.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(1994a) Gray Iron Castings
ASTM A 48M	(1994 el) Gray Iron Castings (Metric)
ASTM A 123/A 123M	(1997ael) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 536	(1999el) Ductile Iron Castings
ASTM A 716	(1995) Ductile Iron Culvert Pipe
ASTM A 742/A 742M	(1998) Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe
ASTM A 760/A 760M	(1997) Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
ASTM A 762/A 762M	(1998) Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A 798/A 798M	(1997a) Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
ASTM A 807	(1997) Installing Corrugated Steel Structural Plate Pipe for Sewers and Other Applications
ASTM A 849	(1997) Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
ASTM A 929/A 929M	(1997) Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
ASTM B 26/B 26M	(1998) Aluminum-Alloy Sand Castings
ASTM B 745/B 745M	(1997) Corrugated Aluminum Pipe for Sewers and Drains
ASTM C 12	(1998el) Installing Vitrified Clay Pipe Lines
ASTM C 14	(1999) Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 14M	(1999) Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)

ASTM C 32	(1999el) Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C 55	(1999) Concrete Brick
ASTM C 62	(1997a) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 76	(1999) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 76M	(1999a) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 139	(1999) Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C 231	(1997el) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(1997) Mortar for Unit Masonry
ASTM C 425	(1998b) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 443M	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric)
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C 506	(1999) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C 506M	(1999) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 507	(1999) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
ASTM C 507M	(1999) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 655	(1995a) Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe

ASTM C 700	(1999) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 789	(1998) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
ASTM C 828	(1998) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 850	(1998) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 Ft. of Cover Subjected to Highway Loadings
ASTM C 877	(1994) External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 877M	(1994) External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)
ASTM C 923	(1998) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Materials
ASTM C 924	(1998) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C 924M	(1998) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method (Metric)
ASTM C 1103	(1994) Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C 1103M	(1994) Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric)
ASTM D 1056	(1998) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1171	(1994) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural

	Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2321	(1989; R 1995) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3034	(1998) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3350	(1998a) Polyethylene Plastics Pipe and Fittings Materials
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 679	(1995) Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F 714	(1997) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F 794	(1999) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 894	(1998a) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F 949	(1999) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth

	Interior and Fittings
ASTM F 1417	(1992; R 1998) Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

ENGINEERING MANUALS (EM)

EM 385-1-1	(1992) U.S. Army Corps of Engineers Safety and Health Requirements Manual

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 Data

Placing Pipe; G-RE,

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

Frame and Cover for GratingsG-RE,

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

SD-14 Samples

Pipe for Culverts and Storm Drains; G-RE,

Samples of the following materials, before work is started: All parts.

SD-13 Certificates

Pipeline Testing; G-RE,
Hydrostatic Test on Watertight Joints; G-RE,
Determination of Density; G-RE,

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. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer.

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 and in a manner that will not disturb the protective coating.

1.4 MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for work covered under this Section and all costs shall be included in the contract unit or lump sum price for the item of work to which the materials and work is incidental.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

When corrugated steel pipe is specified, the pipe shall conform to the following requirements:

a. ASTM A 760/A 760M Type I pipe circular pipe with helical corrugations.

b. ASTM A 929/A 929M zinc metallic (galvanized) coating on pipe.

c. AASHTO M 190, ASTM A 849 fully coated Class A (bituminous) material on pipe. The pipe invert shall be paved with Class PA (polymer modified asphalt) material. ASTM A 849 polymer coating may be used in lieu of bituminous material on the pipe.

2.1.1 Pipe Coupling Systems

The corrugated metal pipe shall be joined together with dimple (universal) external bands with an ASTM A 929/A 929 M zinc metallic (galvanized) coating and a ASTM A 849 exterior coated Class A (bituminous) material.

2.2 DRAINAGE STRUCTURES

2.2.1 Flared End Sections

Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A 929/A 929M and a minimum 0.109 inch thickness. The sections shall be designed and detailed to satisfy the loading and functional requirements.

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 5 to 7 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 1752.

2.3.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction 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 but in no case shall exceed 5 gallons of water per sack of cement. 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 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron, ASTM A 48, Class 35B; cast ductile iron, ASTM A 536, Grade 65-45-12. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.

2.3.4 Joints

2.3.4.1 External Sealing Bands

Requirements for external sealing bands shall conform to ASTM C 877.

2.3.4.2 Flexible Watertight, Gasketed Joints

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 AND STEEL INDIVIDUAL-RUNG LADDERS

Steel ladder shall be provided where the depth of the manhole exceeds 12 feet. INDIVIDUAL-RUNG LADDERS WILL BE PROVIDED AT OTHER LOCATIONS. See SECTION 05502, MISC METALS FOR DETAILS. ALL LADDERS SHALLL MEET THE REQUIREMENTS OF EM 385-1-1. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123/A 123M.

2.5 HYDROSTATIC TEST ON WATERTIGHT JOINTS

2.5.1 Corrugated Steel Pipe

A hydrostatic test shall be made on the watertight joint system or coupling band type proposed. The moment strength required of the joint is expressed as 15 percent of the calculated moment capacity of the pipe on a transverse section remote from the joint by the AASHTO HB-16 (Division II, Section 26). The pipe shall be supported for the hydrostatic test with the joint located at the point which develops 15 percent of the moment capacity of the pipe based on the allowable span in feet for the pipe flowing full or 40,000 foot-pounds, whichever is less. Performance requirements shall be met at an internal hydrostatic pressure of 10 psi for a 10 minute period for helical corrugated metal pipe with factory reformed ends.

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 02316 "Excavation, Trenching, and Backfilling for Utilities Systems 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 the outside diameter of the pipe plus 12 inches 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 Contracting Officer, 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 in his performance of 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 Corrugated Metal Pipe

Bedding for corrugated metal pipe and pipe arch shall be in accordance with ASTM A 798/A 798M.

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. 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. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (%)
Corrugated Steel	5

Not less than 30 days after the completion of backfilling, the Government may perform a deflection test on the entire length of installed flexible pipe using a mandrel or other suitable device. Installed flexible pipe showing deflections greater than those indicated above shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced at no cost to the Government.

3.3.1 Corrugated Metal Pipe

Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Invert paved pipe shall be installed so that the centerline of bituminous pavement in the pipe, indicated by suitable markings on the top at each end of the pipe sections, coincides with the specified alignment of pipe. Any unprotected metal in the joints shall be coated with bituminous material as specified in AASHTO M 190 or AASHTO M 243. Interior coating shall be protected against damage from insertion or removal of struts or tie wires. Lifting lugs shall be used to facilitate moving pipe without damage to exterior or interior coatings. During transportation and installation, pipe or pipe arch and coupling

bands shall be handled with care to preclude damage to the coating, paving or lining. Damaged coatings, pavings and linings shall be repaired in accordance with the manufacturer's recommendations prior to placing backfill. Pipe on which coating, paving or lining has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced. Vertical elongation, where indicated, shall be accomplished by factory elongation. Suitable markings or properly placed lifting lugs shall be provided to ensure placement of factory elongated pipe in a vertical plane.

3.4 JOINTING

3.4.1 Corrugated Metal Pipe

3.4.1.1 Field Joints

Transverse field joints shall be designed so that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A 798/A 798M. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, helical bands and bands of special design that engage factory reformed ends of corrugated pipe. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. The annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 30 inches or larger, shall be filled with a bituminous material after jointing. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.

3.4.1.2 Flexible Watertight, Gasketed Joints

Installation shall be as recommended by the gasket manufacturer for use of lubricants and cements and other special installation requirements. The gasket shall be placed over one end of a section of pipe for half the width of the gasket. The other half shall be doubled over the end of the same pipe. When the adjoining section of pipe is in place, the doubled-over half of the gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so that the gasket covers the end of pipe sections equally. Connecting bands shall be centered over adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. Band Tightening: The band shall be tightened evenly, even tension being kept on the rods or bolts, and the gasket; the gasket shall seat properly in the corrugations. Watertight joints shall remain uncovered for a period of time designated, and before being covered,

tightness of the nuts shall be measured with a torque wrench. If the nut has tended to loosen its grip on the bolts or rods, the nut shall be retightened with a torque wrench and remain uncovered until a tight, permanent joint is assured.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete, plain concrete, brick, precast reinforced concrete, precast concrete segmental blocks, prefabricated corrugated metal, or bituminous coated corrugated metal; complete with frames and covers or gratings; and with fixed galvanized steel ladders where indicated. Pipe studs and junction chambers of prefabricated corrugated metal manholes shall be fully bituminous-coated and paved when the connecting branch lines are so treated. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors.

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 Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 8 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.7.2 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.

3.7.3 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.

3.7.4 Compaction

3.7.4.1 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. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.7.4.2 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 airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.

b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.

c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.7.5 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 1557 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 Contracting Officer. 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

Lines shall be tested for leakage by low pressure air or water testing or exfiltration tests, as appropriate. 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 Contracting Officer. 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. Testing, correcting, and retesting shall be made at no additional cost to the Government.

-- End of Section --

SECTION 02700

ASPHALTIC CONCRETE INTERMEDIATE LEVELING AND SURFACE COURSES (CENTRAL PLANT HOT MIX)

Sept/98

PART 1 GENERAL

1.1 Bituminous Fill

Bituminous concrete fill for rail recesses where shown on the Contract Drawings shall meet requirements of Section: ASPHALTIC CONCRETE INTERMEDIATE LEVELING AND SURFACE COURSES. Material shall be placed and hand-tamped to dimensions and at locations indicated. Where material will contact the face of rail, a tack coat shall be applied to the face of the rail in accordance with Section: BITUMINOUS TACK COAT.

1.2 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

T 168-91	Sampling Bituminous Paving Mixtures
T 248-84	Reducing Field Samples of Aggregate to Testing Size
T 283-89	Resistance of Compacted Bituminous Moisture to Moisture Induced Damage

ASPHALT INSTITUTE

Manual Series No. 2 (MS-2)	Mix Design Methods For Asphalt Concrete Sixth Edition

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS

C 29-91	Unit Weight and Voids in Aggregate
C 88-90	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

C 117-90	Materials Finer than 75-um (No. 200) Sieve in Minera1 Aggregates by Washing
C 127-88	Specific Gravity and Absorption of Coarse Aggregate
C 128-88	Specific Gravity and Absorption of Fine Aggregate
C 131-89	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
C 136-84a	Sieve Analysis of Fine and Coarse Aggregates
C 183-88	Sampling and Acceptance of Hydraulic Cement
C 566-89	Total Moisture Content of Aggregate by Drying
D 75-87	Sampling Aggregates
D 140-88	Sampling Bituminous Materials
D 242-85 (R1990)	Mineral Filler for Bituminous Paving Mixtures
D 1461-85	Test Method for Moisture or Volatile Distillates in Bituminous Paving Mixtures
D1559-89	Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using marshall Apparatus
D 2041-94	Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures
D 2172-92	Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
D 2726-90	Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
D 3381-92	Viscosity-Graded Asphalt Cement for Use in Pavement Construction
D 4791-89	Flat or Elongated Particles in Coarse Aggregate
PS 90-97	Asphalt Content of Hot Mix Asphalt by the

Ignition Method

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Testing Laboratory, para. 1.6.1; GA-RE

The following shall be in one transmittal:

Equipment, para. 2.3; GA-KC

Mixing Plant, para. 2.4 ; GA-KC

SD-09 Reports

The following shall be included in the composition of mixture transmittal

Composition of Mixture, para.'s 2.2 thru 2.2.3.1; GA-KC

Coarse Aggregate, para. 1.4.2.1.a; GA-KC

Fine Aggregate, para. 1.4.2.1.b; GA-KC

Mineral Filler, para. 1.4.2.1.c; GA-KC

QC PRODUCTION OF AGGREGATE

Aggregate Gradation, para. 1.4.2.2.a; GA-KC

Crushed Particle Test, para. 1.4.2.2.b; GA-KC

Specific Gravity Test, para. 1.4.2.2.c; GA-KC

SD-13 Certificates

The following shall be included in the composition of the mixture transmittal:

Bituminous Material, para. 1.5; GA-KC

1.4 DEFINITIONS

1.4.1 General

Bituminous intermediate and surface course shall consist of fine and coarse aggregates and mineral filler uniformly mixed with hot bituminous material,

and placed and compacted on a prepared base course, or intermediate course. All quality control sampling and testing results and reports shall be included in the Contractor's Daily Quality Control Reports.

1.4.2 Aggregates

Aggregates shall consist of crushed stone, crushed gravel, screenings, sand, and mineral filler. The portion of these materials retained on the 4.75 mm (No. 4) sieve shall be known as coarse aggregate; the portion passing the 4.75 mm (No. 4) sieve and retained on the 75 um (No. 200) sieve, as fine aggregate; and the portion passing the 75 um (No. 200), as mineral filler. The coarse and fine aggregates and mineral filler shall be so graded and of such character that when combined, a blend will be produced that will meet the requirements specified in subsequent paragraphs, entitled AGGREGATE GRADATION and COMPOSITION OF MIXTURE.

1.4.2.1 The total aggregate

The total aggregate (coarse aggregate, fine aggregate, and the material passing the 75 um (No. 200) sieve) shall contain not less than 80 percent crushed material for intermediate course and surface course.

1.4.2.2 Coarse aggregates

Coarse aggregates shall consist of clean, sound, durable fragments of crushed stone or crushed gravel meeting the following requirements:

a. Percent of wear shall not exceed 40 after 500 revolutions, as determined in accordance with ASTM C 131-89.

b. Percentage of loss shall not exceed 18 after five cycles performed in accordance with ASTM C 88-90, using magnesium sulfate.

c. The dry weight of crushed slag shall not be less than 1,200 Kg/cubic m (75 pcf),as determined in accordance with ASTM C 29-91.

d. Crushed gravel retained on the 4.75 mm (No. 4) sieve and each coarser sieve shall contain at least 80 percent by weight of crushed pieces having one or more fractured faces with the area of each face equal to at least 80 percent of the smallest midsectional area of piece. When two fractures are contiguous, the angle between planes of fractures shall be at least 30 degrees to count as two fractured faces.

e. Particle shape of crushed aggregates shall be essentially cubical. The quantity of flat and elongated particles in any sieve size shall not exceed 20 percent by weight, when determined in accordance with ASTM D 4791-89.

1.4.2.3 Fine Aggregate

Fine aggregate shall consist of clean, sound, durable particles including natural sand or crushed stone or gravel that meets requirements for wear and soundness specified for coarse aggregate. Fine aggregate

produced by crushing gravel shall have at least 90 percent by weight of crushed particles having two or more fractured faces in the portion retained on the 600 um (No. 30) sieve. This requirement shall apply to the material before blending with natural sand when blending is necessary.

1.4.2.4 Mineral filler

Mineral filler shall conform to ASTM D 242-85 (R1990) and the following additional requirements. At least 50 percent of the mineral filler shall be hydrated lime, limestone dust or Portland cement. However, in areas where long service has shown that there has been no problem with stripping when the proposed aggregates are used, this additional requirement may be waived by the Contracting Officer when requested in writing.

1.5 SAMPLING AND TESTING OF AGGREGATES

1.5.1 General

Sampling shall be performed in accordance with ASTM D 75-87 for aggregates and ASTM C 183-88 for mineral filler, unless otherwise directed. Quality control tests shall be performed at the frequency specified hereinafter. Aggregates shall not be delivered to the job site or used in the production of bituminous mixtures without prior approval.

1.5.2 Preconstruction Aggregate Testing

1.5.2.1 Initial tests (SD09-GA)

Initial tests (SD09-GA)

The Contractor shall perform the following tests on the aggregates prior to designing the mix.

a. Coarse aggregate: Wear (abrasion) test, soundness test, gradation test, and specific gravity test. A crushed particle (fractured-faces) test unless the coarse aggregate is crushed quarried rock.

b. Fine aggregate shall be tested to determine compliance with specification requirements and gradation.

c. Mineral filler shall be tested to determine compliance with specification requirements.

1.5.2.2 Quality control tests (SD09-GA)

Quality control tests (SD09-GA)

During production, aggregates shall be sampled and tested, as required. The test results reported for these samples will be the basis of approval of specific lots of aggregates for the gradation and paving-mixture requirements. Gradation and specific gravity shall not vary significantly. The frequency of testing shall be as follows:

a. One gradation test of aggregate for every 1,000 Metric tons (1,100 tons) of each size of aggregate as it is stockpiled.

b. One crushed particle (fractured faces) test for every 1,000 Metric tons (1,100 tons) of each size of coarse aggregate as it is stockpiled unless the material is crushed quarried rock or unless otherwise approved.

c. One specific gravity test for every 1,000 Metric tons (1,100 tons) of each size grouping of aggregate stockpiled.

1.6 BITUMINOUS MATERIALS (SD13-GA)

Bituminous material shall not be incorporated into the mix without prior approval. Bituminous materials to be mixed with mineral aggregates shall conform to the following:

1.6.1 Asphalt Cement

Asphalt cement shall conform to ASTM D 3381-92, viscosity grade: AC-20. A certified refinery analysis from the proposed source shall be furnished.

1.7 QUALITY CONTROL

1.7.1 General)

All quality control sampling and testing shall be the responsibility of the Contractor in accordance with SECTION: CONTRACTOR QUALITY CONTROL and as specified herein. All sampling and testing shall be performed by a commercial testing laboratory with the capability of performing all the testing specified herein and shall be supervised by a registered professional engineer. The Contractor may elect to establish testing facilities of his own. However the Contractors laboratory shall have the capability of performing all the testing specified herein. No work requiring testing will be permitted until the Contractor's facilities have been inspected and approved. The Contractors testing laboratory shall be supervised by a registered professional engineer. The first inspection of the facilities shall be at the expense of the Government and any subsequent inspections required because of failure of the first inspection will be at the expense of the contractor. Such costs will be deducted from the total amount due the Contractor. The Government may perform verification tests as considered necessary.

PART 2 PRODUCTS

2.1 AGGREGATE GRADATION

Mineral aggregate shall be of such size that the percentage composition by weight, as determined by ASTM C 136-84a and C 117-90, will generally conform to the gradation shown below for the specific course shown on the drawings. Regardless of the gradation chosen by the Contractor, it shall

be his responsibility to furnish a combined aggregate which will produce a bituminous mixture meeting all requirements specified herein, particularly those specified in paragraph: COMPOSITION OF MIXTURE and any aggregate gradation which fails to produce a bituminous mixture meeting all requirements specified shall be rejected and replaced with a satisfactory aggregate gradation at no additional cost to the Government, and with no extension of time due to any delay caused by such replacement.

Percentage Passing, by Weight

Sieve Size	Intermediate Course 19.0 mm (3/4 inch) Max.	Surface course 12.5 mm (1/2 inch) Max.
25.0 mm (1 inch)	100	--
19.0 mm (3/4 inch)	95-100	100
12.5 mm (1/2 inch)	--	--
9.5 mm (3/8 inch)	70-90	79-94
4.75 mm (No. 4)	--	60-77
2.36 mm (No. 8)	28-58	44-62
1.18 mm (No. 16)	--	--
600 um (No. 30)	12-36	22-39
300 um (No. 50)	--	--
150 um (No. 100)	--	--
75 um (No. 200)	2-7	2-7

Note: The job mix formula may have to fall outside the gradation band shown above in order to meet the test properties of the mixture shown in pargraph: COMPOSITION OF MIXTURE.

2.2 COMPOSITION OF MIXTURE (SD09-GA)

2.2.1 Job-Mix Formula

The bituminous mix design shall be established by a laboratory approved as specified in paragraph: QUALITY CONTROL using the materials and properties specified herein. Certified test results of the job-mix formula and materials shall be submitted for approval at least 30 days prior to commencing construction to the Kansas City District, Attention ED-GL. No bituminous mixture shall be produced until the job-mix formula has been approved by the Contracting Officer. The formula will indicate the percentage of each sieve fraction of aggregate, and the percentage of asphalt and temperature of completed mixture when discharged from mixer. The job-mix formula will be allowed the following tolerances.

Aggr. passing 4.75 mm (No. 4) sieve or larger	plus or minus 5%
Aggr. passing 2.36 mm (No. 8), 1.18 mm (No. 16), 600 um (No. 30), and 300 um (No. 50) sieves	plus or minus 4%
Aggregate passing 150 um (No. 100) and 75 um (No. 200)sieves	plus or minus 2%
Asphalt as determined by extraction tests	plus or minus 0.25%

Temperature of mixing	plus or minus 14 degrees C (+ 25 degrees F)

The bitumen content and aggregate gradation may be adjusted within the limits of the tables specified herein to improve the paving mixtures, as directed. The percentages of each sieve fraction in the job-mix formula will be restricted to values such that the application of the above-listed tolerances will not cause the limits of the gradation tables to be exceeded.

NOTE: It shall be noted that when the gradation varies appreciably from the single point gradation used in the mix-design, the test properties of the mix will be out of specifications and the mix-design will have to be adjusted or redesigned. This condition can occur even though the gradation meets the tolerences specified above.

2.2.2 Mineral Filler and Hydrated Lime

The mixtures shall contain one percent hydrated lime by weight of the total aggregate, however this maybe waivered as stated in Part 1, paragraph, Mineral filler. The hydrated lime shall be added during, or ahead of, the addition of the asphalt cement. If minus No. 200 material is needed in addition to the one percent hydrated lime to comply with gradation requirements, mineral filler shall be added.

2.2.3 Test Properties of Bituminous Mixtures

The finished mixture shall meet the requirements described below when tested in accordance with ASTM D1559-89 and the volumetric properites of compacted paving mixtures as calculated by ASTM procedures using Chapter 4 of the Asphalt Institues Manual Series No. 2 (MS-2). The automatic Marshall Hammer may be used when it has be calibrated with a manual hammer. The material for the theoretical specific gravity ASTM D 2041-94 and the material for the Marshall specimens (pucks) shall be cured at 135 degrees C (275 degrees F) for 2 hours in a closed oven after the mix is produced in the laboratory. Also the plant-produced mixture shall not be tested until the mix is 2 hours old. The mixture shall not be reheated. The above procedure shall be used when the water-absorption as determined by ASTM C 127-88 and ASTM C 128-88 of any aggregate in the mixture exceeds 1.25 percent. All samples will be compacted with 50 blows of specified hammer on each side of sample. When bituminous mixture fails to meet the requirements specified below, the paving operation shall be stopped until the cause of noncompliance is determined and corrected.

2.2.3.1 Stability, Flow and Voids

The mixture shall meet the following requirements:

Test Property	Surface Course	Intermediate Course
Stability, minimum	5300 N	5300 N

	(1200 lbs)	(1200 lbs)
Flow, maximum, 0.254 mm (1/100-inch) units	16	16
Voids, total mix, percent (see Note 1)	3-5	3-5
% Voids in Mineral Aggregate (VMA)	(See Note 2)	
Voids filled with asphalt; percent (VFA)	65-75	65-75
The ratio of minus No. 200 material to %effective asphalt cement based on the weight of the aggregate	0.6-1.2	0.6-1.2

Note 1: The laboratory job mix formula shall have the percent voids in the total mix between 4 and 4.5 percent air voids. The voids in the total mix of the mix produced at the plant shall be continually adjusted to ensure the voids stay near the middle of the range of 3 to 5 percent.

Note 2: The minimum VMA percent shall conform to the requirements specified in Table 5.3 , Chapter 5 of the Asphalt Institute manual MS-2. To insure that the VMA is not to high, the gradation of the verified mix design behind the paver shall be adjusted to meet the requirements of the VMA as stated in Chapter 5, paragraph "Evaluation of VMA Curve" of the Asphalt Institute manual MS-2. The asphalt content should be just to the left-hand side of the low point on the VMA versus Asphalt Content percent, not on the Awet@ or right-hand increasing side of the curve.

Note 3: When the absorption is high the mixture will be tender until the asphalt is absorbed into the aggregate. Therefore it may be beneficial to silo the mixture at the plant for a time. This is more important when the truck haul is short.

c. Reduction in strength by saturation with water: The index of retained strength must be greater than 75 percent as determined by AASHTO T 283-89. Specimens shall be conditioned by freezing and thawing. When the index of retained strength is less than 75, the aggregate stripping tendencies may be countered by the use of hydrated lime or by treating the bitumen with an approved antistripping agent. The hydrated lime is considered as mineral filler and should be considered in the gradation requirements. The amount of hydrated lime or antistripping agent added to bitumen shall be sufficient, as approved, to produce an index of retained strength of not less than 75 percent. No additional payment will be made to the Contractor for addition of antistripping agent required.

d. Extraction test shall be performed using ASTM D 2172-92 or PS 90-97.

2.2.4 Sampling, Testing, and Approval of Bituminous Mixtures During

Construction:

2.2.4.1 General

Samples of plant mixtures shall be taken to determine conformance to the specified test properties of bituminous mixtures and to determine bitumen content and aggregate gradation. Quality Control sampling and testing shall be performed by the same testing laboratory that established the mix design. The Quality Control laboratory shall be approved as specified in paragraph: QUALITY CONTROL and as specified herein. All tests shall be performed expeditiously and results immediately furnished to the Contractor and Government representatives at the construction site or mixing plant. As a minimum the test results shall be reported on a form similar to the form "ASPHALTIC CONCRETE TEST" attached at the end of this Specification Section. Back up calculations shall be available at the laboratory and submitted in the project final report. If the mixture is out of specification or near the specified limits, the test report shall contain recommendations of how to correct the mix proportions. Construction operations shall cease when test results are not received and adjustments made within six hours after the mix comes out of the plant. The Government may perform verification tests as considered necessary. Mixtures that do not conform to the specified test properties shall be rejected. No payment will be made to the Contractor for mixtures rejected, for additional retesting, or for pavements or portions of pavement removed. T 168-91 Sampling Bituminous Paving Mixtures and T 248-84 Reducing Field Samples of Aggregate to Testing Size are to be used for sampling.

2.2.4.2 Testing frequence

a. One gradation test of hot bin material for conventional plants, or total aggregate material from the final feed belt for the dryer-drum mixer for dryer-drum plants, for each 500 Metric tons (550 tons) of hot mix produced. A minimum of two tests per day and a maximum of three tests per day during hot mix production will be required.

b. Two gradation tests of hot bin material for conventional plants, or total aggregate material from the final feed belt for the dryer-drum mixer for dryer-drum plants, during trial runs performed 10 days before start of production of paving mixtures. Additional tests may be directed by the Contracting Officer when necessary to adjust the plant.

c. Marshall tests: In order to verify the mix design the first set (3 specimens) of tests shall be taken when the plant has produced approximately 75 Metric tons (82.5 tons) of hot mix. Testing shall be repeated until the tests verify that the hot mix produced meets all the properties specified in paragraph: Test properties of bituminous mixtures. After verification of the mix one set (3 specimens) of tests shall be made for each 300 Metric tons (330 tons) of hot mix produced, except that a minimum of two sets per day and a maximum of four tests per day, shall be made. Test shall be taken from the placed bituminous mixture prior to compaction. Material for the sample shall be taken from the following locations; one each side of the plced bituminous mat and one in the center of the mat. A square pointed shovel shall be used for taking the sample and for evenly laying material back into the disturbed mat.

d. Extraction tests shall be made to determine bitumen content and aggregate gradation at the same frequency specified above for Marshall Tests. Gradation test shall also be made when new aggregate is delivered to the plant.

NOTE: The results of the gradation test is very important in determining how to adjust the mix. After the gradation or the bitumen content has been adjusted to obtain the properties of the mix, this verified mix design becomes the project mix design. The plant settings may have to be adjusted again whenever the gradation of the materials change. When a change is made it shall be reported on the Marshall Test Report form.

e. Paving shall stop and the mixture shall be redesigned whenever any of the following occurs; three consecutive sets of marshall tests show the percent voids in the total mix are less than 3 percent or more than 5 percent; two consecutive sets of marshall tests show the percent voids in the total mix are less than 2 percent; two consecutive marshall tests show the voids filled with asphalt exceed 79 percent.

f. Retained strength tests: One set of tests shall be made for the first day's construction and thereafter whenever there is any change in materials or job-mix formula.

g. Moisture tests: The bituminous mixture shall be sampled and tested for moisture in accordance with ASTM D 1461-85 each time a gradation test is performed. Tests shall be taken from the placed bituminous mixture prior to compaction. Additional test shall be made when a significant change in the stockpiles occurs such as rain, delivery of new aggregates, or when visual inspections of the mix leaving the plant show segregation of asphalt resulting from escaping water vapor in the prepared mixture.

h. Sampling, testing, and approval of bituminous materials: During construction the Contractor shall furnish asphalt samples and certified test analysis for each shipment of material delivered to the project. The Government may perform verification tests as considered necessary. During construction, the Contractor shall furnish samples of each shipment of bituminous material received at the project and the samples will be tested and/or retained by the Government for record purposes until the completion of the contract. Sampling shall be in accordance with ASTM D 140-88.

2.3 APPROVAL OF PLANT, EQUIPMENT, MACHINES, AND TOOLS (SD08-GA)

All equipment used shall be subject to approval. Tentative approval of specific items shall be obtained before start of operations. Final approval will be given only after full-scale production has begun. All plant equipment, tools and machines used in the work shall be maintained in a satisfactory working condition at all times.

2.4 MIXING PLANTS (SD08-GA)

Mixing plants shall meet the requirements of the State's Department of Transportion's latest specification in effect when this project contract is awarded to the Contractor, except the temperature of the asphalt shall not exceed 162.8 degrees C (325 degrees F) at anytime and the mixture discharged from the plant shall not exceed 148.9 degrees C (300 degrees F), or shall conform to the requirement hereinafter. The plant may be either a weigh-batch type or a continuous-mixing type of conventional plant or a dryer-drum mixing type plant provided the equipment has demonstrated suitability for producing finished mixtures similar to those required by these specifications. The plant shall have a suitable capacity to accomplish the work. Plants shall conform to subparagraph: Requirements for all plants, except that scale requirements apply only when weight proportioning is used, and in addition, shall conform to subparagraph: Special requirements for batch-mixing plants or special requirements for conventional continuous-mixing plants, below, as applicable.

2.4.1 Requirements for All Plants

These requirements apply to dryer-drum mixing process plants only as specifically referenced hereinafter.

2.4.1.1 Plant scales

Plant scales for any weigh box or hopper shall be of standard make and design, either of the beam or the springless-dial type and shall be sensitive to 0.5 percent of the maximum load required. Beam-type scales shall have a separate beam for each size aggregate, with a single telltale actuated for each beam, and a tare beam for balancing the hopper. Standard test weights accurate to plus or minus 0.1 percent shall be provided for checking plant scales

2.4.1.2 Equipment for preparation of bituminous material

Tanks for storage of bituminous material shall be capable of heating the material, under effective and positive control at all times, to the temperatures specified herein. Heating shall be accomplished by steam coils, hot oil or electricity. Continuous circulation between storage tank and mixer during the entire operating period shall be provided. Pipelines and other bituminous handling equipment shall be stream-jacketed or otherwise properly insulated to prevent heat loss. The storage-tank capacity shall be sufficient for at least a 1-day run.

2.4.1.3 Feeder for dryer

The plant shall be provided with adjustable mechanical feeders that feed each aggregate individually and in ratios required. Feeders shall have accurate and separate adjustments for proportioning each aggregate to be incorporated into the mix. Gates or other proportioning devices shall have locks for fastening the devices in any desired position. A separate bin or compartment shall be provided for each aggregate to be fed into the dryer.

2.4.1.4 Rotary dryers
shall be provided in sufficient numbers to heat and dry the aggregates to

the temperature and the moisture content specified herein.

2.4.1.5 Plant screens

shall be capable of screening dry aggregate output of the dryers to the sizes required for proportioning into the mix. The screen sizes shall be such as to properly fractionate the aggregates so that the total aggregate mixture may be controlled within the tolerances of the job-mix formula at operating capacity.

2.4.1.6 Bins

Bins of sufficient capacity to continuously supply the mixer when it is operating at full capacity shall be provided. The bins shall be divided into at least three compartments, arranged to insure separate and adequate storage of appropriate fractions of the aggregate. Each compartment shall be provided with an overflow pipe of such size and at such location as to prevent any backing up of material into other bins. Approved dry storage shall be provided for mineral filler; and provisions shall be made for accurately weighing or proportioning the mineral filler to the mixtures. Each aggregate bin shall be equipped with mechanical or electrical telltales to indicate when the aggregate in the bin is below the level that will permit accurate proportioning of the aggregate to the mixing unit. Each bin shall be constructed or equipped in such manner that a representative sample of hot aggregate may be readily and safely taken from each bin during plant operations.

2.4.1.7 Bituminous control unit

Satisfactory means, incorporating either weighing, metering, or volumetric measurements, shall be provided to obtain the required percentage of bitumen in the mix within the tolerances specified. When the quantity of bitumen is controlled by metering, provision shall be made whereby the amount of bitumen delivered through meter can be readily checked by weight.

2.4.1.8 Thermometric equipment

An armored thermometer with a range of 93.3 to 204.4 degrees C (200 to 400 degrees F) shall be fixed in the bituminous feed line near the discharge valve at the mixture unit. The plant shall be further equipped with an approved recording dial-scale, a mercury-actuated thermometer, or an electric pyrometer so placed at the discharge chute of the dryer as to register automatically or indicate the temperature of the heated aggregate.

2.4.1.9 Control of mixing time

Unless otherwise directed, the plant shall be equipped with positive means for governing and maintaining time of mixing constant. Interval of mixing shall be in accordance with subparagraphs: Mixer unit for batch method and Mixer unit for continuous method, specified below.

2.4.1.10 Dust collectors

The plant shall be equipped with dust collectors. Provisions shall be made to waste collected material or to return all or any part of the collected

material uniformly to the mixture, as directed.

2.4.2 Special Requirements for Batch-Mixing Plants

2.4.2.1 Weigh box or hopper

Equipment shall include means for accurately weighing each bin size of aggregate in a weigh box or hopper suspended on scales, and these weigh boxes or hoppers shall be ample in size to hold a full batch without running over. The gates on both the bins and hoppers shall be constructed to prevent leakage of aggregate when closed. On manually operated plants, an interlocking device shall be provided to prevent opening more than one gate at a time. On automatic plants designed for simultaneous weighing of all sizes of aggregate, this provision does not apply while the plant is operating under automatic control.

2.4.2.2 Weigh bucket

The bitumen bucket shall have sufficient capacity to hold not less than 10 percent in excess of the weight of the bitumen required for one batch. The bitumen bucket shall be suspended on dial or beam scales equipped with a telltale so that the tare weight of the bucket will be shown for each weighing, and the net weight of the bituminous material will be measured within plus or minus 1 percent of the weight required. Use of a volumetric-metering-type device that will proportion the bitumen into the mix with the above accuracy will be permitted. The bucket shall be so arranged that the heated bituminous material will be delivered in a thin, uniform sheet, or in multiple streams the full width of the mixer, except in the case of a mixer where bituminous material is sprayed.

2.4.2.3 Mixer unit for batch method

The mixer shall be an approved twin-pugmill capable of producing a uniform mixture within job-mix tolerance specified. Batch capacity of the mixer shall be suitable to accomplish the work. The mixer shall have a time lock, accurate within five seconds, to control operation of the complete mixing cycle by locking the weigh-box gate after the mixer is charged until closing of the mixer gate at the completion of the cycle. The time lock shall lock the bitumen bucket throughout the dry-mixing period and shall lock the mixer gate throughout the dry and wet-mixing periods. The dry-mixing period is defined as the interval of time between opening of the weigh-box gate and application of bituminous material and opening of the mixer gate. Control of the time shall be flexible and capable of being set at intervals of not more than 5 seconds throughout cycles up to 3 minutes. A mechanical batch counter shall be installed as part of the timing device and shall be designed to register only the actuation of the bituminous-bucket release and to preclude register of any dry batches, or the register of any material through the operation of pulling bins. If not enclosed, the mixer box shall be equipped with an adjustable hood to prevent loss of mineral filler by dispersion. The clearance of the blades from all fixed parts shall not exceed 19.1 mm (3/4-inch).

2.4.3 Special Requirements for Conventional Continuous-Mixing Plants

2.4.3.1 Gradation control unit

The plant shall include means for accurately proportioning each bin size of aggregate either by weighing or measuring volumetrically. When gradation control is by volume, the unit shall include a feeder mounted under the compartment bins. Each bin shall have an accurately controlled, lockable gate for volumetrically measuring material to be drawn from it. Indicators shall be provided on each gate to show the gate opening in inches.

2.4.3.2 Weight calibration of aggregate feed

The plant shall include means for calibration of gate openings by weight of test samples. The materials fed out of the bins through the individual orifices shall be bypassed to suitable test boxes. The plant shall be equipped to handle conveniently such test samples weighing approximately 181.4 Kg (400 pounds) combined weight of samples from bins, and not less than a 45.4 Kg (100 pounds) sample from any one bin. The size of the sample may be increased to 362.9 Kg (800 pounds) when so directed. A platform scale having sufficient capacity to accurately weigh the samples shall be provided. Mechanical means shall be provided to accurately proportion the mineral filler to the mixing plant.

2.4.3.3 Synchronization of aggregate and bitumen feed

Approved means shall be provided for interlocking control between flow of aggregate from bins and flow of bitumen from meter or other proportioning device.

2.4.3.4 Mixer

unit for continuous method shall be of an approved twin-pugmill type capable of producing a uniform mixture within the job-mix tolerances specified. Blades shall be adjustable for angular position on the shafts and reversible to retard the flow of the mix. The mixer shall bear a manufacturer's plate indicating the net volumetric contents of the mixer at the several heights inscribed on a permanent gate and the rate of feed of aggregate per minute of plant-operating speed. Unless otherwise required, determination of mixing time shall be by weight method, using the following formula.

$$\text{Mixing time in seconds} = \frac{\text{pugmill dead capacity in pounds}}{\text{pugmill output in pounds per second}}$$

Weights for the job will be determined by tests made by the Contracting Officer.

2.4.3.5 Discharge hopper

The pugmill shall be equipped with a discharge hopper having a capacity of approximately 910 Kg (1 ton). The hopper shall be equipped with dump gates that permit rapid and complete discharge of the bituminous mixture without segregation.

2.4.4 Requirements for Dryer-Drum Mixing Plants

Dryer-drum mixing plants shall conform to the following requirements. Equipment for preparation of bituminous material; feeder for dryer; thermometric equipment; and safety requirements shall be as specified in paragraph: REQUIREMENT FOR ALL PLANTS.

2.4.4.1 Aggregate supply and control

At least two aggregate storage bins shall be furnished and used to feed at least two separate sizes of aggregate. Each bin shall have the feed rate controlled by a variable speed belt, or a remotely operated gate, calibrated to accurately deliver any specified quantity of material. The feed rate from each bin shall be readily adjustable from the control panel to change aggregate proportions of aggregate from each bin when the combined aggregate delivery is increased or decreased. The combined aggregate belt feeding type dryer-drum shall be equipped with an approved belt scale. The belt scale shall operate automatic controls which will maintain the established proportion of the bitumen and the total aggregate, with provisions for readily changing the proportions. Approved means shall be provided for storing, metering, and feeding mineral filler as a separate material when a separate mineral filler is necessary.

2.4.4.2 Bituminous control unit

Approved means shall be provided to inject the required percentage of bitumen in the mix within the tolerances provided. Injection shall be so designed and controlled that no detrimental effect takes place form too close contact with dryer flame. Control of the quantity of bitumen injected shall be automatically linked to the aggregate feed scales as specified in the previous subparagraph. Provision shall be made so the amount of bitumen delivered can be checked by weight. Approved steam-jacketing or other insulation for maintaining the required temperature of bitumen in pipelines, meters, spray nozzles, etc., shall be provided. The system shall be capable of maintaining a continuous circulation of bituminous material.

2.4.4.3 Dryer-drum mixer

The dryer-drum mixer shall be an approved unit specially made for such operation by a manufacturer regularly engaged in production of such units and shall be a model which has a satisfactory record of use on previous jobs. Capacity shall be sufficient to supply the work under this contract without delay to any part of the construction operations. The unit shall be capable of effectively heating and drying the mineral aggregate as required and of effectively and completely combining the bitumen and all other materials into a uniform mixture with all aggregate particle thoroughly coated. Approved means shall be provided to maintain a constant rate of rotation of the dryer drum. The unit shall be equipped with automatic burner controls and shall provide approved means for temperature sensing of the bituminous mixture at discharge.

2.4.4.4 Holding bins

An approved holding bin or bins shall be provided to receive the hot bituminous mixture as it discharges from the mixer.

2.5 OTHER EQUIPMENT

2.5.1 Bituminous-Materials Spreaders

Bituminous-materials spreaders shall be the self-propelled type equipped with hoppers, tamping, or vibrating devices, distributing screws, adjustable screeds operated either manually or automatically, equipment for heating the screeds and equalizing devices. The spreader shall be capable of spreading hot bituminous mixtures without leaving indented areas, tearing, shoving, or gouging and capable of producing a finished surface conforming to the smoothness requirements specified hereinafter. The spreader shall be capable of spreading hot bituminous mixtures without leaving indented areas, tearing, shoving, or gouging and capable of confining edge of strips to true lines without use of stationary side forms and capable of placing the course to the required thickness. If an automatic grade control device is used on the spreader for two-lane paving operations, it shall consist of sensing device for control of one end of the screed and a slope-control mechanism for control of the othcr end of the screed, or a sensing device on each side of the paving machine. Where the paver is used on multiple paving lanes (more than two paving lanes), sensing devices shall be used on each side of the spreader for control of the screed. The slope-control mechanism shall not be used for grade control in multiple paving lane operations.

2.5.2 Steel-Wheel Rollers

Steel-wheel rollers shall be self-propelled, three-wheel, (two-axle) and tandem (two-axle) types, weighing not less than 9,071.8 Kg (20,000 pounds) each. The three-wheel rollers shall have a minimum weight of 136 Kg per mm of width (300 pounds per inch of width) of rear wheel. Wheels shall be equipped with adjustable scrapers, water tanks, and sprinkling apparatus for keeping the wheels wet; thereby preventing the bituminous mixture from sticking to the wheels. Rollers shall be capable of reversing without backlash and free from worn parts. Roller wheels with flat and pitted areas or protections that leave marks in the pavement will not be permitted. Three-axle tandems will be permitted in lieu of two-axle tandems if approved by the Contracting Officer.

2.5.3 Heavy Pneumatic-Tired Rollers

Heavy pneumatic-tired rollers shall be self-propelled and shall consist of two axles on which are mounted multiple pneumatic-tire wheels in such manner that the rear group of wheels will not follow in the tracks of the forward group but spaced to give essentially uniform coverage with each pass. Axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. Tires shall be smooth and

capable of being inflated to at least 621 KPa (90 p.s.i.) Construction of the roller shall be such that each wheel can be loaded to a minimum of 2,040 Kg (4,500 pounds).

2.5.4 Blowers and Brooms

Blowers and brooms shall be power type and suitable for cleaning the surface to be paved.

2.5.5 Saw and Core Drill

Saw and core drill shall be of the power type. The saw shall be capable of rapidly cutting pavement samples and trimming joints and edges of pavement. The core drill used for obtaining pavement samples shall be equipped with a diamond, tungsten carbide, or other bit capable of rapidly cutting a precision core sample 101.6 mm (4 inches) in diameter.

2.5.6 Small Tools

Small tools shall consist of rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heater for heating small tools, stilt sandals, and other small tools in numbers as required.

PART 3 EXECUTION

3.1 WEATHER LIMITATIONS

Bituminous courses shall be constructed only when the base course or intermediate course is dry and when the weather is not rainy. Unless otherwise directed, asphalt courses shall not be constructed when the temperature of the surface of existing pavement or base course is below 4.4 degrees C (40 degrees F).

3.2 PREPARATION OF SURFACE

3.2.1 Bituminous mixtures
shall not be placed with-out ample time to complete spreading and rolling during daylight hours, unless approved satisfactory artificial lighting is provided. Immediately prior to placing the bituminous base or surface course, all loose material, dirt, clay, or other objectionable material shall be removed from the surface.

3.2.2 If the surface of the underlying material
has been damaged after placement or has inadequate compaction (soft spots) or other deviations from this contract specification requirements, such defects shall be repaired immediately prior to placement of the bituminous course. Trucks delivering materials shall be routed in a manner to minimize traveling over the subgrade during the placement operation. Paving operations shall be conducted in such a manner to prevent runoff

water from being ponded on the subgrade in case of rain.

3.3 GRADE CONTROL

The lines and grades shown on the contract drawings shall be established and maintained by means of line and grade stakes placed at the site of the work by the Contractor in accordance with CONSTRUCTION CLAUSE: LAYOUT OF WORK. Elevations of bench marks used by the Contractor for controlling pavement operations at site of work will be determined, established, and maintained by the Government. Finished pavement gradelines and elevations shown shall be established and controlled at site of work by the Contractor in accordance with bench mark elevations furnished by the Contracting Officer.

3.4 MIXING

The bituminous mixtures shall be produced in a plant as specified hereinafter.

3.4.1 Conventional Plant

3.4.1.1 Preparation of mineral aggregates

Each component of various-sized aggregates blended in preparation of the bituminous mixture shall be placed and maintained in separate stockpiles. Various-sized aggregates shall be stockpiled to prevent segregation or intermixing. Bulldozers shall not be used for stockpiling aggregates or feeding aggregates to plant. The aggregate shall be fed into the cold elevator by separate mechanical feeders in a manner that will produce an aggregate graded within the requirements of the job mix formulas and tolerances specified. The aggregates shall be heated and thoroughly dried before entering the hot bins. The temperature and moisture content of the aggregate determined as it enters the mixer shall be uniform and such that the temperature and moisture content of the finished mixture will be uniform and within the tolerances specified. The heated and dried aggregates shall be screened and conveyed to separate hot bins ready for mixing with the bituminous material. The aggregate shall be separated into the sizes designated or approved, except that hot aggregate shall be separated into not less than three sizes. Approved dry storage shall be provided for mineral filler.

3.4.1.2 Preparation of bituminous mixtures

Each size of aggregate, prepared as specified hereinbefore, and dry mineral filler shall be accurately weighed or measured and conveyed into the mixer in the proportionate quantities required to meet the job-mix formula. The required amount of asphalt for each batch or calibrated amount for continuous mixing, shall be introduced into the mixer. In batch mixing, after the aggregates and mineral filler have been introduced into the mixer and mixed for not less than 5 seconds, the asphalt shall be added and the mixing continued for not less than 20 seconds and as much longer as may be required to obtain a homogeneous mixture. When a continuous mixer is employed, the mixing time shall be not less than 25 seconds, and as much longer as may be required to obtain a homogeneous mixture. Additional mixing time when required will be determined by the Contracting Officer.

In no case shall the aggregate be introduced into the mixer at a temperature more than (-) 4 degrees C (25 degrees F) above the temperature of the asphalt. The temperature of the asphalt at the time of mixing shall not exceed 163 degrees C (325 degrees F). The temperature of the aggregate and mineral filler in the mixer shall not exceed 177 degrees C (350 degrees F) when the asphalt is added. However, the temperature discharged from the plant shall not exceed 149 degrees C (300 degrees F). The temperatures of both the aggregate and asphalt at the time of mixing and the additional mixing time required shall be as determined by the Contracting Officer. When the mixture is prepared in a twin-shaft pugmill mixer, the volume of the aggregates, mineral filler, and asphalt shall not be so great that the mixture extends above the tips of the mixer blades when the blades are in a vertical position. All overheated and carbonized mixtures or mixtures which foam or show indications of moisture will be rejected. When moisture is detected in the finished mixture, all aggregate in the bins shall be removed immediately and returned to the respective stockpiles.

3.4.1.3 Water content of aggregates

During drying operations, the water content shall be reduced to less than 0.25 percent for aggregate blends with water absorption of 2.5 percent or less, and to less than 0.50 percent for aggregate blends with water absorption greater than 2.5 percent, absorption to be determined by ASTM C 127 and C 128. The water absorption for the aggregate blend shall be the weighted average of the absorption value for the coarse aggregate and the fine aggregate. The water content test shall be conducted in accordance with ASTM C 566-89. Water content for the blend will be a weighted average based on the composition of the blend.

3.4.2 Dryer-Drum Mixer

3.4.2.1 Preparation of mineral aggregates

The mineral aggregate shall be furnished in at least two separate sized materials. Each component of the various-sized aggregates to be blended in preparation of the bituminous mixture shall be placed in separate stockpiles in such manner that the separate sizes will not be intermixed and that segregation does not take place. Each size shall be stored in a separate bin without mixing, for feeding the dryer-drum mixer. The aggregate shall be fed into the dryer-drum mixer by the equipment previously specified in such manner that will produce a total aggregate graded within the requirements of the job-mix formula and tolerances specified. Moisture content of the aggregates fed to the dryer-drum mixer shall be as necessary to produce a bituminous mixture meeting all specified requirements.

3.4.2.2 Preparation of bituminous mixture

The aggregates and mineral filler shall be accurately weighed using the specified equipment and conveyed to the dryer-drum mixer in amounts required to conform to the job-mix formula. The required amount of asphalt shall be continuously injected into the dryer-drum mixer with the aggregate in the amount required by the job-mix formula, using the injection and control equipment previously specified. The temperature of the asphalt

shall not exceed 163 degrees C (325 degrees F) at any time. The temperature of the bituminous mixture as discharged from the dryer-drum mixer shall not exceed 149 degrees C (300 degrees F). The speed of rotation of the drum, the temperature within the drum and time the mixture is within the drum shall be controlled so as to produce a uniform bituminous mixture without segregation and with all aggregate particles thoroughly coated and conforming to all requirements of these specifications. All overheated and carbonized mixtures shall be rejected. Particular care shall be taken when commencing operations each day to reject any bituminous mixture that does not meet all requirements of these specifications.

3.4.2.3 Moisture test

Absorbed moisture in the aggregate shall be reduced to such a quantity that there is no objectionable segregation of asphalt resulting from escaping water vapor in the prepared mixture. A maximum of 0.5 percent moisture based on weight of the mixture, will be allowed in the mixture when sampled behind the paver and tested in accordance with ASTM D 1461.

3.5 TRANSPORTATION OF BITUMINOUS MIXTURE

The bituminous mixture shall be transported from the mixing plant to the site in trucks having tight, clean, smooth beds coated with a minimum amount of a concentrated solution of hydrated lime and water to prevent adhesion of the mixture to the truck beds. Each load of mixture shall be covered with canvas, or other suitable material of ample size to protect the mixture from the weather and to prevent loss of heat. Deliveries shall be scheduled so that spreading and rolling of all mixture prepared for one day's run can be completed during daylight unless approved adequate artificial lighting is provided. The mixture shall be delivered in such manner that the temperature at the time of dumping into the spreader will be not less than hereinafter specified. Loads that have crusts of cold, unworkable material or have become wet by rain will be rejected. Hauling over freshly placed material will not be permitted.

3.6 PLACING

Intermediate course, or any layer of surfaace source shall not be left uncovered by the subsequent course for more than 5 days, weather permitting. Material trucks hauling materials other than asphaltic concrete or tack coat shall not travel on previously constructed layers of asphaltic concrete until the final surface course is constructed.

3.6.1 Surface Preparation of Underlying Course

Prior to placing of the intermediate or surface course, the underlying course shall be cleared of all foreign or objectionable matter with power blowers, power brooms, or hand brooms. A tack coat shall be applied between the intermediate and surface course mixture. The tack coat between layers of recently constructed inter-mediate course, or layers of recently constructed surface course, may have the application rate reduced when specifically approved if the surface of the previously placed layer as approved is entirely free of dust, dirt or other foreign matter which might

reduce the bond between the layers of the intermediate or surface course. Tack coat shall not be completely omitted.

3.6.2 Offsetting Joints in Intermediate and Surface Courses

The surface course shall be placed so that longitudinal joints of the surface course will not coincide with joints in the intermediate course by approximately 230 mm (9 inches). Care shall be taken when possible to offset longitudinal joints in a manner that the final surface course joint is in the center of the pavement or on a lane line. Transverse joints in the surface course shall be offset by at least two feet from transverse joints in the intermediate course.

3.6.3 General Requirements for Use of Mechanical Spreader

The range of temperatures of the mixture, when dumped into the mechanical spreader shall be as determined by the Contractor. Asphalt mixtures having temperatures less than 113 degrees C (235 degrees F) when dumped into a mechanical spreader will be rejected. The mechanical spreader shall be so adjusted and its speed so regulated that the surface of the course being placed will be smooth and continuous without tears and pulling, and of such depth that, when compacted, the surface will conform with the cross section, grade, and contour shown on the drawings. Unless otherwise directed, placing shall begin along the centerline of areas paved on a crowned section or on the high side of areas with a one-way slope, and shall be in the direction of the major traffic flow. The mixture shall be placed in consecutive adjacent strips having a minimum width of 3.05 meters (10 feet), except when edge lanes require strips less than 3.05 meters (10 feet) to complete an area. Each strip placed before a succeeding strip shall be of such length that sufficient heat will be retained to make the strip readily compactible so that a joint can be obtained conforming to the requirements for texture, density, and smoothness specified in the paragraph: JOINTS. The length of any strip to be laid prior to the succeeding strip shall be as directed and may be decreased or increased as dictated by changes in climatic conditions. Longitudinal joints and edges shall be constructed to true line markings. The Contractor shall establish lines parallel to the centerline of the area to be paved and shall place string lines coinciding with established lines for the spreading machine to follow. Number and location of lines shall be as directed. Placing of the mixture shall be as nearly continuous as possible, and the speed of placing shall be adjusted, as directed, to permit proper rolling.

3.6.3.1 Special Procedures to Prevent Segregation

The wings of the spreader hopper shall not be emptied (flipped) between truck loads. The screed auger shall be operated approximately three-fourths (3/4) full and the hopper conveyor shall not be allowed to run out of material.

3.6.4 Special Requirements for Placing Strips Succeeding Initial Strips

In placing each succeeding strip after the initial strip has been spread and compacted as specified hereafter, the screed endgate of the mechanical

spreader shall overlap the previously placed strip slightly and shall be 1.25 times thicker than the existing compacted strip in order to produce a smooth compacted joint with the specified density. Mixture placed on the edge of the previously placed strip by the mechanical spreader shall be pushed back (tucked) to the edge of the strip being placed by use of a lute (rake). The pushed back material shall form a ridge on the uncompacted strip along the edge of the previously placed strip. The height of the ridge above the uncompacted strip should be approximately equal to the thickness being allowed for roll down during compaction. Procedures similar to these outlined above shall be used to facilitate getting a smooth joint with density. When the quantity of mixture on the previously placed strip plus uncompacted material in the strip being placed exceeds that required to produce a smooth, dense joint, the excess mixture shall be removed and wasted. Excess material shall not be spread over the uncompacted mat.

3.6.5 Shoveling, Raking, and Tamping After Machine Spreading

A sufficient number of experienced shovelers and rakers shall follow the spreading machine, adding hot mixture and raking the mixtures as required to produce a course that, when completed, will conform to all requirements specified herein. Broadcasting or fanning of mixture over areas being compacted will not be permitted. When segregation occurs in the mixture during placing, the spreading operation shall be suspended until the cause is determined and corrected. Irregularities in alignment of the course left by the mechanical spreader shall be corrected by trimming directly behind the machine. Immediately after trimming, the edges of the course shall be thoroughly compacted by tamping laterally with a lute. Distortion of the course during tamping will not be permitted.

3.6.6 Hand Spreading in Lieu of Machine Spreading

In areas where the use of machine spreading is impractical, the mixture shall be spread uniformly with hot shovels and hot rakes in a loose layer of a thickness that, when compacted, will conform to the required grade and thickness. During hand spreading, each shovelful of mixture shall be carefully placed by turning the shovel over in a manner that will prevent segregation. In no case shall the mixture be placed by throwing or broadcasting from a shovel. The loads shall not be dumped faster than can be properly handled by the shovelers and rakers.

3.7 COMPACTION OF MIXTURE

3.7.1 General

Compaction of the mixture shall be accomplished using a minimum of 2 steel-wheel rollers and a pneumatic-tired roller specified above. Rolling shall begin as soon after placing as mixture will bear roller without undue displacement. Delays in rolling freshly spread mixture will not be permitted. After initial rolling, preliminary tests of crown, grade, and smoothness shall be made by the Contractor under supervision of the Contracting Officer. Before rolling is continued, deficiencies shall be corrected so that finished course will conform to requirements for grade and smoothness specified herein. Further smoothness checks shall be made

by the Contractor as directed by the Contracting Officer. After preliminary smoothness tests, rolling shall be continued until density is obtained in all portions of each course of not less than 95 percent of density of laboratory compacted Marshall specimens taken behind the paver.

3.7.2 Density Tests

Density of the compacted mixture of the surface or intermediate course shall be determined by tests made on specimens taken from the compacted course in accordance with the requirements of paragraph: SAMPLING PAVEMENTS. Specimens shall be tested in accordance with the requirements of ASTM D 2726-90.

3.7.3 Operation of Rollers, Tampers and Vibro Plate Compactors

3.7.3.1 The speed of rollers shall be slow enough at all times to avoid displacement of the hot mixture. Displacement of the mixture resulting from reversing the direction of the roller or from any other cause shall be corrected at once by use of rakes, and fresh mixture shall be applied or removed when necessary. Alternate passes of the roller shall be varied slightly in length. During rolling, the wheels of steel-wheel rollers and plates of vibro plate compactors shall be moistened to prevent adhesion of the mixture to the wheels or plates, but excess water will not be permitted. Tires of heavy pneumatic roller shall be moistened with soapy water when required to prevent mixture from sticking to tires during rolling. Rollers shall not be permitted to stand on finished courses until the courses have thoroughly cooled. The minimum number of rollers shall be adequate to obtain the specified density. Places inaccessible to rollers shall be thoroughly compacted with hot hand-tampers or vibro plate compactors.

3.7.3.2 Unless otherwise directed by Contracting Officer, a pneumatic-tired roller shall be used as an intermediate roller. Longitudinal joints shall be pinched to ensure compaction with the pneumatic-tired roller. The roller shall make at least one complete pass (forward and backward) operated on the hot lane as the intermediate roller. The roller shall be operated with its outside tire as close as possible to the previously placed lane.

3.7.4 Correcting Deficient Areas

Mixtures that become contaminated or are defective shall be removed. Skin patching of an area that has been rolled will not be permitted. Holes the full thickness of the course shall be cut so that the sides are perpendicular and parallel to the direction of traffic and the edges are vertical. Edges shall be sprayed with bituminous materials conforming to the requirements of SECTION: BITUMINOUS TACK COAT. Sufficient fresh paving mixture shall be placed in the holes so that finished surface will conform to the grade and smoothness requirements. The paving mixture shall be compacted to the density specified herein.

3.8 JOINTS

3.8.1 General

Joints between old and new pavements or between successive day's work, or joints that have become cold because of delay, shall be tacked and shall be made carefully to insure continuous bond between old and new sections of the course. All joints shall have the same texture, density, and smoothness as other sections of the course. The tack shall be overlapped onto the previous pavement 25 mm (1 inch) or 50 mm (2 inches). Contact surfaces of previously constructed pavements, curbs, gutters, manholes, etc., shall be tacked. If these surfaces have become coated with dust, sand, or other objectionable material shall be cleaned by brushing or cut back with an approved power saw, as directed. The surface against which new material is to be placed shall be sprayed with a thin, uniform coat of bituminous material conforming to the requirements of SECTION: BITUMINOUS TACK COAT. The material shall be applied far enough in advance of placement of the fresh mixture to insure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

3.8.2 Transverse Joints

The roller shall pass over the unprotected end of freshly placed mixture only when placing of the course is discontinued or when delivery of mixture is interrupted to the extent that unrolled material may become cold. In all cases, the edge of the previously placed course shall be cut back to expose an even, vertical surface the full thickness of the course. In continuing placement of strip, the mechanical spreader shall be positioned on the transverse joint so that sufficient hot mixture will be spread to obtain a joint after rolling which conforms to the required density and smoothness specified herein. When required, the fresh mixture shall be raked against the joints, thoroughly tamped with hot tampers, smoothed with hot irons and rolled.

3.8.3 Longitudinal Joints

Longitudinal joints in surface course or intermediate course shall be offset as stated in specification paragraph: Offsetting Joints in Intermediate and Surface Courses. Procedures outlined in specification paragraph: Special Requirements for Placing Strips Succeeding Initial Strips shall be followed when making longitudinal joints. Edges of previously placed strips that have cooled or are irregular, honeycombed, poorly compacted, damaged, or otherwise defective, and unsatisfactory sections of the joint shall be cut back to expose a clean, sound surface for the full thickness of the course as directed. When required, fresh mixtures shall be raked against the joint, thoroughly tamped with hot tampers, smoothed with hot irons and rolled.

3.9 EDGES OF PAVEMENT

Edges of pavement adjacent to the shoulders shall be trimmed neatly to line. Shoulder material not less than 0.3 meters (1 foot) wide shall be placed against and to the full height of the pavement surface as soon as practicable after final rolling has been completed and the pavement has sufficiently hardened.

3.10 PROTECTION OF PAVEMENT

After final rolling of the pavement, no vehicular traffic of any kind shall be permitted until the pavement has cooled and hardened or for at least 6 hours.

3.11 SURFACE REQUIREMENTS

Finished surface of bituminous courses, when tested as specified below shall conform to gradeline and elevations shown and to surface-smoothness requirements specified.

3.11.1 Plan Grade

The grade of the completed surface shall not deviate more than 1.5 mm (0.05 foot) from the plan grade.

3.11.2 Bituminous Intermediate Course

Upon completion of final rolling the surface of the intermediate course, if any, shall be smooth and true to grade and cross section. When a 12-foot straightedge is laid on the surface parallel with the centerline of the paved area or transverse from crown to pavement edge, the surface shall not vary more than 1/4 inch from the straightedge. Surface irregularities exceeding these requirements shall be corrected as directed. Testing for plan-grade conformance and surface smoothness shall be performed by the Contracting Officer immediately after rolling is completed. Tests shall be made at intervals as directed.

3.11.3 Bituminous Surface Course

The surface course, upon completion of final rolling, shall be smooth and true to grade and cross section. When a 3.66 meters (12-foot) straightedge is laid on the surface parallel with the centerline, the surface shall not vary more than 3.2 mm (1/8 inch) from the straightedge. When the 3.66 meters (12-foot) straightedge is laid on the surface transverse to the centerline between the crown and edge of payment, the surface shall not vary more than 6.4 mm (1/4 inch) from the straightedge. Low or defective areas shall be immediately corrected by cutting out the faulty areas with fresh, hot mixture, and compacting the area to conform to the remainder of the pavement. Testing for plan-grade conformance and surface smoothness shall be performed by the Contractor in the presence of a representative of the Contracting Officer immediately after rolling is completed. Tests shall be made at intervals as directed.

3.11.4 Equipment

The Contractor shall furnish and maintain at the site, in good condition, one straightedge for each bituminous paver, for use of the Contracting Officer in testing the finished surface. Straightedges shall be aluminum or other approved lightweight metal and shall have blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on the pavement. Where devices other than straightedges are

approved for surface smoothness determination, the Contractor shall furnish and maintain in good condition at the site, one such device for each bituminous paver.

3.12 SAMPLING PAVEMENTS

Samples of finished pavement, including samples that span the longitudinal joints, shall be obtained by the Contractor. A minimum of one test (three cores or sawed samples) shall be taken for each tonage lot represented by a Marshall test. The three cores or sawed samples shall be taken at locations throughout the tonage lot. The locations shall not be previously marked. Sample shall be taken at locations determined by the Contracting Officer. Additional samples shall be taken and testedat the start of the paving operations when directed. One-half of the samples shall be cut from longitudinal joints. The Contracting Officer may require additional testing at no additional cost to the Government. The Government may also perform verification tests as considered necessary. Cores shall be at least 101.6 mm (4 inches) in diameter and sawed samples at least 127.0 mm (5 inches) on each side. The samples shall be tested by the Contractor to determine conformance to density, thickness and, if directed, other specified requirements. All quality control sampling and testing shall be the responsibility of the Contractor in accordance with paragraph SECTION: CONTRACTOR QUALITY CONTROL, specification paragraph: QUALITY CONTROL and as specified herein. Samples of each day's production shall be taken by noon of the following day and results of tests reported to the Contracting Officer by the end of that day. The Contractor shall furnish a power saw or core drill and labor for cutting samples and shall immediately replace the pavement. Sample holes shall have all surfaces tacked. Hot-mix bituminous mix shall be compacted in the sample hole to the satisfaction of the Contracting Officer. The finished surface of the repaired sample hole shall be sealed by mopping with tack coat.

3.13 INSPECTION OF PLANT AND EQUIPMENT

The Contracting Officer shall have access at all times to all parts of the paving plant for checking adequacy of equipment in use, for inspecting operation of plant, verifying weights, proportions, and character of materials, and for checking temperatures maintained in preparation of mixtures. Checks so made shall not relieve the Contractor from performing all work as specified.

-- End of Section --

SECTION 02721

RIGID BASE COURSE
03/97

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 basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(1993) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457-mm (18-in) Drop

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29	(1991a) Unit Weight and Voids in Aggregate
ASTM C 88	(1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1995a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1992) Sampling Aggregates
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate n Place by Nuclear Methods (Shallow Depth)

ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes

1.2 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in AASHTO T 180, Method D. In this specification, degree of compaction shall be a percentage of laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment; FIO-RE.

List of proposed equipment to be used in performance of construction work, including descriptive data.

SD-08 Statements

Material Source; GA-RE.

Source of the material to be used for producting aggregates in accordance with subparagraph: Approval of Materials. This shall be submitted with the report below

SD-09 Reports

Sampling and Testing; GA-RE.

Copies of initial and in-place test results.

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 01440 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 Contracting Officer.

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 maximum density and optimum moisture shall be determined in accordance with AASHTO T 180, Method D.

1.4.2.4 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 on the drawings 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 paragraph Calibration, of the ASTM 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. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration, in ASTM D 2922, on each different type of material to be tested at the beginning of a job and at intervals as directed.

1.4.2.5 Soundness Test

Soundness tests shall be made in conformance with ASTM C 88.

1.4.2.5 Wear Test

Wear tests shall be made on rigid base course material in conformance with ASTM C 131.

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 not including 0.02 mm size material
b. Liquid limit and plasticity index moisture-density relationship
c. Wear Test
d. Soundness Testfoot

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 rigid base course. Samples shall be taken for each 835 square yards of each layer of material placed in each area and not less than on test for each day's placement.

a. Sieve Analysis not including 0.02 mm size material
b. Field Density
c. Moisture liquid limit and plasticity index

1.4.4 Approval of Material

The source of the material shall be selected at least 60 days prior to the time the material will be required in the work. Initial approval of the source will be based on an inspection by the Contracting Officer. Initial approval of material will be based on tests of samples for the specific job. Final approval of both the source and the material will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted rigid base 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 will be subject to approval 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, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Rigid Base Course

Aggregates shall consist of crushed stone or gravel, screenings, natural sand, or other clean, sound, durable, approved materials processed and blended or naturally combined. Aggregates shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. Material retained on the No. 4 sieve shall have a percentage of wear not to exceed 40 percent after 500 revolutions when tested as specified in ASTM C 131, and have a loss not greater than 24 percent weighted average at 5 cycles when tested for soundness in magnesium sulfate in accordance with ASTM C 88. The percentage of flat and/or elongated particles shall not exceed 20 in the fraction retained on the 1/2 inch sieve and in the fraction passing the 1/2 inch sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. When the course aggregate is supplied from more than one source, aggregate from each source shall meet the requirements set forth herein. In the portion retained on each sieve specified, the crushed gravel shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the face. Gradation requirements specified herein shall apply to the completed compacted material. When 2 fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as 2 fractured faces. Aggregates shall have a maximum size of 2.0 inches and be graded continuously well within the limits specified as follows:

Maximum Allowable Percentage by Weight
Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3	No. 4
No. 10	50	80	--	85
No. 200	15	15	15	15

Liquid limit and plasticity index requirements stated herein shall apply to any aggregate component that is blended to meet the required gradation and also to the aggregate in the completed aggretgate surface. The portion of any blended component and of the completed course passing the No. 40 sieve shall be either nonplastic or shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 OPERATION OF AGGREGATE SOURCES

All clearing, stripping and excavating work involved in the opening or operation of aggregate sources shall be performed by the Contractor. Aggregate sources shall be opened to working depth in a manner that produces excavation faces that are as nearly vertical as practicable for the materials being excavated. Materials excavated from aggregate sources shall be obtained in successive cuts extending through all exposed strata.

All pockets or strata of unsuitable materials overlying or occurring in the deposit shall be wasted as directed. The methods of operating aggregate sources and the processing and blending of the material may be changed or modified by the Contracting Officer, when necessary, in order to obtain material conforming to specified requirements. Upon completion of work, aggregate sources on Government reservations shall be conditioned to drain readily, and shall be left in a satisfactory condition. Aggregate sources on private lands shall be conditioned in agreement with local laws and authorities.

3.2 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.3 PREPARATION OF UNDERLYING MATERIAL

Prior to constructing the rigid base course, the underlying course or subgrade shall be cleaned of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. Ruts, or soft yielding spots, in the underlying courses, subgrade areas having inadequate compaction, and deviations of the surface from the specified requirements, shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the rigid base course is placed.

3.4 GRADE CONTROL

The finished and completed rigid 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.

3.5 MIXING AND PLACING MATERIALS

The materials shall be mixed and placed to obtain uniformity of the rigid base material at the water content specified. The Contractor shall make such adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory rigid base course.

3.6 LAYER THICKNESS

The compacted thickness of the completed course shall be as indicated. When a compacted layer of 6 inches is specified, the material may be placed

in a single layer; when a compacted thickness of more than 6 inches is required, no layer shall exceed 6 inches nor be less than 3 inches when compacted.

3.7 COMPACTION

Each layer of the rigid base course shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus 2 percent of optimum water content, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer is compacted through the full depth to at least 95 percent of laboratory maximum density. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory rigid base course. 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.

3.8 PROOF ROLLING

Areas designated on the drawings to be proof rolled shall receive an application of 30 coverages with a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 30,000 pounds and inflated to a minimum of 150 psi. A coverage is defined as the application of one tire print over the designated area. In the areas designated, proof rolling shall be applied to the top layer of the rigid base course. Water content of the top layer of the rigid base course shall be maintained such that the water content is within plus or minus 2 percent of optimum water content, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. Any material in the rigid base courses or underlying materials indicated to be unsatisfactory by the proof rolling shall be removed, dried, and recompacted, or removed and replaced with satisfactory materials.

3.9 EDGES

Approved material shall be placed along the edges of the rigid base course in such quantity as will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least a 1 foot width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the rigid base course, as directed.

3.10 SMOOTHNESS TEST

The surface of each layer shall not show deviations in excess of 3/8 inch when tested with a 12 foot straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by removing material, replacing with new material, or reworking existing material and compacting, as directed.

3.11 THICKNESS CONTROL

The completed thickness of the rigid base course shall be in accordance with the thickness and grade indicated on the drawings. The thickness of each course shall be measured at intervals providing at least one measurement for each 500 square yards or part thereof of rigid base course. The thickness measurement shall be made by test holes, at least 3 inches in diameter through the course. The completed rigid base 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 as conforming with the specified thickness requirements plus 1/2 inch. The average job thickness shall be the average of the job measurements as specified above but within 1/4 inch of the thickness shown.

3.12 MAINTENANCE

The rigid base course shall be maintained in a satisfactory condition until accepted.

-- End of Section --

SECTION 02722

GRADED, CRUSHED AGGREGATE BASE COURSE AND RIGID BASE COURSE
12/97

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 basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(1993) Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-in (457 mm) Drop

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 88	(1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1992) Sampling Aggregates
ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow

	Depth)
ASTM D 4318	(1995a) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes
ASTM E 548	(1994) General Criteria Used for Evaluating Laboratory Competence

1.2 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in AASHTO T 180, Method D. This will be abbreviated herein after as percentage of laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having no designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment; .

List of proposed equipment to be used in performance of construction work, including descriptive data.

SD-08 Statements

Material Source; GA-RE.

Source of the material to be used for producting aggregates in accordance with subparagraph: Approval of Materials. This shall be submitted with the report below.

SD-09 Reports

Sampling and Testing; GA-RE.

Copies of initial and in-place test results.

1.4 EQUIPMENT

1.4.1 Approval

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall have the capability of producing the required compaction, meeting grade controls,

thickness control, and smoothness requirements as indicated.

1.4.2 Weather Limitation

Base courses shall be placed when the atmospheric temperature is above 35 degrees F. Areas of completed base course that are damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirement.

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, or by the Contractor, subject to approval. If the Contractor elects to establish its own testing facilities, approval of such facilities shall be based on compliance with ASTM E 548, and work requiring testing will not be permitted until the Contractor's facilities have been inspected and approved. The first inspection of the facilities will be at the expense of the Government and any subsequent inspections, required because of failure of the first inspection, shall be at the expense of the Contractor. Such costs will be deducted from the total amount due the Contractor. The materials shall be tested to establish compliance with the specified requirements. Copies of test results shall be furnished to the Contracting Officer.

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 Contracting Officer.

1.5.2 Tests

1.5.2.1 Initial Tests

One of each of the following tests shall be performed on the proposed material, prior to commencing construction for each source of material: Sieve analysis, wear test, soundness, liquid limit and plasticity index, and moisture-density relationships. Test results shall be submitted to the Contracting Officer prior to commencing construction.

1.5.2.1 Sieve Analyses

Sieve analyses shall be made in conformance with ASTM C 117 and ASTM C 136. 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 Testing Frequency

Testing frequency for sieve analysis, liquid limit and plasticity index:

Results shall varify that the material complies with the specifications. After the initial test, a minimum of one analysis shall be performed for each 1,000 metric ton (1,000 tons) of material placed, with a minimum of one analysis for each day's placement until the base course is completed. When the source of materials is changed or deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced.

1.5.2.5 Density Tests

Density shall be measured in the field in accordance with ASTM D 1556 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 paragraph Calibration of the ASTM publication. Tests performed in accordance with 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 also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed. Not less than one test shall be made to determine the field density of the compacted base course for each 1000 square meters (1000 square yards) of each layer of material placed and not less than one test for each day's placement.

1.5.2.4 Soundness Test

Soundness tests shall be made in conformance with ASTM C 88.

1.5.2.5 Wear Test

Wear tests shall be made in conformance with ASTM C 131.

1.5.3 Approval of Material

The source of the material to be used for producing aggregates shall be selected 60 days prior to the time the material will be required in the work. Tentative approval of the source will be based on an inspection by the Contracting Officer. Tentative approval of material will be based on tests of samples for the specific job. Final approval of both the source and the material will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted base course.

PART 2 PRODUCTS

2.1 AGGREGATES

Aggregates shall consist of clean, sound, durable particles of crushed stone or crushed gravel, and screenings. The Contractor shall obtain

materials that meet the specification and can be used to meet the grade and smoothness requirements specified herein, after compaction operations have been completed. The aggregates shall be free of silt and clay as defined by ASTM D 2487, vegetable matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.

2.1.1 Coarse Aggregates

Coarse aggregates shall be angular particles of uniform density. The coarse aggregate shall have a loss not greater than 24 percent weighted averaged at 5 cycles when tested for soundness in magnesium sulfate in accordance with ASTM C 88. The coarse aggregate shall have a percentage of wear not to exceed 40 after 500 revolutions as determined by ASTM C 131. The percentage of flat and/or elongated particles shall not exceed 20 in the fraction retained on the 1/2 inch sieve and in the fraction passing the 1/2 inch sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements. Crushed gravel shall be manufactured from gravel particles 90 percent of which by weight are retained on the maximum-size sieve listed in TABLE I. In the portion retained on each sieve specified, the crushed gravel shall contain at least 90 percent by weight of crushed pieces having 2 or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the plane. When 2 fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as 2 fractured faces.

2.1.2 Fine Aggregate

Fine aggregate shall be natural sand or angular particles produced by crushing stone or gravel that meets the requirements for wear and soundness specified for coarse aggregate.

2.1.3 Gradation Requirements

Gradation requirements specified shall apply to the completed base course. The aggregates shall be graded continuously within the limits specified in TABLE I. Sieves shall conform to ASTM E 11.

TABLE I. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
2 inch	100	--	--
1-1/2 inch	70-100	100	--
1 inch	45-80	60-100	100
1/2 inch	30-60	30-65	40-70

TABLE I. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
No. 4	20-50	20-50	20-50
No. 10	15-40	15-40	15-40
No. 40	5-25	5-25	5-25
No. 200	0-10	0-10	0-10

NOTE 1: The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves may require appropriate correction by the Contracting Officer when aggregates of varying specific gravities are used.

2.1.4 Liquid Limit and Plasticity Index

Liquid limit and plasticity index requirements stated herein shall apply to any aggregate component that is blended to meet the required gradation and also to the aggregate in the completed base course. The portion of the aggregate passing the No. 40 sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.2 PREPARATION OF UNDERLYING COURSE

Prior to constructing the crushed, aggregate base course, the underlying course shall be cleaned of all foreign substances. At the time of construction of the base course, the underlying course shall contain no frozen material. The underlying course shall conform to Section LIME-MODIFIED SUBGRADE or SUBBASE COURSES. Ruts or soft, yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements specified shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the base course is placed.

3.3 GRADE CONTROL

During construction, the lines and grades, including crown and cross slope indicated for the base course, shall be maintained by means of line and grade stakes placed by the Contractor.

3.4 MIXING OF MATERIALS

The coarse and fine aggregates shall be mixed in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. The Contractor shall make such adjustments in mixing procedures or in equipment as may be directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to ensure a satisfactory base course meeting requirements of this specification.

3.5 PLACING

The mixed material shall be placed on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 6 inches or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 6 inches is required, the material shall be placed in layers of equal thickness. No layer shall exceed 6 inches or be less than 3 inches when compacted. The layers, when compacted, shall be true to the grades or levels required, with the least possible surface disturbance. Where the base course is placed in more than 1 layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Adjustments in placing procedures or equipment shall be made as directed, to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to ensure an acceptable base course.

3.6 COMPACTION

3.6.1 Requirements

Each layer of base course, including shoulders, shall be compacted to produce an average field-measured density, through the full depth, of at least 100 percent of laboratory maximum density obtained in the laboratory for graded crushed aggregate base course and 95 percent of laboratory maximum density for rigid base course. Water content shall be maintained during the compaction procedure and subsequent proof rolling of designated areas. Water content shall be within plus or minus 2 percent of optimum water content, as determined from laboratory tests and as specified in density test procedures listed in paragraph SAMPLING AND TESTING. In places not accessible to the rollers, the base course material shall be compacted with mechanical tampers.

3.6.2 Finishing

The surface of top layer of base course shall be finished after final compaction by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of top layer of base course is 1/2 inch or more below the grade, the top layer of base

shall be scarified to a depth of at least 3 inches, new material shall be added, and the layer shall be blended and recompacted to bring to grade. Adjustments in rolling and finishing procedures shall be made as may be directed to obtain grades, to minimize segregation and degradation of base course material, to adjust the water content, and to ensure an acceptable base course. Material found unacceptable shall be removed and replaced, as directed, with acceptable material.

3.7 EDGES OF BASE COURSE

Acceptable material shall be placed along the edges of the base course that will compact to the thickness of the course being constructed. When the course is being constructed in 2 or more layers, at least a 1 foot width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the base course, as directed.

3.8 SMOOTHNESS TEST

The surface of the top layer shall not deviate more than 3/8 inch when tested with a 10 footstraightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding 3/8 inch shall be corrected as directed.

3.9 THICKNESS CONTROL

The completed thickness of the base course shall be within 1/2 inch of the thickness indicated. The thickness of the base course shall be measured at intervals of one measurement for at least each 500 square yards of base course. The depth measurement shall be made by test holes at least 3 inches in diameter. Where the measured thickness of the base course is more than 1/2 inch deficient, such areas shall be corrected by excavating to the required depth and replacing with new material. Where the measured thickness of the base course is 1/2 inch more than indicated, it will be considered as conforming with the requirements plus 1/2 inch, provided the surface of the base course is within 1/2 inch of established grade. The average job thickness shall be the average of the job measurements as specified above but within 1/4 inch of the thickness indicated.

3.10 MAINTENANCE

The base course shall be maintained in a condition that will meet specification requirements until accepted.

-- End of Section --

SECTION 02731

AGGREGATE SURFACE COURSE
01/98

PART 1 GENERAL

Aggregate surface course shall be used for the road surface constructed along the levee centerline.

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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1992) Sampling Aggregates
ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

ASTM D 3740	(1996) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D 4318	(1995a) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes

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 laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment; FIO.

List of proposed equipment to be used in performance of construction work including descriptive data.

SD-09 Reports

Sampling and Testing; GA. Density Test; GA.

Calibration curves and related test results shall be submitted prior to using the device or equipment being calibrated. Copies of field test results shall be submitted within 24 hours after the tests are performed. Test results from samples, shall be submitted not less than 30 days before material is required for the work. Results of laboratory tests for quality control purposes shall be approed, prior to using the material.

weight certificates; GA

The Contracting Officer may elect to accept certified weight certificates furnished by a public weigh master in lieu of scale weights at the jobsite.

DENSITY TESTS; GA

Density shall be measured in the field.

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 Contracting Officer 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 or by the Contractor, subject to approval. If the Contractor elects to establish its own testing facilities, approval of such facilities will be based on compliance with ASTM D 3740. No work requiring testing will be permitted until the Contractor's facilities have been inspected and 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 Contracting Officer.

1.5.2 Testing

1.5.2.1 Gradation

Aggregate gradation shall be made 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.

1.5.3 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 Contracting Officer. 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 Contracting Officer. Surfaces damaged by freeze,

rainfall, or other weather conditions shall be brought to a satisfactory condition by the Contractor.

PART 2 PRODUCTS

2.1 AGGREGATES

Aggregates shall consist of clean, sound, durable particles of natural gravel, crushed gravel, crushed stone, sand, slag, soil, or other approved materials processed and blended or naturally combined. Aggregates shall be free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign materials. The Contractor shall be responsible for obtaining materials that meet the specification and can be used to meet the grade and smoothness requirements specified herein after all compaction and proof rolling operations have been completed.

2.1.1 Coarse Aggregates

The material retained on the No. 4 sieve shall be known as coarse aggregate. Coarse aggregates shall be reasonably uniform in density and quality. The coarse aggregate shall have a percentage of wear not to exceed 50 percent after 500 revolutions as determined by ASTM C 131. The amount of flat and/or elongated particles shall not exceed 20 percent. A flat particle is one having a ratio of width to thickness greater than three; an elongated particle is one having a ratio of length to width greater than three. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the requirements set forth herein.

2.1.2 Fine Aggregates

The material passing the No. 4 sieve shall be known as fine aggregate. Fine aggregate shall consist of screenings, sand, soil, or other finely divided mineral matter that is processed or naturally combined with the coarse aggregate.

2.1.3 Gradation Requirements

Gradation requirements shall meet the requirements of Type 1 aggregate from Section 1007, of the Missouri State Highway commission Standard Specifications, 1996 edition.

2.2 LIQUID LIMIT AND PLASTICITY INDEX REQUIREMENTS

The portion of the completed aggregate surface course passing the No. 40 sieve shall have a maximum liquid limit of 35 and a plasticity index of 4 to 9.

PART 3 EXECUTION

3.1 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 specification requirements in the specified time limit. Upon completion of the work, the aggregate sources on Government property shall be conditioned to drain readily and be left in a satisfactory condition. Aggregate sources on private lands 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, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled in such a manner that will prevent segregation. Aggregates and binders obtained from different sources shall be stockpiled separately.

3.3 PREPARATION OF UNDERLYING COURSE SUBGRADE

The subgrade shall be compacted to 95 percent of maximum laboratory dry density according to paragraph
DENSITY.

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 in accordance with the SPECIAL CONTRACT REQUIREMENTS.

3.5 LAYER THICKNESS

The aggregate material shall be placed in a five inch layer of uniform thickness.

3.6 COMPACTION

Each layer of the aggregate surface course shall be compacted with approved compaction equipment. The water content during the compaction procedure shall be maintained at optimum or at the percentage specified by the Contracting Officer. 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 100 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.

3.7 EDGES OF AGGREGATE-SURFACED ROAD

Approved material shall be placed along the edges of the aggregate surface course in such quantity as to compact to the thickness of the course being constructed.

3.8 THICKNESS CONTROL

The completed thickness of the aggregate surface course shall be within 1/2

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 1/2 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 more than 1/2 inch thicker than that indicated, it shall be considered as conforming with the specified thickness requirements plus 1/2 inch. 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 fails to meet this criterion, the Contractor shall, at no additional expense to the Government, make corrections by scarifying, adding or removing mixture of proper gradation, and reblading and recompacting, as directed.

3.9 DENSITY TESTS

Density shall be measured in the field in accordance with ASTM D 2922. 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 paragraph Calibration of the ASTM 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. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals, as directed.

3.10 WEAR TEST

Wear tests shall be made in conformance with ASTM C 131.

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 02748

BITUMINOUS TACK AND PRIME COATS
01/98

PART 1 GENERAL

1.1 Bituminous Fill

Where material will contact the face of rail, a tack coat shall be applied to the face of the rail in accordance with Section: BITUMINOUS TACK COAT.

1.2 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 40	(1978; R 1983) Sampling Bituminous Materials

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

ASTM D 140	(1993) Sampling Bituminous Materials
ASTM D 977	(1991) Emulsified Asphalt
ASTM D 2027	(1976; R 1992) Cutback Asphalt (Medium-Curing Type)
ASTM D 2397	(1994) Cationic Emulsified Asphalt
ASTM D 2995	(1993) Determining Application Rate of Bituminous Distributors

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Tests; GA-RE.

Copies of all test results for bituminous materials, within 24 hours of

completion of tests. Certified copies of the manufacturer's test reports indicating compliance with applicable specified requirements, not less than 30 days before the material is required in the work.

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.

1.4.2 Bituminous Distributor

The distributor shall have pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the base surface or other layers in the pavement structure. The distributor shall be designed and equipped to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled rates with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Distributor equipment shall include a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the bituminous material during the heating process.

1.4.3 Power Brooms and Power Blowers

Power brooms and power blowers shall be suitable for cleaning the surfaces to which the bituminous coat is to be applied.

1.5 WEATHER LIMITATIONS

Bituminous coat shall be applied only when the surface to receive the bituminous coat is dry. Bituminous coat shall be applied only when the atmospheric temperature in the shade is 50 degrees For above and when the temperature has not been below 35 degrees F for the 12 hours prior to application.

PART 2 PRODUCTS

2.1 TACK COAT

Emulsified asphalt shall conform to ASTM D 977 or ASTM D 2397, for Type ss-1, ss-1h, css-1, or css-1h.

2.2 PRIME COAT

Cutback asphalt shall conform to ASTM D 2027, Grade MC-30 or MC-70.

PART 3 EXECUTION

3.1 PREPARATION OF SURFACE

Immediately before applying the bituminous coat, all loose material, dirt, clay, or other objectionable material shall be removed from the surface to be treated. The surface shall be dry and clean at the time of treatment.

3.2 APPLICATION RATE

The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Contracting Officer.

3.2.1 Tack Coat

Bituminous material for the tack coat shall be applied in quantities of not less than 0.05 gallon nor more than 0.15 gallon per square yard of pavement surface.

3.2.2 Prime Coat

Bituminous material for the prime coat shall be applied in quantities of not less than 0.15 gallon nor more than 0.40 gallon per square yard of pavement surface.

3.3 APPLICATION TEMPERATURE

3.3.1 Viscosity Relationship

Asphalt application temperature shall provide an application viscosity between 10 and 60 seconds, Saybolt Furol, or between 20 and 120 centistokes, kinematic. The temperature viscosity relation shall be furnished to the Contracting Officer.

3.3.2 Temperature Ranges

The viscosity requirements shall determine the application temperature to be used. The following is a normal range of application temperatures:

Liquid Asphalts

[MC-30	85-190 degrees F]
[MC-70	120-225 degrees F]

Emulsions

[SS-1	70-160 degrees F]
[SS-1h	70-160 degrees F]
[CSS-1	70-160 degrees F]
[CSS-1h	70-160 degrees F]

*These temperature ranges exceed the flash point of the material and care should be taken in their heating.

3.4 APPLICATION

Following preparation and subsequent inspection of the surface, the bituminous coat shall be applied at the specified rate with uniform distribution over the surface to be treated. All areas and spots missed by the distributor shall be properly treated with the hand spray. Until the succeeding layer of pavement is placed, the surface shall be maintained by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, clean dry sand shall be spread 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 shall be permitted within 25 feet of heating, distributing, and transferring operations of bituminous material other than bituminous emulsions. To obtain uniform application of the prime coat on the surface treated at the junction of previous and subsequent applications, building paper shall be spread on the surface for a sufficient distance back from the ends of each application to start and stop the prime coat on the paper. Immediately after application, the building paper shall be removed and destroyed.

3.5 CURING PERIOD

Following application of the bituminous material 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. Prime coat shall be allowed 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.

3.6 FIELD QUALITY CONTROL

Samples of the bituminous materialused shall be obtained by the Contractor as directed, under the supervision of the Contracting Officer. The sample may be retained and tested by the Government at no cost to the Contractor.

3.7 SAMPLING AND TESTING

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved.

3.7.1 Sampling

The samples of bituminous material, unless otherwise specified, shall be in accordance with ASTM D 140 or AASHTO T 40. Sources from which bituminous materials are to be obtained shall be selected and notification furnished the Contracting Officer within 15 days after the award of the contract.

3.7.2 Calibration Test

The Contractor shall furnish all equipment, materials, and labor necessary to calibrate the bituminous distributor. Calibration shall be made with the approved job material and prior to applying the bituminous coat

material to the prepared surface. Calibration of the bituminous distributor shall be in accordance with ASTM D 2995.

3.7.3 Trial Applications

Before providing the complete bituminous coat, three lengths of at least 100 feet for the full width of the distributor bar shall be applied to evaluate the amount of bituminous material that can be satisfactorily applied.

3.7.3.1 Tack Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous tack coat materials shall be applied in the amount of 0.05 gallons per square yard. Other trial applications shall be made using various amounts of material as may be deemed necessary.

3.7.3.2 Prime Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous materials shall be applied in the amount of 0.25 gallon per square yard. Other trial applications shall be made using various amounts of material as may be deemed necessary.

3.7.4 Sampling and Testing During Construction

Quality control sampling and testing shall be performed as required in paragraph FIELD QUALITY CONTROL.

-- End of Section --

SECTION 02754
CONCRETE PAVEMENTS FOR SMALL PROJECTS
03/97

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 basic designation only.

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 301	(1996) Standard Specification for Structural Concrete
ACI 305R	(1991) Hot Weather Concreting

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 184/A 184M	(1996) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 615/A 615M	(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 31/C 31M	(1996) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1997) Concrete Aggregates
ASTM C 39	(1996) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94	(1997) Ready-Mixed Concrete
ASTM C 123	(1996) Lightweight Pieces in Aggregate
ASTM C 143	(1990a) Slump of Hydraulic Cement Concrete
ASTM C 150	(1997) Portland Cement
ASTM C 192/C 192M	(1995) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1997) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1995) Air-Entraining Admixtures for Concrete

ASTM C 494	(1992) Chemical Admixtures for Concrete
ASTM C 595	(1998) Blended Hydraulic Cements
ASTM C 618	(1997) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 666	(1992) Resistance of Concrete to Rapid Freezing and Thawing
ASTM C 881	(1990) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 989	(1997) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1077	(1997) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

ARMY CORPS OF ENGINEERS (COE)

COE CRD-C 130	(1989) Scratch Hardness of Coarse Aggregate Particles
COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete
COE CRD-C 540	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1996) Concrete Plant Standards

1.2 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of concrete (rigid) pavement or Reinforced Concrete Pavement. However, where the construction covered herein interfaces with other sections, the construction at each interface shall conform to the requirements of both

this section and the other section, including tolerances for both.

1.3 ACCEPTABILITY OF WORK

The pavement will be accepted on the basis of tests made by the Government and by the Contractor or its suppliers, as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing. Concrete samples shall be taken by the Contractor at the placement to determine the slump, air content, and strength of the concrete. Test cylinders shall be made for determining conformance with the strength requirements of these specifications and, when required, for determining the time at which pavements may be placed into service. All air content measurements shall be determined in accordance with ASTM C 231. All slump tests shall be made in accordance with ASTM C 143. All test cylinders shall be 6 by 12 inch cylinders and shall be fabricated in accordance with ASTM C 192/C 192M, using only steel molds, cured in accordance with ASTM C 31/C 31M, and tested in accordance with ASTM C 39. 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. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory.

1.3.1 Evaluation Sampling

Sampling, testing, and mixture proportioning shall be performed by a commercial Testing Laboratory, conforming with ASTM C 1077. The individuals who sample and test concrete and concrete constituents shall be certified as American Concrete Institute (ACI) Concrete Field Testing Technicians, Grade I. The individuals who perform the inspection of concrete shall be certified as ACI Concrete Construction Inspector, Level II. All mix design, weekly quality control reports, smoothness reports, and project certification reports shall be signed by a Registered Engineer.

1.3.2 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 Government within 24 hours after measurement is made. A final report of surface testing, signed by a Registered Engineer, containing all surface measurements and a description of all actions taken to correct deficiencies, shall be provided to the Government upon conclusion of surface testing.

1.3.2.1 Surface Smoothness Requirements

The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more, and all pavements shall be within the tolerances specified in Table 1 when checked with the straightedge.

TABLE 1
STRAIGHTEDGE SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Tolerances inches
Calibration Hardstands &	Longitudinal	1/8

TABLE 1
STRAIGHTEDGE SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Tolerances inches
Compass Swinging Bases	Transverse	1/8
Roads and Streets	Longitudinal	3/16
	Transverse	1/4
Hardstands, Parking Areas, Open Storage Areas	Longitudinal	1/4
	Transverse	1/4

1.3.2.2 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.

1.3.3 Edge Slump Testing and Conformance

When slip-form paving is used, not more than 15 percent of the total free edge of the slipformed portion of the pavement, shall have an edge slump exceeding 1/4 inch and no slab shall have an edge slump exceeding 3/8 inch. Edge slump shall be determined as above for surface smoothness, at each free edge of each slipformed paving lane constructed. Measurements shall be made at 5 to 15 foot spacings, and as directed. When edge slump exceeding the limits specified above is encountered on either side of the paving lane, additional straightedge measurements shall be made, if required, to define the linear limits of the excessive slump. The concrete for the entire width of the paving lane within these limits of excessive edge slump shall be removed and replaced. Adding concrete or paste to the edge or otherwise manipulating the plastic concrete after the sliding form has passed, or patching the hardened concrete, shall not be used as a method for correcting excessive edge slump.

1.3.4 Plan Grade Testing and Conformance

The finished surface of the pavements shall conform, within the tolerances shown in Table 1, to the lines, grades, and cross sections shown. The finished surface of new abutting pavements shall coincide at their juncture. The finished surface of other pavements shall vary not more than 0.06 foot above or below the plan grade line or elevation indicated. Each pavement category shall be checked by the Contractor for conformance with plan grade requirements by running lines of levels at intervals to determine the elevation at each joint intersection.

1.4 PRECONSTRUCTION TESTING OF MATERIALS

The Contractor shall not be entitled to any additional payment or extension of time because of delays caused by sampling and testing additional sources, or samples, necessitated by failure of any samples. Aggregates shall be sampled and tested by the Test Laboratory and shall be representative of the materials to be used for the project. Test results, signed by a Registered Engineer, shall be submitted 45 days before commencing paving. No aggregate shall be used unless test results show that it meets all requirements of these specifications, including compliance with ASTM C 33 and deleterious materials limitations.

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment.

Manufacturer's literature on the concrete plant; mixing equipment; hauling equipment; placing and finishing, and curing equipment; at least 7 days prior to start of paving.

SD-07 Schedules

Paving.

Paving Schedules at least 7 days prior to start of paving.

SD-08 Statements

Mixture Proportions; GA.

The report of the Contractor's mixture proportioning studies showing the proportions of all ingredients and supporting information on aggregate and other materials that will be used in the manufacture of concrete, at least 14 days prior to commencing concrete placing operations.

1.6 EQUIPMENT

1.6.1 Batching and Mixing

The batching plant shall conform to NRMCA CPMB 100, the equipment requirements in ASTM C 94, and as specified. Water shall not be weighed or measured cumulatively with another ingredient. All concrete materials batching shall meet ASTM C 94 requirements. Mixers shall be stationary mixers . DELETED. Batching, mixers, mixing time, permitted reduction of mixing time, and concrete uniformity shall meet the requirements of ASTM C 94, and shall be documented in the initial weekly QC Report. If truck mixers are proposed for use in the work, all water and ingredients conforming to the mix design shall be batched to the drum at the plant, in which case no water shall be carried in the truck's water tank. The Contractor may hold back a portion of the mix water from the batching for later site addition, subject to specific approval. The weights of all the water in the truck's drum and truck's water tank system must be included on the weigh ticket, and shall conform to the mix design for the concrete batched. Trucks shall not carry additional water, except that required to

conform to the mix design. Trucks containing more water than required by the mix design shall be rejected, and the concrete batch wasted off-site. If the truck operator requires water at the site for rinsing his drum he shall obtain the water on-site from another vehicle or source after the concrete batch has been placed. The Government inspector shall have inspection access at all times to the truck's water tank and the tank shall have a water gauge which is in good and readable condition. If the water tank contents cannot be readily determined in the opinion of the Government inspector, the truck shall be immediately rejected from use in the work, and the batch wasted off-site. Truck mixers proposed for use shall conform to ASTM C 94, and shall be tested for uniformity immediately prior to use in the work. Certified copies of the laboratory testing for mixer uniformity shall be submitted for Government approval prior to use of the truck mixer in the work.

1.6.2 Transporting Equipment

Transporting equipment shall be in conformance with ASTM C 94 and as specified herein. Concrete shall be transported to the paving site in rear-dump trucks, in truck mixers, or in agitators. Truck mixers for use with low slump concrete shall be designed with extra large blading and rear opening. Bottom-dump trucks shall not be used for delivery of concrete.

1.6.3 Delivery Equipment

When concrete transport equipment cannot operate on the paving lane, side-delivery transport equipment consisting of self-propelled moving conveyors shall be used to deliver concrete from the transport equipment and discharge it in front of the paver. Front-end loaders, dozers, or similar equipment shall not be used to distribute the concrete.

1.6.4 Paver-Finisher

The paver-finisher shall be a heavy-duty, self-propelled machine designed specifically for paving and finishing high quality pavement. The paver-finisher shall spread, consolidate, and shape the plastic concrete to the desired cross section in one pass. The paver-finisher shall be equipped with a full width "knock-down" auger, capable of operating in both directions, which will evenly spread the fresh concrete in front of the screed or extrusion plate. Immersion vibrators shall be gang mounted at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or completely withdrawn from the concrete. The vibrators shall be automatically controlled so that they will be immediately stopped as forward motion of the paver ceases. The spacing of the immersion vibrators across the paving lane shall be as necessary to properly consolidate the concrete, but the clear distance between vibrators shall not exceed 30 inches, and the outside vibrators shall not exceed 12 inches from the edge of the lane. The paver-finisher shall be equipped with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface.

1.6.4.1 Paver-Finisher with Fixed Forms

The paver-finisher shall be equipped with wheels designed to ride the forms, keep it aligned with the forms, and to spread the preventing deformation of the forms.

1.6.4.2 Slipform Paver-Finisher

The slipform paver-finisher shall be automatically controlled and crawler mounted with padded tracks. Horizontal alignment shall be electronically referenced to a taut wire guideline. Vertical alignment shall be electronically referenced on both sides of the paver to a taut wire guideline, to an approved laser control system, or to a ski operating on a completed lane. Control from a slope-adjustment control or control operating from the underlying material shall not be used.

1.6.4.3 Other Types of Finishing Equipment

Clary screeds or other rotating tube floats will not be allowed on the project.

1.6.5 Curing Equipment

Equipment for curing is specified in paragraph CURING.

1.6.6 Texturing Equipment

Texturing equipment shall be as specified below.

1.6.6.1 Fabric Drag

A fabric drag shall consist of a piece of fabric material as wide as the lane width securely attached to a separate wheel mounted frame spanning the paving lane or to one of the other similar pieces of equipment. The material shall be wide enough to provide 12 to 18 inches dragging flat on the pavement surface. The fabric material shall be clean, reasonably new burlap, kept clean and saturated during use .

1.6.6.2 Deep Texturing Equipment

Texturing equipment shall consist of a stiff bristled broom forming a drag at least 4 feet long. This drag shall be mounted in a wheeled frame spanning the paving lane and constructed to mechanically pull the drag in a straight line across the paving lane perpendicular to the centerline.

1.6.7 Sawing Equipment

Equipment for sawing joints and for other similar sawing of concrete shall be standard diamond-tip-bladed concrete saws mounted on a wheeled chassis.

1.6.8 Straightedge

The Contractor shall furnish and maintain at the job site one 12 foot straightedge for testing concrete surface smoothness. The straightedge shall be constructed of aluminum or magnesium alloy and shall have blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Straightedges shall have handles for operation on the pavement.

1.7 Measurement and Payment

1.1.16 07 - Site work For Q2

1.7.1 Payment

Site work for Q2 work includes structural excavation,

backfilling/compaction with select onsite soils, subgrade preparation and fine grading. This also includes all work to provide Q2 site ready for vertical construction. This includes all rail road work.

1.7.2 Unit of Measure

Unit of measure: lump sum.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious materials shall be only portland cement in combination with pozzolan ground granulated blast furnace slag and shall conform to appropriate specifications listed below.

2.1.1 Portland Cement

Portland cement shall conform to ASTM C 150 Type II, low-alkali .

2.1.2 High-Early-Strength Portland Cement

High-early-strength cement shall conform to ASTM C 150 Type III, with C3A limited to 5 percent, low-alkali.

2.1.3 Blended Cements

Blended cement shall conform to ASTM C 595 Type IP .

2.1.4 Pozzolan (Fly Ash)

Fly ash shall conform to ASTM C 618 Class F, including all the supplementary optional physical requirements.

2.1.5 Ground Granulated Blast-Furnace Slag (GGBF Slag)

Ground granulated blast-furnace slag shall conform to ASTM C 989 Grade 120.

2.2 AGGREGATES

Aggregates shall consist of clean, hard, uncoated particles meeting the requirements of ASTM C 33, including deleterious materials, abrasion loss and soundness requirements of ASTM C 33, and other requirements specified herein. Aggregate not having a satisfactory demonstrable service record shall have a durability factor of 50 or more when subjected to freezing and thawing in concrete in accordance with ASTM C 666.

2.2.1 Coarse Aggregate

Coarse aggregate shall consist of crushed gravel, crushed stone, or a combination thereof. The nominal maximum size of the coarse aggregate shall be 3/4 inches . When the nominal maximum size is greater than 1 inch, the aggregates shall be furnished in two ASTM C 33 size groups, No. 67 and No. 4. The amount of deleterious material in each size of coarse aggregate shall not exceed the limits shown in ASTM C 33 Class 1N, 4M or 4S, depending on the weathering region, and the following limits:

a. Lightweight particles 1.0 max. percent by mass (ASTM C 123).

b. Other soft particles 2.0 max. percent by mass (COE CRD-C 130).

c. Total of all deleterious 5.0 max. percent by mass (substances listed in ASTM C 33 and above, exclusive of material finer than No. 200 sieve).

d. The separation medium for lightweight particles shall have a density of Sp. Gr. of 2.0.

2.2.2 Fine Aggregate

Fine aggregate shall consist of natural sand, manufactured sand, or a combination of the two, and shall be composed of clean, hard, durable particles. All fine aggregate shall be composed of clean, hard, durable particles meeting the requirements of ASTM C 33 and the requirements herein. The amount of deleterious material in the fine aggregate shall not exceed the limits in ASTM C 33 and shall not exceed the following limits:

a. Lightweight particles (ASTM C 123) 1.0 percent max. by mass using a medium with a density of Sp. Gr. of 2.0.

b. The total of all deleterious material types, listed in ASTM C 33 and above, shall not exceed 3.0 percent of the mass of the fine aggregate.

2.3 CHEMICAL ADMIXTURES

Air-entraining admixture shall conform to ASTM C 260. An accelerator shall be used only when specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES and shall not be used to reduce the amount of cementitious material used. Accelerator shall conform to ASTM C 494Type C. Calcium chloride and admixtures containing calcium chloride shall not be used. A water-reducing or retarding admixture shall meet the requirements of ASTM C 494. Type G or H admixtures are not allowed.

2.4 CURING MATERIALS

Membrane forming curing compound shall be a white pigmented compound conforming to COE CRD-C 300. Burlap shall be new or shall be clean material never used for anything other than curing concrete.

2.5 WATER

Water for mixing and curing shall be clean, potable, and free of injurious amounts of oil, acid, salt, or alkali.

2.6 JOINT MATERIALS

2.6.1 Expansion Joint Material

Expansion joint filler shall be a preformed material conforming to ASTM D 1751 . Expansion joint filler shall be 3/4 inch thick.

2.6.2 Slip Joint Material

Slip joint material shall be 1/4 inch thick expansion joint filler conforming to ASTM D 1751 or ASTM D 1752.

2.6.3 Contraction Joint Inserts

Sawable contraction joint inserts shall conform to COE CRD-C 540. No metal inserts of any kind shall be used.

2.7 REINFORCING

2.7.1 General

Reinforcing bars shall conform to ASTM A 615/A 615M Grade 60. Bar mats shall conform to ASTM A 184/A 184M. Reinforcement shall be free from loose, flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete.

2.7.2 Steel Fiber Reinforcing

Minimum ultimate tensile strength of the fibers shall be 50000 psi. The maximum aspect ratio (length divided by diameter) shall not exceed 100. Fibers longer than 2-1/2 inches shall not be used. The fibers shall be deformed and shall be furnished in small bundles adhered with water soluble glue. Fiber reinforcing shall only be used where specifically indicated.

2.8 DOWELS AND TIE BARS

2.8.1 Dowels

Dowels shall be single piece, plain (non-deformed) steel bars conforming to ASTM A 615/A 615M Grade 60 or higher. Dowels shall be free of loose, flaky rust and loose scale and shall be clean and straight.

2.8.2 Tie Bars

Tie bars shall be deformed steel bars conforming to ASTM A 615/A 615M Grade 60. Grade 60 or higher shall not be used for bars that are bent and straightened during construction.

2.9 EPOXY RESIN

All epoxy-resin materials shall be two-component materials conforming to ASTM C 881, Class as appropriate for each application temperature to be encountered; except, that in addition, the materials shall meet the following requirements:

a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.

b. Material for use as patching for complete filling of spalls, wide cracks, and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.

c. Material for injecting cracks shall be Type IV, Grade 1.

d. Material for bonding freshly mixed portland cement concrete, mortar, or freshly mixed epoxy resin concrete to hardened concrete shall be Type V, Grade as approved.

2.10 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES

Specified compressive strength, f'c, for concrete is 4000psi at 28 days. Maximum allowable water-cementitious material ratio is 0.45 . The water-cementitious material ratio is based on absolute volume equivalency, where the ratio is determined using the weight of cement for a cement only mix, or using the total volume of cement plus pozzolan converted to an equivalent weight of cement by the absolute volume equivalency method described in ACI 211.1. The concrete shall be air-entrained with a total air content of 4 plus or minus 1 percent. The maximum allowable slump of the concrete shall be 3 inches for pavement constructed with fixed forms.

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. 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.

2.11 MIXTURE PROPORTIONS

2.11.1 Composition Concrete

Composition concrete shall be composed of cementitious material, water, fine and coarse aggregates, and admixtures. Fly ash, if used, shall be used only at a rate between 15 and 35 percent by mass of the total cementitious material. Admixtures shall consist of air entraining admixture and may also include accelerator and/or water-reducing admixture. High range water-reducing admixtures and admixtures to produce flowable concrete shall not be used. No substitutions shall be made in the materials used in the mixture proportions without additional tests to show that the quality of the concrete is satisfactory.

2.11.2 Concrete Mixture Proportioning Studies

Trial design batches, mixture proportioning studies, and testing shall be the responsibility of the Contractor, and shall be performed by the Test Laboratory and signed by a Registered Engineer. No concrete pavement shall be placed until the Contracting Officer has approved the Contractor's mixture proportions. All materials used in mixture proportioning studies shall be representative of those proposed for use on the project. If there is a change in materials, additional mixture design studies shall be made using the new materials. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in ACI 211.1. At least three different water-cementitious ratios, which will produce a range of strength encompassing that required on the project, shall be used. Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content. Maximum sand content shall be 40 percent of the total aggregate SSD weight. Aggregate quantities shall be based on the mass in a saturated surface dry condition.

2.11.3 Mixture Proportioning Procedure

The Contractor shall perform the following:

a. Fabricate, cure and test 6 test cylinders per age for each mixture at 7 and 28 days.

b. Using the average strength for each w/(c+p), plot the results from each of the three mixtures on separate graphs for w/(c+p) versus 28-day strength.

c. From the graphs select a w/(c+p) which will produce a mixture giving a 28-day strength equal to the required strength determined in accordance with the following paragraph.

2.11.4 Average Strength Required for Mixtures

In order to ensure meeting, during production, the strength requirements specified, the mixture proportions selected shall produce a required average strength, f'cr, exceeding the specified strength, f'c, in accordance with procedures in Chapter 3 of ACI 301, "Proportioning."

PART 3 EXECUTION

3.1 CONDITIONING OF UNDERLYING MATERIAL

Underlying material, base course, upon which concrete is to be placed shall be clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. After the underlying material has been prepared for concrete placement, no equipment shall be permitted thereon.

3.2 WEATHER LIMITATIONS

3.2.1 Hot Weather Paving

The temperature of concrete shall not exceed 90 degrees F. Steel forms, dowels and reinforcing shall be cooled prior to concrete placement when steel temperatures are greater than 120 degrees F.

3.2.2 Cold Weather Paving

The ambient temperature of the air at the placing site and the temperature of surfaces to receive concrete shall be not less 40 degrees F. The temperature of the concrete when placed shall be not less than 50 degrees F. 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, chemical admixture conforming to ASTM C 494 Type C or E may be used provided it contains no calcium chloride. Calcium chloride shall not be used at any time. 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. Pavement damaged by freezing shall be completely removed and replaced at the Contractor's expense as specified in paragraph, REPAIR, REMOVAL, AND REPLACEMENT OF SLABS.

3.3 CONCRETE PRODUCTION

3.3.1 General Requirements

Concrete shall be deposited in front of the paver within 45 minutes from the time cement has been charged into the mixing drum, except that if the ambient temperature is above 90 degrees F, the time shall be reduced to 30 minutes. Every load of concrete delivered to the paving site shall be accompanied by a batch ticket from the operator of the batching plant. Tickets shall show at least the mass, or volume, of all ingredients in each batch delivered, the water meter and revolution meter reading on truck mixers and the time of day. Tickets shall be delivered to the placing foreman who shall keep them on file and deliver them to the Government

daily.

3.3.2 Transporting and Transfer-Spreading Operations

Non-agitating equipment shall be used only on smooth roads and for haul time less than 15 minutes. No equipment shall be allowed to operate on the prepared and compacted underlying material in front of the paver-finisher. Equipment shall be allowed to operate on the underlying material only if no damage is done to the underlying material and its degree of compaction. Any disturbance to the underlying material that does occur shall be corrected before the paver-finisher reaches the location of the disturbance and the equipment shall be replaced or procedures changed to prevent any future damage. Additional water may be added to truck mixers to bring the slump within the specified range provided the mixture water-cement ratio is not exceeded.

3.4 PAVING

Pavement shall be constructed with paving and finishing equipment utilizing fixed forms and/or slipforms.

3.4.1 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.

3.4.2 Operation

When the paver 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, and placing rubber mats beneath the paver tracks. Transversely oscillating screeds and extrusion plates shall overlap the existing pavement the minimum possible, but in no case more than 8 inches.

3.4.3 Required Results

The paver-finisher shall be operated to produce a thoroughly consolidated slab throughout, true to line and grade within specified tolerances. The paver-finishing operation shall produce a surface finish free of irregularities, tears, voids of any kind, and any other discontinuities. It shall produce only a very minimum of paste at the surface. Multiple passes of the paver-finisher shall not be permitted. The equipment and its operation shall produce a finished surface requiring no hand finishing, other than the use of cutting straightedges, except in very infrequent instances. No water, other than true fog sprays (mist), shall be applied to the concrete surface during paving and finishing.

3.4.4 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 for overlay pavements and for other locations where forms must be set on existing pavements shall be held securely in place with stakes or by other approved methods. Holes in existing pavements for form stakes shall be carefully drilled without cracking or spalling the existing pavement. Prior to setting forms for paving operations, the Contractor shall demonstrate the proposed form setting procedures at an approved location and shall not proceed further until the proposed method is approved. Forms shall remain in place at least 12 hours after the concrete has been placed. Forms shall be removed without injuring the concrete.

3.4.5 Slipform Paving

The slipform paver shall shape the concrete to the specified and indicated cross section in one pass, and shall finish the surface and edges so that only a very minimum 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. If a keyway is required, a 26 gauge thick metal keyway liner shall be installed as the keyway is extruded. The keyway liner shall be protected and shall remain in place and become part of the joint.

3.4.6 Placing Reinforcing Steel

Reinforcement shall be positioned on suitable chairs securely fastened to the subgrade prior to concrete placement, or may be placed on an initial layer of consolidated concrete, with the subsequent layer placed within 30 minutes of the first layer placement. If reinforcing for Continuously Reinforced Concrete Pavement (CRCP) is required, the entire operating procedure and equipment proposed shall be submitted for approval at least 30 days prior to proposed start of paving.

3.4.7 Placing Dowels and Tie Bars

Dowels shall be installed with alignment not greater than 1/8 inch per ft. Except as otherwise specified below, location of dowels shall be within a horizontal tolerance of plus or minus 5/8 inch and a vertical tolerance of plus or minus 3/16 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. Dowels and tie bars in joints shall be omitted when the center of the dowel or tie bar is located within a horizontal distance from an intersecting joint equal to or less than one-fourth of the slab thickness.

3.4.7.1 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/or 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.

3.4.7.2 Construction Joints-Fixed Form Paving

Installation of dowels and tie bars shall be by the bonded-in-place method, supported by means of devices fastened to the forms. Installation by removing and replacing in preformed holes will not be permitted.

3.4.7.3 Dowels Installed in Hardened Concrete

Installation shall be by bonding the dowels into holes drilled into the hardened concrete. Holes approximately 1/8 inch greater in diameter than the dowels shall be drilled into the hardened concrete. Dowels shall be bonded in the drilled holes using epoxy resin injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel shall not be permitted. The dowels shall be held in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic collar fitted around the dowel. The vertical alignment of the dowels shall be checked by placing the straightedge on the surface of the pavement over the top of the dowel and measuring the vertical distance between the straightedge and the beginning and ending point of the exposed part of the dowel. Where tie bars are required in longitudinal construction joints of slipform pavement, bent tie bars shall be installed at the paver, in front of the transverse screed or extrusion plate. If tie bars are required, a standard keyway shall be constructed, and the bent tie bars shall be inserted into the plastic concrete through a 26 gauge thick metal keyway liner. Tie bars shall not be installed in preformed holes. The keyway liner shall be protected and shall remain in place and become part of the joint. Before placement of the adjoining paving lane, the tie bars shall be straightened, without spalling the concrete around the bar.

3.4.7.4 Expansion Joints

Dowels in expansion joints shall be installed by the bonded-in-place method or by bonding into holes drilled in hardened concrete, using procedures specified above.

3.5 FINISHING

Clary screeds, "bridge deck" finishers, or other rotating pipe or tube type equipment shall not be permitted. The sequence of machine operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Hand finishing shall be used only infrequently and only on isolated areas of odd slab shapes and in the event of a breakdown of the mechanical finishing equipment. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Equipment to be used for supplemental hand finishing shall primarily be 10 to 12 feet cutting straightedges; only very sparing use of bull floats shall be allowed. At no time shall water be added to the surface of the slab in any way, except for fog (mist) sprays to prevent plastic shrinkage cracking.

3.5.1 Machine Finishing With Fixed Forms

The machine shall be designed to ride the forms. Machines that cause displacement of the forms shall be replaced. The machine shall make only

one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

3.5.2 Machine Finishing With Slipform Pavers

If there is sufficient concrete slurry or fluid paste on the surface that it runs over the edge of the pavement, the paving operation shall be immediately stopped and the equipment, mixture, or operation modified to prevent formation of such slurry. Any slurry which does run down the vertical edges shall be immediately removed. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens.

3.5.3 Surface Correction

While the concrete is still plastic, irregularities and marks in the pavement surface shall be eliminated by means of cutting straightedges, 10 to 12 feet in length. Depressions shall be filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. Long-handled, flat "bull floats" shall be used sparingly and only as necessary to correct minor, scattered surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished.

3.5.4 Hand Finishing

Hand finishing operations shall be used only for those unusual slabs as specified previously. Grate tampers (jitterbugs) shall not be used. As soon as placed and vibrated, the concrete shall be struck off and screeded. The surface shall be tamped with a strike-off and tamping screed, or vibratory screed. Immediately following the final tamping of the surface, the pavement shall be floated longitudinally. Long-handled, flat bull floats shall be used sparingly and only as necessary to correct surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished. No water shall be added to the pavement during finishing operations.

3.5.5 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 Placing Foreman, Contracting Officer representative, and a representative of the Using Agency 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. The concrete in areas of recesses for tie-down anchors, lighting fixtures, and other outlets in the pavement shall be finished to provide a surface of the same texture as the surrounding area. Surface texturing shall be selected to match the existing adjacent concrete pavement, and shall be subject to approval.

3.5.5.1 Fabric-Drag Surface Finish

Surface texture shall be applied by dragging the surface of the pavement, in the direction of the concrete placement, with a moist fabric drag. The

dragging shall produce a uniform finished surface having a fine sandy texture without disfiguring marks.

3.5.5.2 Broom Texturing

Surface texture shall be applied using a mechanical stiff bristle broom drag of a type that will uniformly score the surface transverse to the pavement center line. The broom shall be capable of traversing the full width of the pavement in a single pass at a uniform speed and with a uniform pressure. Successive passes of the broom shall be overlapped the minimum necessary to obtain a uniformly textured surface. The scores should be uniform in appearance and approximately 1/16 inchin depth but not more than 1/8 inch in depth. Hand brooming will be permitted only on isolated odd shaped slabs or slabs where hand finishing is permitted.

3.5.5.3 **DELETED**

3.5.5.4 **DELETED**

3.5.6 Edging

After texturing has been completed, the edge of the slabs along the forms shall be carefully finished with an edging tool to form a smooth rounded surface of 1/8 inch radius. No water shall be added to the surface during edging.

3.6 CURING

Concrete shall be continuously protected against loss of moisture and rapid temperature changes for at least 7 days from the completion of finishing operations. Unhardened concrete shall be protected from rain and flowing water. During hot weather with low humidity and/or wind, the Contractor shall institute measures to prevent plastic shrinkage cracks from developing. ACI 305R contains means of predicting plastic shrinkage cracking and preventative measures. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry. Curing shall be accomplished by one of the following methods.

3.6.1 Membrane Curing

A uniform coating of white-pigmented membrane-forming curing compound shall be applied to the entire exposed surface of the concrete including pavement edges as soon as the free water has disappeared from the surface after finishing. If evaporation is high and no moisture is present on the surface even though bleeding has not stopped, fog sprays shall be used to keep the surface moist until setting of the cement occurs. Curing compound shall then be immediately applied. Curing compound shall be applied to the finished surfaces by means of a self-propelled automatic spraying machine, equipped with multiple spraying nozzles with wind shields, spaning the newly paved lane. The curing compound shall be applied at a maximum application rate of 200 square feet per gallon. The application of curing compound by hand-operated, mechanical powered pressure sprayers will be permitted only on odd widths or shapes of slabs where indicated and on concrete surfaces exposed by the removal of forms. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel and that will be free from pinholes and other discontinuities. Areas where

the curing compound develops the above defects or is damaged by heavy rainfall, sawing or other construction operations within the curing period, shall be immediately resprayed.

3.6.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Impervious sheet curing shall not be used.

3.7 JOINTS

No deviation from the jointing pattern shown on the drawings shall be made without written approval of the Design District Pavement or Geotechnical Engineer. All joints shall be straight, perpendicular to the finished grade of the pavement, and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 1/2 inch.

3.7.1 Longitudinal Construction Joints

Dowels shall be installed in the longitudinal construction joints, or the edges shall be thickened as indicated.

3.7.2 Transverse Construction Joints

Transverse construction joints shall be installed at a planned transverse joint, at the end of each day's placing operations and when concrete placement is interrupted. Transverse construction joints shall be constructed either by utilizing headers and hand placement and finishing techniques, or by placing concrete beyond the transverse construction joint location and then saw cutting full depth and removing concrete back to the transverse construction joint location. For the latter case, dowels shall be installed using methods for dowels installed in hardened concrete described above. All transverse construction joints shall be dowelled.

3.7.3 Expansion Joints

Expansion joints shall be formed where indicated, and about any structures and features that project through or into the pavement, using preformed joint filler of the type, thickness, and width indicated, and shall extend the full slab depth. Edges of the concrete at the joint face shall be edged. The joint filler strips shall be installed to form a recess at the pavement surface to be filled with joint sealant. Expansion joints shall be constructed with dowels for load transfer.

3.7.4 Slip Joints

Slip joints shall be installed the full depth of the slab using expansion joint preformed joint filler material attached to the face of the original concrete placement. A reservoir for joint sealant shall be constructed at the top of the joint. Edges of the joint face shall be edged.

3.7.5 Contraction Joints

Transverse and longitudinal contraction joints shall be of the weakened-plane or dummy type. Longitudinal contraction joints shall be

constructed by sawing a groove in the hardened concrete with a power-driven saw. Transverse contraction joints shall be constructed in conformance with requirements for sawed joints.

3.7.5.1 Sawed Joints

Sawed contraction joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the indicated depth. The time of initial sawing shall vary depending on existing and anticipated weather conditions and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. Sawing at a given joint location shall be discontinued when a crack develops ahead of the saw cut. Immediately after the joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. The surface shall be resprayed with curing compound as soon as free water disappears. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed with cord or backer rod before the concrete in the region of the joint is resprayed with curing compound.

3.7.5.2 Insert-Type Joints

Insert-type joints shall not be used for slipformed pavements. Insert-type non-metallic contraction joints shall be constructed by installing a preformed insert in the plastic concrete to form a weakened plane to induce cracking. Inserts shall be installed using a machine equipped with a vibrating bar for cutting a groove in the plastic concrete for placement of the insert or for vibrating the insert into place at the prescribed joint location. The installed insert shall be perpendicular to the finished grade of the pavement, with the top of the insert not more than 1/8 inch below the pavement surface.

3.7.6 Thickened Edge Joints

Underlying material in the transition area shall meet the requirements for smoothness and compaction specified for all other areas of the underlying material.

3.7.7 Special Joints

Special joints shall be constructed adjacent to existing pavement as indicated. The concrete shall be worked under the edge of the existing pavement to completely fill the void and shall be thoroughly consolidated by the use of hand-held vibrators.

3.8 REPAIR, REMOVAL, AND REPLACEMENT OF SLABS

New pavement slabs that contain full-depth cracks shall be removed and replaced, as specified herein at no cost to the Government. Removal and replacement shall be full depth, shall be full width of the paving lane, and the limit of removal shall be from each original transverse joint . The Contracting Officer will determine whether cracks extend full depth of the pavement and may require minimum 6 inch diameter cores to be drilled on the crack to determine depth of cracking. Cores shall be drilled and the hole later filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin. Drilling of

cores and refilling holes shall be at no expense to the Government. Cracks that do not extend full depth of slab shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1. The Contractor shall ensure that the crack is not widened during epoxy resin injection. Where a full depth crack intersects the original transverse joint, the slab(s) containing the crack shall be removed and replaced, with dowels installed, as required below. Spalls along joints shall be repaired as specified.

3.8.1 Removal and Replacement of Full Slabs

Unless there are keys or dowels present, all edges of the slab shall be sawcut full depth. If keys, dowels, or tie bars are present along any edges, these edges shall be sawed full depth 6 inches from the edge if only keys are present, or just beyond the end of dowels or tie bars if they are present. These joints shall then be carefully sawed on the joint line to within 1 inch of the depth of the dowel or key. The main slab shall be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. The narrow strips along keyed or doweled edges shall be carefully broken up and removed. Care shall be taken to prevent damage to the dowels, tie bars, or keys or to concrete to remain in place. Protruding portions of dowels shall be painted and lightly oiled. The joint face below keys or dowels shall be suitably trimmed so that there is no abrupt offset. If underbreak occurs at any point along any edge, the area shall be hand-filled with concrete, producing an even joint face from top to bottom, before replacing the removed slab. If underbreak over 4 inches deep occurs, the entire slab containing the underbreak shall be removed and replaced. Where there are no dowels, tie bars, or keys on an edge, or where they have been damaged, dowels of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete. Original damaged dowels or tie bars shall be cut off flush with the joint face. All four edges of the new slab shall thus contain dowels or original keys or original tie bars. Prior to placement of new concrete, the underlying material shall be graded and recompacted, and the surfaces of all four joint faces shall be cleaned of all loose material and contaminants, and coated with a double application of membrane forming curing compound as bond breaker. Placement of concrete shall be as specified for original construction. The resulting joints around the new slab shall be prepared and sealed as specified.

3.8.2 Repairing Spalls Along Joints

Spalls along joints and cracks shall be repaired by first making a vertical saw cut at least 1 inch outside the spalled area and to a depth of at least 2 inches. Saw cuts shall be straight lines forming rectangular areas. The concrete between the saw cut and the joint, or crack, shall be chipped out to remove all unsound concrete. The cavity shall be thoroughly cleaned with high pressure water jets supplemented with compressed air to remove all loose material. Immediately before filling the cavity, a prime coat shall be applied to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Prime coat for portland cement repairs shall be a neat cement grout and for epoxy resin repairs shall be epoxy resin, Type III, Grade 1. The cavity shall be filled with low slump portland cement concrete or mortar, or with epoxy resin concrete or mortar. Portland cement concrete shall be used for larger spalls, those more than 1/3 cu. ft. in size after removal operations; portland cement mortar shall be used for spalls between 0.03 and 1/3 cu. ft; and epoxy resin mortar or Type III, Grade 3 epoxy resin for

those spalls less than 0.03 cu. ft. in size after removal operations. Portland cement concretes and mortars shall be very low slump mixtures, proportioned, mixed, placed, tamped, and cured. If the materials and procedures are approved in writing, latex modified concrete mixtures may be used for repairing spalls less than 1/3 cu.ft. in size. Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, using proportions, mixing, placing, tamping and curing procedures as recommended by the manufacturer. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens. Where the spalled area abuts a joint, an insert or other bond-breaking medium shall be used to prevent bond at the joint face. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints. In lieu of sawing, spalls not adjacent to joints, and popouts, both less than 6 inches in maximum dimension, may be prepared by drilling a core 2 inches in diameter greater than the size of the defect, centered over the defect, and 2 inches deep or 1/2 inch into sound concrete, whichever is greater. The core hole shall be repaired as specified above for other spalls.

3.8.3 Areas Defective in Plan Grade or Smoothness

In areas not meeting the specified limits for surface smoothness and plan grade, high areas shall be reduced to attain the required smoothness and grade, except as depth is limited below. High areas shall be reduced by grinding the hardened concrete with a surface grinding machine after the concrete is 14 days or more old. The depth of grinding shall not exceed 1/4 inch. All pavement areas requiring plan grade or surface smoothness corrections in excess of the specified limits, shall be removed and replaced. In pavement areas given a wire comb or tined texture, areas exceeding 25 square feet that have been corrected by rubbing or grinding shall be retextured by grooving machine sawn grooves meeting the requirements for the wire comb or tined texture. All areas in which grinding has been performed will be subject to the thickness tolerances specified in paragraph Thickness. Any grinding performed on individual slabs with excessive deficiencies shall be performed at the Contractor's own decision without entitlement to additional compensation if eventual removal of the slab is required.

3.9 EXISTING CONCRETE PAVEMENT REMOVAL AND REPAIR

Existing concrete pavement shall be removed as indicated and as specified , and expanded as specified herein. Removal, repair and replacement shall be made as indicated and as specified in paragraph, "REPAIR, REMOVAL, AND REPLACEMENT OR SLABS."

3.10 PAVEMENT PROTECTION

The Contractor shall protect the pavement against all damage prior to final acceptance of the work. Traffic shall be excluded from the new pavement. As a construction expedient in paving intermediate lanes between newly paved pilot lanes, operation of the hauling equipment will be permitted on the new pavement after the pavement has been cured for 7 days and the joints have been sealed or otherwise protected. All new and existing pavement carrying construction traffic or equipment shall be continuously kept completely clean. Special cleaning and care shall be used where Contractor's traffic uses or crosses active airfield pavement.

3.11 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL (CQC)

Paragraph ACCEPTABILITY OF WORK contains additional CQC requirements. 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 submit reports as specified. When, in the opinion of the Contracting Officer, the paving operation is out of control, concrete placement shall cease.

3.11.1 Batch Plant Control

A daily report shall be prepared indicating checks made for scale accuracy with test weights, checks of batching accuracy, and corrective action taken prior to and during placement for weighing or batching, 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 masses per cubic yd, amount of water as free moisture in each size of aggregate, and the batch aggregate and water masses per cubic yd. for each class of concrete batched during each day's plant operation.

3.11.2 Concrete Mixture

a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two other tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of paving. Whenever air content reaches specified limits, an immediate confirmatory test shall be made. If the second test also shows air content at or exceeding specified limits, an adjustment shall immediately be made in the amount of air-entraining admixture batched to bring air content within specified limits. If the next adjusted batch of concrete is not within specified limits, concrete placement shall be halted until concrete air content is within specified limits.

b. Slump Testing. Slump tests shall be made when test specimens are fabricated. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Whenever slump approaches the maximum limit, an adjustment shall immediately be made in the batch masses of water and fine aggregate, without exceeding the maximum w/(c+p). When a slump result exceeds the specification limit, no further concrete shall be delivered to the paving site until adjustments have been made and slump is again within the limit.

c. Temperature. The temperature of the concrete shall be measured when strength specimens are fabricated.

d. Concrete Strength Testing. Four (4) cylinders from the same batch shall be fabricated, cured and tested for compressive strength, testing two cylinders at 7-day and two cylinders at 28-day age. A minimum of one set of four (4) cylinders shall be fabricated, cured and tested for each shift of concrete placement. Control charts for strength, showing the 7-day and 28-day CQC compressive strengths, and the 28-day required compressive strength, shall be maintained and submitted with weekly CQC Reports.

3.11.3 Inspection Before Placing

Underlying materials, joint locations and types, construction joint faces, forms, reinforcing, dowels, and embedded items shall be inspected by a Registered Engineer in sufficient time prior to each paving operation 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, and the certification signed by the Registered Engineer, prior to each days' paving.

3.11.4 Paving Operations

The placing foreman shall supervise all placing and paving operations, shall determine that the correct quality of concrete is placed in each location as shown, shall insure that the concrete is consolidated full depth and that finishing is performed as specified. The placing foreman shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume of concrete placed, and method of paving and any problems encountered.

3.11.5 Curing Inspection

a. Moist Curing Inspections. Each 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. When any inspection finds an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for the area shall be extended by 1 day.

b. Membrane Curing Inspection. At the end of each day's placement, the CQC Representative shall determine the quantity of compound used by measurement of the container; shall determine the area of concrete surface covered; shall then compute the rate of coverage in square feet per gallon and shall also note whether or not coverage is uniform. 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.

3.11.6 Cold-Weather Protection

At least once per day, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.11.7 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report, signed by a registered engineer, shall be prepared for the updating of control charts and test data, and all CQC inspections and actions covering the entire period from the start of the construction through the current week. 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 CQC records. A copy of weekly reports shall be faxed to the Design District Pavement or Geotechnical Engineer. At the completion of concrete placement, a certification report shall be prepared containing mix designs, all updated control charts and concrete test data, quality control reports, smoothness reports, and other pertinent data on the concrete, with a certification by a registered engineer that the concrete placed meets all specification requirements. A copy of the certification report shall be mailed to the Design District pavement or Geotechnical Engineer.

-- End of Section --

SECTION 02821

FENCING
04/99

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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 116	(1995) Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
ASTM A 121	(1992a) Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM A 153/A 153M	(1998) Zinc-Coated (Hot Dip) on Iron and Steel Hardware
ASTM A 176	(1997) Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
ASTM A 392	(1996) Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A 478	(1997) Chromium-Nickel Stainless and Heat-Resisting Steel Weaving and Knitting Wire
ASTM A 491	(1996) Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A 585	(1997) Aluminum-Coated Steel Barbed Wire
ASTM A 666	(1996b) Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Paste, and Flat Bar
ASTM A 702	(1989; R 1994) Steel Fence Posts and Assemblies, Hot Wrought
ASTM A 780	(1993a) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM A 824	(1995) Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
ASTM C 94	(1998) Ready-Mixed Concrete
ASTM D 4541	(1995) Pull-Off Strength of Coatings Using Portable Adhesion Testers

ASTM F 626	(1996) Fence Fittings
ASTM F 668	(1996) Poly(Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric
ASTM F 883	(1997) Padlocks
ASTM F 900	(1994) Industrial and Commercial Swing Gates
ASTM F 1043	(1998a) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework
ASTM F 1083	(1997) Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
ASTM F 1184	(1994) Industrial and Commercial Horizontal Slide Gates
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
ASTM G 26	(1996) Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
ASTM G 53	(1996) Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials

AMERICAN WOOD PRESERVERS ASSOCIATION (AWPA)

AWPA C1	(1997) All Timber products - Preservative Treatment by Pressure Processes
AWPA C4	(1995) Poles - Preservative Treatment by Pressure Processes

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Chain Link Fence; GA-RE.

Statement, signed by an official authorized to certify on behalf of the manufacturer, attesting that the chain link fence and component materials meet the specified requirements.

PART 2 PRODUCTS

2.1 FENCE FABRIC

Fence fabric shall conform to the following:

2.1.1 Chain Link Fence Fabric

ASTM A 392, Class 2, zinc-coated steel wire with minimum coating weight of 2.0 ounces of zinc per square foot of coated surface, or ASTM A 491, Type I, aluminum-coated steel wire. Fabric shall be fabricated of 9 gauge wire woven in 2 inch mesh. Fabric height shall be as shown. Fabric shall be twisted and barbed on the top selvage and knuckled on the bottom selvage.

2.2 GATES

ASTM F 900 and/or ASTM F 1184. Gate shall be the type and swing shown. Gate frames shall conform to strength and coating requirements of ASTM F 1083 for Group IA, steel pipe, with external coating Type A, nominal pipe size (NPS) 1-1/2. Gate frames shall conform to strength and coating requirements of ASTM F 1043, for Group IC, steel pipe with external coating Type A or Type B, nominal pipe size (NPS) 1-1/2. Gate fabric shall be as specified for chain link fabric. Gate leaves more than 8 feet wide shall have either intermediate members and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 8 feet wide shall have truss rods or intermediate braces. Intermediate braces shall be provided on all gate frames with a mechanical lock. Gate fabric shall be attached to the gate frame by method standard with the manufacturer except that welding will not be permitted. Latches, hinges, stops, keepers, rollers, and other hardware items shall be furnished as required for the operation of the gate. Latches shall be arranged for padlocking so that the padlock will be accessible from both sides of the gate. Stops shall be provided for holding the gates in the open position. For high security applications, each end member of gate frames shall be extended sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence.

2.3 POSTS

2.3.1 Metal Posts for Chain Link Fence

ASTM F 1083, zinc-coated. Group IA, with external coating Type A steel pipe. Group IC steel pipe, zinc-coated with external coating Type A or Type B and Group II , formed steel sections, shall meet the strength and coating requirements of ASTM F 1043. Group III, ASTM F 1043 steel H-section may be used for line posts in lieu of line post shapes specified for the other classes. Sizes shall be as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Gate post shall be for the gate type specified subject to the limitation specified in ASTM F 900 and/or ASTM F 1184.

2.4 BRACES AND RAILS

ASTM F 1083, zinc-coated, Group IA, steel pipe, size NPS 1-1/4. Group IC steel pipe, zinc-coated, shall meet the strength and coating requirements of ASTM F 1043. Group II , formed steel sections, size 1-21/32 inch, conforming to ASTM F 1043, may be used as braces and rails if Group II line posts are furnished.

2.5 WIRE

2.5.1 Tension Wire

Tension wire shall be Type I or Type II, Class 2 coating, in accordance with ASTM A 824.

2.5.2 Barbed Wire

Three strand of four point barbed wire on 45 degree post brackets standing to the outside shall be mounted on chain link fence where specified on the plans.

2.6 ACCESSORIES

ASTM F 626. Ferrous accessories shall be zinc or aluminum coated. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment. Barbed wire shall be 2 strand, 12-1/2 gauge wire, zinc-coated, Class 3 in accordance with ASTM A 121 or aluminum coated Type I in accordance with ASTM A 585. Barbed wire shall be four-point barbed type steel wire. Barbed wire support arms shall be the single arm type and of the design required for the post furnished. Tie wire for attaching fabric to rails, braces, and posts shall be 9 gauge steel wire and match the coating of the fence fabric. Miscellaneous hardware coatings shall conform to ASTM A 153/A 153M unless modified.

2.7 CONCRETE

ASTM C 94, using 3/4 inch maximum size aggregate, and having minimum compressive strength of 3000 psi at 28 days. Grout shall consist of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

2.8 PADLOCKS

Padlocks shall conform to ASTM F 883, Type PO1, Option , Grade 6. , Size 1-3/4 inch. All padlocks shall be keyed alike.

PART 3 EXECUTION

3.1 INSTALLATION

Fence shall be installed to the lines and grades indicated. The area on either side of the fence line shall be cleared to the extent indicated. Line posts shall be spaced equidistant at intervals not exceeding 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 500 feet. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM A 780.

3.2 EXCAVATION

Post holes shall be cleared of loose material. Waste material shall be spread where directed. The ground surface irregularities along the fence line shall be eliminated to the extent necessary to maintain an inch clearance between the bottom of the fabric and finish grade.

3.3 POST INSTALLATION

3.3.1 Posts for Chain Link Fence

Posts shall be set plumb and in alignment. Except where solid rock is encountered, posts shall be set in concrete to the depth indicated on the drawings. Where solid rock is encountered with no overburden, posts shall be set to a minimum depth of 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, posts shall be set to the minimum depth indicated on the drawing unless a penetration of 18 inches in solid rock is achieved before reaching the indicated depth, in which case depth of penetration shall terminate. All portions of posts set in rock shall be grouted. Portions of posts not set in rock shall be set in concrete from the rock to ground level. Posts set in concrete shall be set in holes not less than the diameter shown on the drawings. Diameters of holes in solid rock shall be at least 1 inch greater than the largest cross section of the post. Concrete and grout shall be thoroughly consolidated around each post, shall be free of voids and finished to form a dome. Concrete and grout shall be allowed to cure for 72 hours prior to attachment of any item to the posts. Group II line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Driven posts shall be set to a minimum depth of 3 feet and shall be protected with drive caps when being set. For high security fences, fence post rigidity shall be tested by applying a 50 pound force on the post, perpendicular to the fabric, at 5 feet above ground; post movement measured at the point where the force is applied shall be less than or equal to 3/4 inch from the relaxed position; every tenth post shall be tested for rigidity; when a post fails this test, further tests on the next four posts on either side of the failed post shall be made; all failed posts shall be removed, replaced, and retested at the Contractor's expense.

3.4 RAILS

3.4.1 Top Rail

Top rail shall be supported at each post to form a continuous brace between terminal posts. Where required, sections of top rail shall be joined using sleeves or couplings that will allow expansion or contraction of the rail. Top rail, if required for high security fence, shall be installed as indicated on the drawings.

3.4.2 Bottom Rail

The bottom rail shall be bolted to double rail ends and double rail ends shall be securely fastened to the posts. Bolts shall be peened to prevent easy removal. Bottom rail shall be installed before chain link fabric.

3.5 BRACES AND TRUSS RODS

Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished. Horizontal (compression) braces and diagonal truss (tension) rods shall be installed on fences over 6 feet in height. A center brace or 2 diagonal truss rods shall be installed on 12 foot fences. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal. No bracing is required on fences 6 feet high or less if a top rail is installed.

3.6 TENSION WIRES

Tension wires shall be installed along the top and bottom of the fence line and attached to the terminal posts of each stretch of the fence. Top tension wires shall be installed within the top 4 inches of the installed fabric. Bottom tension wire shall be installed within the bottom 6 inches of the installed fabric. Tension wire shall be pulled taut and shall be free of sag.

3.7 CHAIN LINK FABRIC

Chain link fabric shall be installed on the side of the post indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 15 inch intervals. The fabric shall be installed and pulled taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fabric shall be fastened to line posts at approximately 15 inch intervals and fastened to all rails and tension wires at approximately 12 inch intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be 1 plus or minus 1/2 inch above the ground. For high security fence, after the fabric installation is complete, the fabric shall be exercised by applying a 50 pound push-pull force at the center of the fabric between posts; the use of a 30 pound pull at the center of the panel shall cause fabric deflection of not more than 2-1/2 inches when pulling fabric from the post side of the fence; every second fence panel shall meet this requirement; all failed panels shall be resecured and retested at the Contractor's expense.

3.8 GATE INSTALLATION

Gates shall be installed at the locations shown. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Slide gates shall be installed as recommended by the manufacturer. Padlocks shall be attached to gates or gate posts with chains. Hinge pins, and hardware shall be welded or otherwise secured to prevent removal.

3.9 GROUNDING

Fences crossed by powerlines of 600 volts or more shall be grounded at or near the point of crossing and at distances not exceeding 150 feet on each side of crossing. Ground conductor shall consist of No. 8 AWG solid copper wire. Grounding electrodes shall be 3/4 inch by 10 foot long copper-clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable, electrodes shall be buried a minimum of 12 inches deep and radially from the fence. The top of the electrode shall be not less than 2 feet or more than 8 feet from the fence. Ground conductor shall be clamped to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. After installation the total resistance of fence to ground shall not be greater than 25 ohms.

-- End of Section --

SECTION 02921

SEEDING
06/98

PART 1 GENERAL

Areas to be seeded are shown or defined in the project drawings., If more than one method of establishing seed is specified, drawings will delineate areas for each method.

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 basic designation only.

AGRICULTURAL MARKETING SERVICE (AMS)

AMS-01	(Aug 95) Federal Seed Act Regulations Part 201

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602	(1995a) Agricultural Liming Materials
ASTM D 977	(1991) Emulsified Asphalt
ASTM D 2028	(1976; R 1992) Cutback Asphalt (Rapid-Curing Type)
ASTM D 4972	(1995a) pH of Soils
ASTM D 5268	(1992; R 1996) Topsoil Used for Landscaping Purposes
ASTM D 5883	(1996) Standard Guide for Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having a "GA" designation or an "FIO" designation are for information only. When ysed, a designation following the "GA" designation identifies the office(s) that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment; GA-RE . Surface Erosion Control Material; GA-RE . Chemical Treatment Material; GA-RE .

Manufacturer's literature including physical characteristics, application and installation instructions for equipment, surface erosion control material and chemical treatment material.

SD-07 Schedules

Equipment;GA-RE .

A listing of equipment to be used for the seeding operation.

SD-08 Statements

Delivery; GA-RE.

Delivery schedule.

Finished Grade and Topsoil; GA-RE.

Finished grade status.

Topsoil; GA-RE.

Availability of topsoil from the stripping and stock piling operation.

SD-09 Reports

Equipment Calibration; GA-RE.

Certification of calibration tests conducted on the equipment used in the seeding operation.

Soil Test; GA-RE.

Results of soil test.

SD-13 Certificates

Seed; GA-RE. Topsoil; GA-RE. pH Adjuster; GA-RE. Fertilizer; GA-RE. Organic Material; GA-RE. Soil Conditioner; GA-RE. Wood Fiber Mulch/Tackifier; GA-RE. Mulch/Tackifier; GA-RE. Pesticide; GA-RE. Leguminous Inoculant; GA-RE.

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

a. Seed. Classification, botanical name, common name, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, and date tested.

b. Topsoil. Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.

c. pH Adjuster. Calcium carbonate equivalent and sieve analysis.

d. Fertilizer. Chemical analysis and composition percent.

e. Organic Material: Composition and source.

f. Soil Conditioner: Composition and source.

g. Wood Fiber Mulch/Tackifier: Composition and source.

i. Pesticide. EPA registration number and registered uses.

SD-14 Samples

Delivered Topsoil; GA-RE.

Samples taken from several locations at the source.

Soil Amendments; GA-RE.

A 10 pound sample.

Wood Fiber Mulch/Tackifier; GA-RE.

A 10 pound sample.

SD-18 Records

Quantity Check; GA-RE.

Bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed.

Seed Establishment Period; GA-PM-PR.

Calendar time period for the seed establishment period. When there is more than one seed establishment period, the boundaries of the seeded area covered for each period shall be described in written submittals and shown on appropriate project drawings.

Maintenance Record; GA-RE.

Maintenance work performed; areas repaired, reseeded or reestablished; diagnosis for unsatisfactory stand of grass plants.

Application of Pesticide; GA-RE.

Pesticide treatment plan with sequence of treatment, times, and rationale for application. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

1.2 AREAS

The unprotected finish surfaces and slopes of the random and impervious fill, and all disturbed construction areas, shall be seeded and mulched. Hillside/offsite borrow areas will not require seeding and mulching in excess of those measures in an approved Erosion Control Plan, unless the Contractor disturbs areas outside the established haul route and hillside excavation. Seeding and mulching of these areas will be performed by the Contractor at the Contractor's expense. Disturbed areas other than required for construction work shall be held to the minimum practicable to perform the work. Where areas are disturbed solely for the convenience of

the Contractor, as determined by the Contracting Officer's Representative (COR), such areas shall be seeded and mulched, and will be considered as protection of the environment.

1.3 SOURCE INSPECTION

The source of delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.4.1.1 Delivered Topsoil

Prior to the delivery of any topsoil, its availability shall be verified in accordance with paragraph TOPSOIL. Soil test shall be provided for topsoil delivered to the site.

1.4.1.2 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.1.3 Pesticides

Pesticide material 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.

1.4.2 Inspection

Seed shall be inspected upon arrival at the job site for conformity to species and quality. Seed that is wet, moldy, or bears a test date five months or older, will be rejected. Other materials shall be inspected for compliance with specified requirements. The following will be rejected: open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter; and topsoil that contains viable plants and plant parts. Unacceptable materials shall be removed from the job site and shall not be stored at the job site.

1.4.3 Storage

Materials shall be stored in designated areas. Seed, lime, and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with seeding operation materials.

1.4.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.4.5 Hydroseeding Time Limitation

The maximum hydroseeding time limitation for holding seed in a slurry shall be 12 hours.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Seed Classification

State certified seed is required for native grass and wildflower mixtures, and preferred for the turf mixture. Seed shall be from the latest season's crop and shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. The Contractor shall furnish signed copies of statements from the suppliers, certifying that each container of seed delivered complies with specified requirements and is at least equal to the requirements specified herein. This certification shall be furnished on or with all copies of seed invoices. Each lot of seed will be tested by the COR and PM-PR, in accordance with the latest Rules and Regulations under the Federal Seed Act, at the discretion of the COR. Labels shall be in conformance with AMS-01 and applicable state seed laws.

2.1.2 Seed Percentages and Required Descriptions

Seed mixtures shall be proportioned by seed count and seed count percentages. The seed counts and seed count percentages indicated per acre shall mean the total amount of pure live seed per acre for all species listed except forbs. At least 2 weeks prior to the time of seeding, the Contractor shall provide, for the approval of the COR, a written description of the grass and forbs seed and/or plant mix showing the percentage by number of seeds and/or plants of each species.

This description shall also include the following:

Name and location of seed and/or plant supplier;

Origin of the various species of seed. Wherever practical, the seed source shall be located within a 200-mile radius of the project site.

A statement of the purity of the grasses; and

The estimated number of seeds per pound of each of the kinds of seed to be furnished.

2.1.3 Seed Labeling

Seed shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act. Seeds and plants shall be true to their name as specified. Seed shall be furnished in sealed, standard containers, unless approved by the COR. Each lot of seed will be tested by the COR in accordance with the latest Rules and Regulations under the Federal Seed Act, at the discretion of the COR.

2.1.4 Seed Treatment, Storage, and Inspection Requirements

All legumes shall be inoculated with the proper rhizobia and at the

appropriate time prior to planting. All seeds shall be packed and covered in such a manner as to ensure adequate protection against damage and maintain dormancy while in transit or storage, or during planting operations. Seed that is wet or moldy or that has been otherwise damaged in transit or storage will not be acceptable, and shall be removed from the site.

2.1.5 Permanent Seed Mixtures

Permanent seed species and mixtures shall be proportioned by weight as follows:

2.1.5.1 Levee Slope Mixture

The levee slope mixture is to be used on levee slopes, on disturbed areas within 10 feet each side of the final levee slopes, and on all other areas as directed by the COR, with the exception of areas designated for seeding with the native grass and wildflower mixtures. The Levee Slope grass seed mixture shall consist of the following:

Kinds of Seed	Pounds Pure Live Seed/Acre
K-31 fescue (Festuca elatior)	50 lbs.
Domestic Ryegrass (Lolium perenne)	20 lbs.
Smooth brome (Bromus inermis)	30 lbs.
TOTAL POUNDS PURE LIVE SEED (PLS)/ACRE	100 lbs. PLS/ACRE

2.1.5.2 Native Grass and Wildflower Mixture A

The grass and wildflower seed mixture A is to be used on the upper borrow slopes and overbank areas as designated on the Drawings. Mixture A shall consist of the following:

Kinds of Seed	Pounds Pure Live Seed/Acre
Grasses	
Big bluestem (Andropogon gerardii).....	2.00 lbs.
Indiangrass (Sorghastrum nutans).....	2.50 lbs.
Virginia wildrye (Elymus virginicus).....	1.00 lbs.
Switchgrass (Panicum virgatum)(Pathfinder var.).	.25 lbs.
Prairie cordgrass(Spartina spectinata).....	2.25 lbs.
Regreen sterile wheat (Triticum x agropyron)....	32.00 lbs.
Grasses Subtotal: Pounds Pure Live Seed/Acre....	**40.00** lbs. PLS/ACRE
Forbs	
White prairieclover(Petalostemom candidum).....	2.00 oz
Purple prairieclover (Petalsotemom purpureum)...	3.00 oz
Red-hat coneflower (Ratibida columnaris, red)...	1.00 oz
Upright yellow coneflower (Ratibida columnaris).	2.00 oz
Clasping/Grayhead coneflower (Ratibida pinnata).	4.00 oz
Pale purple coneflower (Echinacea pallida).....	6.00 oz
Sweet black-eyed Susan (Rudbeckia subtomentosa).....	3.00 oz
Lead plant(Amorpha canescens).....	2.00 oz
Prairie blazing star (Liatris pycnostachya).....	5.00 oz
Dense/Marsh blazing star (Liatris spicata).....	3.00 oz

Shasta daisy (Chrysanthemum maximum)..... 6.00 oz
Butterflyweed (Asclepias tuberosa)..... 1.00 oz
Lanceleaf coreopsis (Coreopsis lanceolata)..... 2.00 oz
Rattlesnake master (Eryngium yuccifolium)..... 3.00 oz
White wild indigo (Baptisia leucantha)..... 2.00 oz
Partridge pea (Cassia fasiculata)..... 3.00 oz
Golden Alexanders (Zizia aurea)..... 0.50 oz
Swamp red milkweed (Asclepias
incarnata)..... 5.00 oz
Blue flax (Linum lewisii)..... 2.50 oz
Scarlet flax (Linum rubrum)..... 1.00 oz
False Dragonhead (Physostegia virginiana)..... 1.50 oz
Prairie aster (Machaeranthera tanacetifolia).... 1.00 oz
New England aster (Aster novae-angliae)..... 0.50 oz
Blue Flag Iris (Iris versicolor)..... 1.00 oz
Blanketflower (Gaillardia aristata)..... 1.00 oz
Showy Evening primrose (Oenothera speciosa)..... 1.00 oz
Missouri primrose (Oenthera missouriensis)..... 1.00 oz
Prairie phlox (Phlox pilosa)..... 1.00 oz
Bundleflower (Desmanthus illinoensis)..... 3.00 oz

Forbs Subtotal: Pounds PLS/Acre **4.25 lbs. PLS/ACRE**

TOTAL POUNDS PURE LIVE SEED/ACRE **44.25 lbs. PLS/ACRE**

2.1.5.3 Native Grass Mixture B

The native grass seed mixture B is to be used on lower slopes and bottoms of the riverward borrow areas and other wet areas such as ditches. Mixture B shall consist of the following:

Kinds of Seed	Pounds Pure Live Seeds/Acre
Grasses	
Big bluestem (Andropogon gerardii).....	4.50 lbs.
Virginia wildrye (Elymus virginicus).....	1.00 lbs.
Switchgrass (Panicum virgatum)(Var. Pathfinder)...	.50 lbs.
Indiangrass (Sorghastrum nutans).....	4.50 lbs.
Prairie cordgrass (Spartina spectinata).....	2.25 lbs.
Regreen Sterile Wheat (Triticum x agropyron).....	32.00 lbs.

TOTAL POUNDS PURE LIVE SEED/ACRE **44.75 lbs. PLS/ACRE**

2.1.5.4 (Short) Native Grass and Wildflower Mixture C

The (short) native grass and wildflower mixture C is to be used on the landside permanent rights-of-way adjacent to the 10-foot-wide landward area seeded with the levee slope mixture.

Kinds of Seed	Pounds Pure Live Seed/Acre
Grasses	
Little bluestem (Andropogon scoparium).....	3.00 lbs.
Sideoats grama (Bouteloua curtipendula).....	3.00 lbs.
Prairie dropseed (Sporolus heterolepsis).....	2.00 lbs.
Virginia wildrye (Elymus virginicus).....	1.00 lbs.
Regreen sterile wheat (Triticum x agropyon).....	32.00 lbs.

Grasses Subtotal: Pounds PLS/Acre **40.00 lbs. PLS/ACRE**

Forbs

White prairieclover(Petalostemom candidum)..... 2.00 oz
Purple prairieclover (Petalsotemom purpureum)... 3.00 oz
Red-hat coneflower (Ratibida columnaris, red)... 1.00 oz
Upright yellow coneflower (Ratibida columnaris). 2.00 oz
Clasping/Grayhead coneflower (Ratibida pinnata). 4.00 oz
Pale purple coneflower (Echinacea pallida)..... 6.00 oz
Sweet black-eyed Susan (Rudbeckia
subtomentosa)..... 3.00 oz
Lead plant(Amorpha canescens)..... 2.00 oz
Prairie blazing star (Liatris pycnostachya)..... 5.00 oz
Dense/Marsh blazing star (Liatris spicata)..... 3.00 oz
Shasta daisy (Chrysanthemum maximum)..... 6.00 oz
Butterflyweed (Asclepias tuberosa)..... 1.00 oz
Lanceleaf coreopsis (Coreopsis lanceolata)..... 2.00 oz
Rattlesnake master (Eryngium yuccifolium)..... 3.00 oz
White wild indigo (Baptisia leucantha)..... 2.00 oz
Partridge pea (Cassia fasiculata)..... 3.00 oz
Golden Alexanders (Zizia aurea)..... 0.50 oz
Swamp red milkweed (Asclepias
incarnata)..... 5.00 oz
Blue flax (Linum lewisii)..... 2.50 oz
Scarlet flax (Linum rubrum)..... 1.00 oz
False Dragonhead (Physostegia virginiana)..... 1.50 oz
Prairie aster (Machaeranthera tanacetifolia).... 1.00 oz
New England aster (Aster novae-angliae)..... 0.50 oz
Blue Flag Iris (Iris versicolor)..... 1.00 oz
Blanketflower (Gaillardia aristata)..... 1.00 oz
Showy Evening primrose (Oenothera speciosa)..... 1.00 oz
Missouri primrose (Oenthera missouriensis)..... 1.00 oz
Prairie phlox (Phlox pilosa)..... 1.00 oz
Bundleflower (Desmanthus illinoensis)..... 3.00 oz

Forbes Subtotal: Pounds PLS/Acre **4.25 lb. PLS/ACRE**

TOTAL POUNDS PLS/ACRE **44.25 lbs. PLS/ACRE**

2.1.6 Temporary Seed Mixture/Cover Crop

The temporary seed mixture will be seeded on any areas brought to a temporary or final grade outside of the planting season that will not be finalized or revisited within 30 days of stoppage, completion or halting of activities.

Kinds of Seed	Pounds Pure Live Seeds/Acre
Sterile wheat	32.00 lbs.

2.1.7 Quality/Weed Seed Limit

Weed seed shall not exceed 0.5 percent by weight of the total of seed and other material in the mixture. be a maximum 1 percent by weight of the total mixture.

2.1.8 Quality

Weed seed shall be a maximum 1 percent by weight of the total mixture.

2.1.9 Seed Mixing

The mixing of seed shall be done by the seed supplier under the inspection of the Contracting Officer prior to delivery.

2.1.10 Substitutions

Substitutions will not be allowed without a written request and without written approval from both the Contracting Officer and from CENWK-PM-PR, (Environmental Resources Section, Planning Branch; Planning, Programs, and Project Management Division).

2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02331 LEVEE CONSTRUCTION. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the seed specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts.

2.3 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite shall not be used.

2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, sulfur, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

2.3.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a No. 8 sieve and a minimum 55 percent shall pass through a No. 60 sieve. To raise soil pH, ground limestone shall be used.

2.3.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a No. 8 sieve and a minimum 97 percent shall pass through a No. 60 sieve.

2.3.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a No. 8 sieve and a minimum 35 percent shall pass through a No. 60 sieve.

2.3.2 Fertilizer

Commercial dry fertilizers used shall be complete fertilizers (e.g. 13-13-13). Such fertilizers shall be granular in texture and of controlled release (UF, 1BDU, SCU) type.

A slow-release type fertilizer of 18-46-6 grade, uniform in composition, free flowing and suitable for application with approved equipment, shall be provided. The fertilizer shall be delivered to the site in bags or other convenient containers, fully labeled or otherwise designated in accordance with applicable State fertilizer laws, and bearing the name, trade name or trademark, and warranty of the producer. Fertilizer may be supplied in bulk provided an analysis of samples tested in a laboratory is furnished for each shipment of fertilizer delivered to the project.

2.3.3 Organic Material

Organic material shall consist of either bonemeal, decomposed wood derivatives, or recycled compost.

2.3.3.1 Bonemeal

Bonemeal shall be finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

2.3.3.2 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, yard trimmings, or other wood waste material that is free of stones, sticks, soil, and toxic substances harmful to plants, and is fully composted or stabilized with nitrogen.

2.3.3.3 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source. Compost shall be derived from food; agricultural or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The compost material shall not contain substances toxic to plants. Compost material shall possess a pH of 5.5 to 8.0, have a moisture content between 35-55 percent by weight, and be of a gradation such that it shall pass through a 10-mm 3/8-inch screen. The material shall not contain more than 1 percent by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 2 inches in length.

2.3.4 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for use singly or in combination to meet the requirements of the soil test.

2.3.4.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a No. 10 sieve and a minimum 10 percent by weight shall pass a No. 16 sieve. Green sand shall be balanced with the inclusion of trace minerals and nutrients.

2.3.4.2 Super Absorbent Polymers

To improve water retention in soils, super absorbent polymers shall be sized and applied according to the manufacturer's recommendations. Polymers shall be added as a soil amendment and be cross-linked polyacrylamide, with an absorption capacity of 250 to 400 times its weight. Polymers shall also be added to the seed and be a starch grafted polyacrylonitrite, with graphite added as a tacky sticker. It shall have an absorption capacity of 100 plus times its weight.

2.3.4.3 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.

2.3.4.4 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

2.3.4.5 Expanded Shale, Clay, or Slate (ESCS)

Rotary kiln produced ESCS material shall be in conformance with ASTM D 5883.

2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be prairie hay, or if prairie hay is not available, straw or cereal grain such as oats or wheat.

2.4.1 Hay

Hay shall be native hay, sudan-grass hay, or broomsedge hay, furnished in an air-dry condition suitable for placing with commercial mulch-blowing equipment.

2.4.2 Straw

Straw shall be stalks from oats, wheat, rye, barley, or rice, furnished in air-dry condition and with a consistency for placing with commercial mulch-blowing equipment.

2.4.3 Wood Fiber Mulch

Wood fiber mulch, for use with the hydraulic application, shall consist of specially prepared wood fibers, dyed an appropriate color to facilitate visual metering of application of the materials. The wood fiber material shall have a composition, on an air-dry weight basis, between 9 to 15 percent moisture, with a pH range from 4.5 to 6.0. The wood fiber mulch shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate placement during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 4.5 to 6.0.

The wood fiber mulch shall be manufactured so that after addition and agitation in slurry tanks with seeds, water, and any other approved additives, the fibers in the material will become uniformly suspended to

form a homogeneous slurry. When hydraulically sprayed on the ground, the material shall form a blotter-like ground cover impregnated uniformly with seed, which, after application, will allow the absorption of moisture and allow rainfall or mechanical watering to percolate to the underlying soil. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished, and that their product meets all the requirements based upon such testing.

The mulch shall include a colloidal polysaccharide tackifier. The tackifier shall be adhered to the fibers during mulch manufacturing to prevent separation during shipment, and to avoid chemical agglomeration during mixing in the hydraulic mulching equipment. The tackifier shall comprise no less than 3% by weight of the total bulk weight of the packaged wood fiber mulch.

2.5 WATER

Water, for use in the hydraulic application of seeding, shall be free from oil, acid, alkali, salt, and other substances harmful to plant growth. Unless otherwise noted, the Contractor shall be responsible for obtaining all water sources. All water sources are subject to approval of the COR.

2.6 PESTICIDE

In this specification pesticide shall include any insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

2.7 SURFACE EROSION CONTROL MATERIAL

Surface erosion control material shall conform to the following:

2.7.1 Surface Erosion Control Blanket

Blanket shall be machine produced mat of wood excelsior formed from a web of interlocking wood fibers; covered on one side with either knitted straw blanket-like mat construction; covered with biodegradable plastic mesh; or interwoven biodegradable thread, plastic netting, or twisted kraft paper cord netting.

2.7.2 Surface 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 Surface Erosion Control Net

Net shall be heavy, twisted jute mesh, weighing approximately 1.22 pounds per linear yard and 4 feet wide with mesh openings of approximately 1 inch square.

2.7.4 Surface Erosion Control Chemicals

Chemicals shall be high-polymer synthetic resin or cold-water emulsion of selected petroleum resins.

2.7.5 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.

2.7.6 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 PLANTING AND ESTABLISHING SEED TIME AND CONDITIONS

3.1.1 Seeding Time

The levee cover seed mixture shall be planted from 1 March to 15 May for spring planting; and from 15 August to 1 October for fall planting, unless otherwise approved by the Contracting Officer.

3.1.1.1 Native Grass/Wildflower Mixtures

Native grass/wildflower mixtures shall be planted from 1 April to 30 July .

3.1.1.2 Dormant Season Plantings

Dormant season plantings of levee seed mixture may occur from 15 December to 1 March. Dormant season plantings of the native grass/wildflower mixtures may occur from 1 December to 31 March. The Contractor must establish a temporary cover crop or protect the seeded areas at the time any dormant season planting occurs. The Contractor shall be responsible for a satisfactory show of green as soon as conditions are favorable and shall be responsible for providing a satisfactory, established stand of the permanent seed mixtures after at least one growing season has occurred.

3.1.2 Seeding Conditions

Seeding operations shall be performed only during periods when beneficial results can be obtained. Work shall be halted as directed when delays in operation extends the work beyond the most favorable planting season or when conditions are such by reason of drought, high winds, excessive moisture, or other factors that satisfactory results are not likely to be obtained. Seeding operations shall be resumed only when conditions are favorable or when approved alternative or corrective measures and procedures have been effected. If delay of seeding is necessary, the finished slopes, berms and levee grade shall be temporarily protected with mulch. In addition, a temporary cover crop of sterile wheat will be seeded on disturbed areas if seeding delays will exceed 21 days. The temporarily protected area shall be cleaned of weeds and the slopes restored before seeding and mulching. If inspection during seeding and mulching, or after there is shown of green, indicates that the areas have been left unplanted, additional seed shall be sown as directed.

3.1.3 Equipment Calibration

At least one week prior to seeding, calibration tests shall be conducted on the equipment to be used to determine or confirm that the equipment is operating within the manufacturer's specifications and will meet the

specified criteria. Calibration test results shall be provided prior to seeding and within 1 week of testing. Calibration tests shall again be conducted on the equipment to be used immediately prior to the commencement of seeding operations. During the seeding operation, the equipment shall be calibrated a minimum of once every day.

3.1.4 Soil Tests

Delivered topsoil, existing soil in smooth graded areas, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. On-site sample collection shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The tests shall determine the quantities and type of soil amendments required to meet local growing conditions for the seed species specified.

3.2 SITE PREPARATION

3.2.1 Finished Grade and Topsoil

The Contractor shall verify that finished grades are as indicated on drawings, and the topsoil placement, smooth grading, and compaction requirements have been completed in accordance with Section 02331 LEVEE CONSTRUCTION AND EARTHWORK, prior to commencement of the seeding operations.

3.2.2 Application of Fertilizer

Fertilizer of 18-46-6 grade shall be broadcast uniformly at a rate of 300 pounds per acre over areas to be seeded. If bulk fertilizer other than 18-46-6 grade is provided, the application rate shall be varied to obtain the quantity of nitrogen, phosphoric acid, and potash equivalent to that which would be provided with the specified rate for 18-46-6 grade.

3.2.3 Tillage

Soil on slopes up to a maximum 3 horizontal to 1 vertical shall be tilled to a minimum 2-inch depth. Rototillers shall be used where soil conditions and length of slope permit. Drainage patterns shall be maintained as indicated on drawings. Areas compacted by construction operations shall be completely loosened by tillage. Soil used for repair of surface erosion or grade deficiencies shall conform to topsoil requirements. The pH adjuster, fertilizer, and soil conditioner may be applied during this procedure.

3.2.4 Prepared Surface

3.2.4.1 Preparation

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. Debris and stones over a minimum 3 inches in any dimension shall be removed from the surface.

3.2.4.2 Protection

Surface areas prepared for seeding shall be protected from compaction or

damage by vehicular or pedestrian traffic and surface erosion.

3.3 INSTALLATION and ESTABLISHMENT

Prior to planting and establishing seed, any previously prepared surface compacted or damaged shall be reworked to meet the requirements of previous paragraph titled SITE PREPARATION. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

3.3.1 Seed Methods

Seeding method shall be drill seeding or hydroseeding. Seeding procedure shall ensure even coverage.

3.3.1.1 Drill Seeding

Seed shall be planted uniformly using a Truax-type, rangeland grass drill seeders capable of handling the native seed mixtures. Half the total rate of seed application shall be broadcast in one direction, with the remainder of the seed rate broadcast at 90 degrees from the first direction. Seed shall be covered a maximum 1/4 inch depth by soil packing/rolling device, cultipacker, or other approved device.

3.3.1.2 Hydroseeding

Seed and fertilizer shall be added to water and thoroughly mixed. Seed shall be held in the slurry for a maximum 12 hours. Wood fiber mulch with tackifier shall be added at the rate recommended by the manufacturer after the seed, fertilizer, and water have been thoroughly mixed to produce a homogeneous slurry. Slurry shall be uniformly applied under pressure over the entire area. The hydroseeded area shall not be rolled.

3.3.2 Mulching

3.3.2.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 2 tons per acre, and shall be used to mulch the Levee Slope Mixture only . Mulch shall be spread by hand, with a blower-type mulch spreader, or by other approved method. Mulching shall start on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. Mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All seeded areas shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.3.2.2 Wood Fiber Mulch

Wood fiber mulch/tackifier shall be applied as part of the hydroseeding and hydromulching operation. The mulch shall be mixed according to the manufacturer's recommendation and applied at a rate of no less than 2000 pounds per acre. Wood fiber shall be used to mulch all areas seeded with native grasses and/or wildflowers. Hay/straw mulch shall not be used to mulch areas seeded with native grasses and/or wildflowers.

3.3.2.3 Mechanical Anchor

Mechanical anchoring of straw mulch shall be accomplished using a crimper; a V-type-wheel land packer; a disk with scallop-edged straight blades

designed to force mulch into the soil surface; or other suitable equipment.

3.4 SURFACE EROSION CONTROL

3.4.1 Surface Erosion Control Material

Where indicated or as directed, surface erosion control material shall be installed in accordance with manufacturer's instructions. Placement of the material shall be accomplished without damage to temporary or permanent seed mixtures and without deviation to finished grade.

3.4.2 Temporary Seeding

As required in these specifications, when directed by the COR during contract delays affecting the seeding operation or when a quick cover is required to prevent surface erosion, the areas designated shall be seeded in accordance with temporary seed species listed under paragraph SEED.

3.4.2.1 Soil Amendments

When soil amendments have not been applied to the area, the quantity of 1/2 of the required soil amendments shall be applied and the area tilled in accordance with paragraph SITE PREPARATION. The area shall be watered in accordance with paragraph Watering Seed.

3.5 QUANTITY CHECK

For materials provided in bags, the empty bags shall be retained for recording the amount used. For materials provided in bulk, the weight certificates shall be retained as a record of the amount used. The amount of material used shall be compared with the total area covered to determine the rate of application used. Differences between the quantity applied and the quantity specified shall be adjusted as directed.

3.6 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan identifing the pest and the area to be treated shall be submitted and coordinated with the COR.

3.6.1 Technical Representative

The Government's certified pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

3.6.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide 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 pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately. A

pesticide plan shall be submitted.

3.7 RESTORATION AND CLEAN UP

3.7.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the seeding operation shall be restored to original condition at Contractor's expense.

3.7.2 Clean Up

Excess and waste material shall be removed from the seeded areas and shall be disposed offsite. Adjacent paved or gravelled areas shall be cleaned.

3.8 PROTECTION OF SEEDED AREAS

Immediately upon completion of the seeding operation in an area, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed.

3.9 SEED ESTABLISHMENT PERIOD

3.9.1 Commencement

The seed establishment period to obtain a healthy stand of grass plants shall begin on the first day of work under this contract and shall end six months after the last day of the seeding operation. Written calendar time period shall be furnished for the seed establishment period. When there is more than one seed establishment period, the boundaries of the seeded area covered for each period shall be described. The seed establishment period shall be modified for inclement weather, shut down periods, or for separate completion dates of areas.

3.9.2 Satisfactory Stand of Grass Plants

Grass plants shall be evaluated for species and health when the grass plants are a minimum 1 inch high. For areas other than levee slopes or the 10-foot wide bands immediately adjacent the levees, a satisfactory seeding operation must provide a stand of grasses, wildflowers, and forbs that has a minimum 20 plants per square foot. Total bare spots shall not exceed 1 percent of the total seeded area.

3.9.3 Maintenance During Establishment Period

Maintenance of the seeded areas shall include eradicating weeds, insects and diseases; protecting embankments and ditches from surface erosion; maintaining erosion control materials and mulch; protecting established/seeded areas from traffic; mowing; and post-fertilization.

3.9.3.1 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

3.9.3.2 Repair or Reinstall

Unsatisfactory stand of grass plants and mulch or grasses, wildflowers, forbs and mulch, shall be repaired or reinstalled, and eroded areas shall

be repaired in accordance with paragraph SITE PREPARATION.

3.9.3.3 Maintenance Record

A record of each site visit shall be furnished by the Contractor, describing the maintenance work performed; the areas repaired or reinstalled; and a diagnosis for the unsatisfactory stand of vegetation; a list of other actions necessary to obtain a satisfactory stand of vegetation; and timeframes for implementing corrections and follow-up inspections.

3.9.3.4 Additional Seeding

If an inspection conducted during seeding operations, or after there is a showing of green, indicates that areas have been left unplanted, additional seed shall be sown as directed.

3.9.4 Grass Drill Methods and Exception for Hydroseeding

The rangeland grass drill shall be used to install the permanent native grass mixture B and the native grass and wildflower seed mixtures (mixtures A and C) at a depth of 1/4 inch. Where slopes, (3 horizontal to 1 vertical or greater) or permanently saturated soils prohibit the use of the rangeland grass drill, the hydroseeding method may be used with approval by the COR.

3.9.5 Hydroseeding/Hydromulching

The hydraulic seeding equipment shall include a pump rated and operated at no less than 100 gallons per minute and at no less than 100 pounds per square inch pressure. A minimum of 1,000 gallons of slurry (seed, water, fiber mulch) shall be used. The tank shall have a mechanical agitator powerful enough to keep all materials in a uniform suspension in the water. Ingredients shall be added for the application at the following rates:

(a) Seed as previously specified

(b) Wood fiber mulch at 2,000 lbs per acre

When hydroseeding the levee seed mixture and all other areas disturbed by construction operations other than areas A, B, and C, the Contractor shall incorporate sufficient fertilizer into the slurry to provide 1 lb of elemental nitrogen per 1,000 SF of seeded area. No fertilizer shall be utilized when reseeding the native grass and native grass and wildflower areas, areas A and B respectively.

3.9.6 Seeding Times

3.9.6.1 Areas A, B, and C

Seeding operations shall be between April 1st, or as soon thereafter as the soil is free of frost and in workable condition, and July 30th; and from December 1st to freeze-up (later if a no-till rangeland grass drill is used). If using a no-till rangeland grass drill, planting can be done any time except from August 1st to December 1st. Wetlands are prohibited only from August 1st to November 1st.

3.9.6.2 Levee Slopes and Other Areas

All areas seeded with the levee slope seed mixture and all other areas disturbed by construction operations, other than Areas A, B, and C, shall be seeded between April 1 and May 15 for spring planting, and August 15 and October 1 for fall planting, unless otherwise approved by the COR and PM-PR.

3.9.7 Post Planting Management, Areas A, B, and C

If weeds infest newly seeded areas and shade the ground by 50 percent, the area shall be mowed to a height of 6 inches removing all clippings. Following the 1st anniversary of the installation, the area shall be mowed in early spring or late fall removing the clippings. Mowing times shall be as approved by the COR and PM-PR.

3.9.8 Protection and Maintenance of Levee Slope Mixture

The following maintenance shall begin immediately after planting of grass in the levee slope mixture, and shall continue until final acceptance.

3.9.9 Grass

Maintenance of grass cover shall consist of watering, weeding, cutting, repair of all erosion and reseeding as necessary to establish a uniform stand of the specified grasses, and shall continue until final acceptance. After the seeded grass has started, all of the areas greater than 12 inches square which fail to show a uniform stand of grass for any reason whatsoever, shall be reseeded until all areas are covered with a satisfactory growth of grass.

3.9.10 Cuttings/Mowings

When newly seeded grass reaches a height of 6 inches, the Contractor shall cut it back to 4 inches in height, and shall repeat the procedure for subsequent cuttings. After the second cutting, the Contractor shall top dress with specified fertilizer at a rate of 1/2 pound of elemental nitrogen from fertilizer per 1,000 sq ft.

3.10 GUARANTEE, AREAS A, B, AND C

At the end of the third full growing season, not to exceed 36 months after seeding, a random sample of 20 percent of the area will be conducted. If 75 percent of the species planted are identified and the sample area has 80 percent coverage of acceptable species, the work will be accepted. If plant establishment was insufficient, the Contractor shall replant specified species at no cost to the Government.

-- End of Section --

SECTION 02945

TREE PROTECTION
12/99

PART 1 GENERAL

1.1 SCOPE

This Section describes/outlines protective measures to be taken to protect the trees and shrubs that are to remain in place from foliage, trunk, and root damages that may result from construction operations.

1.2 MEASUREMENT AND PAYMENT

Separate payment for work covered in this section will not be made.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 PROTECT TREES AND SHRUBS

The Contractor shall use all all due care to protect trees and shrubs that are to remain. The Contractor shall take all appropriate measures to avoid and prevent the following damages from occurring:

a. Compaction by equipment or material storage of soil areas near/above tree/shrub roots (anywhere within the trees' drip lines).

b. Trunk Damages to trees and shrubs resulting from contact with earth-moving and construction equipment, material storage, nailing or bolting, and other means.

c. Girdling / strangling / breakage of trees caused by tying ropes or guy wires to trunks or large branches.

d. Poisoning of trees and shrubs caused by pouring solvents, gas, paint, or other toxic substances or nonnative materials on or around tree trunks and/or roots.;

e. Cutting of tree or shrub roots by excavating, etching, etc;

f. Suffocation of tree/shrub roots due to placement of more than 4 inches of fill material on the surface within the drip line.

g. Damaged branches due to improper pruning and/or machinery operation.

h. Drought or disruption of water source resulting from failure to water

or by cutting off / or changing normal drainage pattern past roots.

i. Changes of soil pH factor by disposal of lime base materials such as concrete, plaster, concrete waste water, etc.

3.1.2 PROTECTION OF TREE ROOTS.

The Contractor shall avoid/minimize the cutting of any tree/shrub roos and shall not cut tree or shrub roots that are 1-1/2 inches or greater in diameter. All excavation and earthwork within the drip line of trees shall be done by hand.

-- End of Section --

SECTION 02950

TREES, SHRUBS AND GROUND COVERS

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 basic designation only.

Datascape Nomenclature Guide available from American Nurserymen Publishing Co., 77 W. Washington St., Suite 2100, Chicago, IL 60602-2904.

American Association of Nurserymen, Inc. "American Standard for Nursery Stock", Z60.1-1973, or latest edition.

Available from: American Association of Nurserymen, Inc., 230 Souther Building, Washington, D.C. 20005

1.2 DESCRIPTION OF WORK

The work covered by this Section consists of furnishing all plants and related materials, supervision, labor, equipment, appliances and services necessary for and incidental to completing all operations in connection with the planting of trees, shrubs, ground covers and other such materials in strict accordance with these Specifications and the applicable drawings and subject to the terms and conditions of the Contract. The work shall include, but not be limited to, the following within the Contract limits:

1.2.1 Excavating and backfill as required for all plant materials;

1.2.2 Furnishing and incorporating of fertilizer;

1.2.3 Furnishing and planting of trees, shrubs and other plant material as indicated;

1.2.4 Maintenance; and

1.2.5 Replacement of unsatisfactory plant material.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having no designation are for information only. The following shall be submitted in accordance with Section 01330: SUBMITTAL PROCEDURES.

SD-13 Certificates

Plant Material Inspection Certificates; GA-PR.

Fertilizer; GA. Ground Cloth ; GA-RE . Mycorrhizal Inoculant ; GA-RE .

Certified analyses by a recognized laboratory shall be submitted before delivery to the site.

1.4 CERTIFICATES OF INSPECTION

All necessary Inspection Certificates shall accompany the invoice for each shipment or order of stock, as may be required by law for the necessary transportation, and such certificates shall be filed, prior to the acceptance of such material, with the Contracting Officer's Representative (COR).

1.5 ACCEPTANCE

1.5.1 Inspection

Inspection of the work to determine completion of the contract, exclusive of the possible replacement of plants, will be made by the COR upon written notice requesting such inspection submitted at least 10 days prior to the anticipated date.

1.5.2 Notification

After inspection of the work, the Contractor will be notified in writing by the COR of acceptance of all work exclusive of the possible replacement of plants subject to guaranty; or, if there are any deficiencies, of the requirements for completion of the work.

1.6 GUARANTEE

1.6.1 Guarantee Terms

All plant material shall be guaranteed by the Contractor for a period of 6 months from the date of acceptance to be in good, healthy, and flourishing condition. In addition, the Contractor shall guarantee a minimum of 80% of each species to be in good, healthy, and flourishing condition for a period of 1 year or one full growing season, whichever is longer, from the date of acceptance.

1.6.2 Replacement

The Contractor shall replace, without cost to the Government, and as soon as weather conditions permit, dead plants and plants not in a vigorous thriving condition, as determined by the COR and PM-PR at the end of the 6 month and 1 year guarantee periods. Replacement plantings shall be of the same species as the species replaced, unless otherwise directed/approved by PM-PR and the COR. The number of bare root stock replacement plantings at the one-year period shall be such that any planted areas which average less than 80% survival shall be replanted to 80% of the original number of trees/shrubs planted. The air pruned method (APM) plantings however, shall be replaced to 90% of the original number of APM trees planted. Replacement plantings shall be subject to all requirements stated in these Specifications.

1.7 MAINTENANCE

Maintenance shall begin immediately after each plant is planted and shall continue throughout the length of the Contract and guarantee period, until

final acceptance of the plantings by PM-PR and the COR. All new plantings shall be maintained until final acceptance. Maintenance activities shall include insect and disease control, watering, removal of dead or damaged plant materials, resetting plants to proper grades and/or upright position, and other necessary operations.

1.8 CONTRACTOR'S RESPONSIBILITY

1.8.1 Examination of Drawings

The Contractor shall examine all drawings relating to the work required and visit the site to become fully informed as to all existing conditions and limitations as they apply to the work, the extent and character of the work required under this section, and its relation to all construction work.

1.8.2 Agreement to Conditions

No consideration will be granted for any alleged misunderstanding of the materials to be furnished or the extent and nature of the work to be done, it being understood that the tender of the proposal carries with it the agreement to all items and conditions specified, referred to herein, or indicated on the contract drawings.

1.8.3 Liability

The Contractor shall be liable for any damages to property caused by operations under this section and shall, without any additional cost to the Government, restore to their original condition all areas disturbed or damaged by construction, including structures, lawns, pavement, curbs, etc.

1.8.4 Cooperation and Coordination

Cooperation and coordination of all planting and maintenance operations with the COR and PM-PR (Mr. Schuettpelz/816-983-3134) is imperative for the successful completion/acceptance of the work.

1.9 PLANT SCHEDULE

1.9.1 Supply of Plants

The Contractor shall supply all plants shown in the Plant Schedule contained herein, and as specified subject to the conditions under the paragraph titled "Contractor's Responsibility".

1.9.2 Height and Spread

Height is shown as an approximate dimension from the ground to the top of the previous year's growth. The top spread is shown as the approximate spread of the top at the principal width.

1.9.3 Ball Size

If plants are collected, the ball shall be at least the size required by American Standards for Nursery Stock.

1.9.4 Schedule

The Schedule of Plant Material to be furnished and planted is contained herein.

1.10 TESTS AND INSPECTIONS

1.10.1 Notification of Source Availability

Within 30 days following acceptance of the bid, the Contractor shall notify the COR and PM-PR (Schuettpelz/816-983-3134) of the plant material sources the Contractor proposes to use and required/desired to be inspected or tested.

1.10.2 Plant Material Inspection Certificates

The Contractor shall be responsible for all Certificates of Inspection of plant materials that may be required by Federal, State, or other authorities to accompany shipments of plants. The Contractor shall furnish the COR with copies of the Certifications that all plants conform to the standards of the American Association of Nurserymen.

1.10.3 Pre-planting Inspection

All plant materials must be inspected and approved before they are planted. Inspection and approval by the COR of plants at the place of growth or upon delivery shall be for quality, size, and vitality only, and shall not in any way impair the right of rejection for failure to meet other requirements during progress of work.

1.10.4 Analyses and Tests

Analyses and tests of materials, if required, such as fertilizers, insecticides, etc., shall be made in accordance with the current method of the Association of Official Agricultural Chemists.

1.10.5 Certified Analyses

Certified analyses by a recognized laboratory of Fertilizer, etc., shall be submitted by the Contractor, at the Contractor's expense, for the COR's approval before delivery to the site. Packaged and sealed standard products accompanied by the manufacturer's or the vendor's analyses, complying with specification requirements, will be acceptable.

1.10.6 Approval of Materials

Approval of materials shall not be construed as final acceptance and the COR reserves the right to analyze, for comparison with Specification requirements, any or all materials delivered for use under this Section. The cost of such tests will be borne by the Government. Should these tests indicate noncompliance with Specification requirements, the COR will charge the entire costs of such tests to the Contractor. All rejected material shall be removed from the site and replaced with acceptable material.

1.11 DELETED

1.12 PLANT SCHEDULE

Botanical/Common Name	Type	Plants/Acre	Total
Trees (APM*):			
Carya laciniosa/Shellbark hickory	APM	6/acre	840
Quercus bicolor/Swamp white oak	APM	4/acre	560
Quercus macrocarpa/Bur oak	APM	6/acre	840
Quercus palustris/Pin oak	APM	4/acre	560
SUBTOTAL. APM TREES:		**20 APM/acre**	**2800 APM**
Trees (BR):**			
Acer saccharinum/Silver maple	BR**	25/acre	3500
Carya illinoensis/Pecan	BR	30/acre	4200
Celtis occidentalis/Common Hackberry	BR	25/acre	3500
Fraxinus pennsylvanica/Green ash	BR	20/acre	2800
Morus rubra/Red mulberry	BR	20/acre	2800
Nyssa sylvatica/Black gum	BR	30/acre	4200
SUBTOTAL, BR TREES:		**150 BR/acre**	**21,000 BR**
Shrubs (BR):**			
Cornus racemosa/Gray dogwood	BR	15/acre	2100
Cercis canadensis/Eastern Redbud	BR	15/acre	2100
Ilex decidua/Deciduous holly	BR	15/acre	2100
Ilex verticillata/Winterberry	BR	15/acre	2100
SUBTOTAL, SHRUBS:		**60 BR/acre**	**8400 BR**
TOTAL, TREES:		**20 APM/ACRE**	**2800 APM**
" , " :		**150 BR/ACRE**	**21,000 BR**
TOTAL, SHRUBS:		**60 BR/ACRE**	**8400 BR**
TOTALS:		**20 APM**	**2800 APM**
" :		**210 BR**	**29,400 BR**

*** APM = "Air-Pruned Method" planting stock. Use potted specimens for these species equivalent to Forrest Keeling Nursery's "Root Pruned Method" (RPM) trees. Use tree specimens in 3 gallon pots which have a minimum diameter of 5/8-inch caliper at the tree base, 6 inches above soil line.**

**** BR = Bare Root planting stock**

PART 2 PRODUCTS

2.1 COMMERCIAL FERTILIZERS

Commercial fertilizers shall conform to all applicable state fertilizer laws, and shall be delivered in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Fertilizer shall be controlled-release pellets, tablets or packets (2 years duration), and be of the size, weight, quantity and analysis recommended by the manufacturer for the type plants specified. Root stimulator shall be used at the time of planting in accordance with the manufacturer's recommendations.

2.2 HERBICIDE

Sulfometuron will be applied, according to label directions, over the top of dormant seedlings or root pruned potted specimens. Herbicide shall be applied in strips at least 4 feet wide or in circles with a radius of 2 feet with each seedling centered in the sprayed area. In order to assure that seedlings are dormant when sprayed, herbicide must be applied at the

time of planting or within 48 hours of removal from cold storage.

2.3 MULCH/GROUND CLOTH

Mulch shall consist of horticultural grade shredded hardwood or cypress bark, free of sticks, stones, clay or other foreign materials. Mulch shall be of such character as not to be easily displaced by wind. Ground cloth shall be a nonwoven geotextile fabric no less than 36 inches square manufactured from polypropylene fibers. The fabric weight shall be no less than 8 ounces per square yard, and shall possess a minimum average roll value (MARV) of 90 gallons per minute per square foot of material as tested in accordance with ASTM D4491, and a puncture resistance of 130 pounds as tested in accordance with ASTM D4833.

2.4 WATER

Water, pumps, hoses, and other equipment required for the distribution of water shall be furnished by the Contractor.

2.5 PLANT MATERIAL

All bare root planting stock shall be of conservation grade or better. The bare root (BR) seedlings shall be at least 1 year old and at least 12 inches in height. A root to shoot ratio must be maintained at a range of 1:1 to 1:1.5. The taproot shall not be shortened to less than 8 inches in length. Any variations in size must be approved by the COR and PM-PR (Mr. Schuettpelz/816-983-3134).

All air pruned method (APM) potted stock shall consist of plant materials grown using an air root pruning technique that develops a heavy, fibrous root system in a pot that is 3 gallons in size. Minimum seedling height is 3 feet, minimum caliper of 5/8-inch at the tree base, measured at 6 inches above soil line. Seedlings will be maintained in a dormant condition until planted.

2.5.1 Plant Schedule

The Plant Schedule preceeding this Section forms a part of these Specifications.

2.5.2 Nomenclature

The scientific and common names of plants herein specified conform with the approved names given in the Datascape Nomenclature Guide. Names of varieties not included therein conform generally with names accepted in the nursery trade..

2.5.3 Quantities

Quantities necessary to complete the planting are indicated on the attached Plant Schedule.

2.5.4 Substitutions

Substitutions will not be permitted. If proof is submitted that any plant specified is not reasonably obtainable, a proposal will be considered for use of the nearest equivalent size or variety with an equitable adjustment of contract price. Any proposed substitution must be approved by PM-PR (Mr. Schuettpelz/816-983-3134). All efforts shall be made to avoid use

of substitions due to considerable earlier coordination/planning efforts.

2.5.4 Quality and Size

Plants shall be sound, healthy, vigorous, and free from insect pests, plant diseases, injuries, and after-effects thereof. Plants will be moist but free of mold, free of defects, with well-developed root systems. Plant materials which do not conform to this description or condition will be discarded, removed from the project site, and shall be replaced by the Contractor.

All plants shall be equal to or exceed the minimum, acceptable sizes, measurements specified in Sections herein. Planting stock shall be measured before pruning and/or planting, with branches in normal position.

All plants and all tree trunks shall be measured when the branches are in their normal position. Dimensions for height and spread as contained herein refer to the main body of the plant and not from branch tip to branch top. No pruning of branches to obtain the required height, however, shall be done before the plants are delivered to the site, unless so approved by the COR.

Nursery-grown plants shall mean plants which are healthy vigorous plants, lined out in rows in a nursery, which are annually cultivated, sprayed, pruned and fertilized in accordance with good horticultural practice as required by the American Association of Nurserymen, Inc.

All plants shall be nursery-grown, unless otherwise specified. All plants must be acclimated to area conditions. All plants shall be freshly dug; neither heeled-in plants nor plants from cold storage will be accepted. All nursery-grown plants shall have been transplanted or root-pruned at least once in the past 3 years.

No trees which have had their leaders cut or which have been so damaged that cutting is necessary will be accepted.

Planting stock specified to be furnished in a size range shall be interpreted to mean *that no less than 50 percent of the trees shall be of the maximum size specified*.

Plants larger in size than specified herein may be used if approved by the COR, but the use of larger plants shall not increase the contract price. If the use of larger plants is approved, the root lengths and root massballs of the planting stock must be of sufficient length to meet the root to shoot ratio specified earlier in this Section.Plants grown in containers shall be fully rooted throughout the earth ball within the container, but not rootbound. All container plants must be acclimated to area conditions.

2.6 MYCORRHIZAL INOCULANT

The Contractor shall provide mycorrhizal inoculant for use with the planting of APM and BR materials. The inoculant shall be Gro-Life Mycorrhizal Tablets or equal.

PART 3 EXECUTION

3.1 DIGGING, WRAPPING AND HANDLING

3.1.1 Protection

All plants shall be handled in such a manner as to avoid unnecessary damage of any kind. No plant shall be bound with wire or rope at any time to prevent bark damage or breakage of branches. Plants shall not be handled or carried by the trunks or stems. Roots shall be especially protected at all times from drying. Plants which cannot be planted immediately upon delivery shall be protected from heat and prevented from drying wind and sun by healing-in any BR stock and covering adjoining area and the root masses of all APM stock with moist mulch, or other protection if approved by the COR. The Contractor shall be responsible for replacement of all plants lost to improper protection and/or handling.

3.1.2 Labeling

Durable, legible labels stating in weather-resistant ink the correct botanical and common plant names and sizes, as specified in the Plant Schedule, shall be securely attached to all plants, bundles or packages of plants of a single species and size, or plant containers delivered to the plant site for the purpose of inspection and plant identification.

3.1.3 Shipment and Delivery

Bare root seedlings shall be delivered to the site in a dormant state and shall be maintained in a dormant state by the Contractor until planted.

The Contractor shall promptly notify the COR in advance of the time and manner of delivery of plants, and shall furnish an itemized list in duplicate of the actual quantity of plant materials in each delivery, in order to ensure satisfactory coordination of delivery, and to expedite the required inspection at the point of delivery. The itemized duplicate list of the plant material for each delivery shall include the pertinent data as specified in the Plant Schedule and otherwise herein. These itemized lists and the necessary certificates to accompany each plant and/or shipment shall be delivered to the COR prior to acceptance and planting of the plant material.

When shipment is made by truck, all plant material shall be packed to provide adequate protection against climatic and seasonal damage and breakage during transit. The tops shall be securely covered with tarpaulin or canvas to minimize windwhipping and drying. When shipment is made by rail, boxcars shall be carefully packed and adequately ventilated in accordance with the plant requirements to prevent "sweating" of the plants during transit. Shipments made by rail to local or nearby freight yards shall be given special attention to insure prompt delivery and careful handling therefrom to the point of final delivery at the plant site.

Under no circumstances shall any plant material, packages, or containers be dropped from boxcars or trucks to the ground. Suitable methods of handling plant stock shall be employed at the point of delivery to insure careful, workmanlike, and acceptable delivery of heavy plant rolls or packages, precluding and preventing cracked, "mushroomed", and/or otherwise damaged/opened packages or containers of BR and especially APM plants.

3.2 WATERING UPON DELIVERY

Plants shall be watered well by the Contractor immediately after being

delivered from the nursery to the site. Plants will be watered daily until planted.

3.3 PLANTING OPERATIONS AND METHODS

Drawings L-1 and L-2 indicate the areas to be planted with trees, shrubs and ground covers. (Text Deleted) The Contractor shall follow these typical plans and sections during planting operations.

3.3.1 Planting Seasons

Planting operations shall be conducted under favorable weather conditions during the seasons which are normal for such work as determined by accepted practice in the locality. **The acceptable planting season for bare root seedlings shall between March 1 and May 15. All air pruned potted stock must be planted between September 1 and December 1 and/or March 1 and May 15.** The Contractor may at his option, taking complete responsibility without additional compensation, conduct planting operations under unseasonable conditions.

3.3.2 Obstructions Below Grade or Overhead

3.3.2.1 Protections

The Contractor shall be responsible for protection of the property including all adjacent structures, trees, shrubs, underground utilities, adjacent paving and curbing, adjacent lawn areas, etc.

3.3.2.2 Barricades

The Contractor shall erect and maintain sufficient barricades to protect adjacent structures, paving, lawns, etc., from damage by construction vehicles and operations. Barricades shall also be erected where required to prevent injury to the public and construction personnel.

3.3.3 Underground Utilities

3.3.3.1 Existing Underground Utilities

All existing underground utilities may not be shown on the contract documents; therefore, it will be necessary for the Contractor to locate all such lines from available documents and/or by on-site inspection and take the appropriate action to protect them during construction operations. The Contractor shall mark the locations of these underground utilities near any construction activities.

3.3.3.2 Existing Insulated Underground Lines

Where excavation, grading or other earthwork is involved around the existing insulated underground lines, the excavation work, etc., shall be accomplished by hand, taking extreme caution not to puncture or damage the lines. Any puncture of insulation of the underground lines constitutes damage.

3.3.3.3 Damage to Utilities

Any and all damage to existing underground utilities shall be repaired or replaced at the COR's option. ***Any damage to the insulated underground lines could result in the replacement of the entire system of lines at the***

Contractor's expense.

3.3.3.4 Uncovered Underground Utilities

Where underground utilities are uncovered during excavation operations, they shall be inspected by the COR for any possible damage before backfilling operations commence. Contractor must coordinate identification and exposure of lines with utility companies.

3.3.4 Unknown Utilities

3.3.4.1 Unknown/Uncharted Utilities

If any unknown and uncharted utilities are encountered during excavation, the Contractor shall promptly notify the COR and wait for instructions before proceeding.

3.3.4.2 Abandoned Utility Lines

If it is ascertained by the COR that such utility line has been abandoned, the Contractor shall properly cap the line at a depth approved by the COR, or shall remove the line if so directed.

3.3.4.3 Damage to Unknown Utilities

If such unknown utilities are encountered and work is continued without contacting the COR for instructions, and damage is caused to said utilities, the Contractor shall repair, at his own expense, such damage to the satisfaction of the COR.

3.3.5 Excavation for Planting

Excavation shall include stripping of all soil to the specified depth. All unsuitable excavation material shall be disposed of by the Contractor on site.

3.3.5.1 Planting Holes for APM Stock

Planting holes for planting APM trees shall be circular in outline with vertical sides and flat but irregular bottoms. Mechanical digging of pits may be approved by the COR. The minimum depth of pits shall be 2 feet from finished grade and as much deeper as necessary to allow a minimum of 6 inches of firmed prepared topsoil under the ball or roots. In addition, planting holes for APM trees shall be as deep as necessary to allow planted trees, after settlement, to be located at a depth where the trees' root collars are at or just below the adjacent soil surface. Planting holes shall have 6 inches of firm, prepared topsoil under the tree ball or roots.

3.3.5.2 Massed Tree and Shrub Beds/Planting Areas

Existing soil in planting beds/areas shall be excavated as indicated in the specifications sections on levee construction and associated earthwork. Earthwork for tree plantings shall be limited to the amount necessary to place plant materials at specified depths.

3.3.6 Soil Preparation

All planting shall be done in prepared soil subject to the approval of the COR. Bed areas shall be backfilled with existing topsoil prepared to a

depth 2 inches below existing grade. A complete fertilizer 12-12-12 shall be uniformly broadcast over the tree and shrub planting areas at the rate of 4 pounds per 1,000 sq ft of bed area. The fertilizer shall be thoroughly mixed into the top 8 inches of the soil before planting.

3.3.7 Setting Plants

3.3.7.1 General

All plants shall be set 1-1/2 inches or 2 inches above existing grade so that, after settlement, they bear the same relation to the finished grade of the surrounding soil that they bore to the grade of the soil from which they were dug from the nursery.

3.3.7.2 Air Pruned Method (APM) Potted Plants

After pits have been dug as specified above, a minimum of 6 inches of compacted prepared soil, or as much more as is needed to allow the ball to rest firmly on such compacted soil at the proper level, shall be placed in the bottom of the pit.Prepared topsoil shall then be placed around the roots and carefully compacted to fill all voids but avoid overcompaction. All broken or frayed roots shall be cut off clean. When the planting hole pit is nearly filled with soil, water shall be added and allowed to soak away.

3.3.7.3 BR Plantings in Beds/Planting Areas

Plants shall be planted upright into prepared beds with no more than a 10% lean and at the same depth as they grew in the nursery. Seedlings shall be planted at slightly above finished grade. Soil shall be packed firmly around seedling roots to eliminate air pockets. When all plants are in place, the entire bed area shall be raked smooth, and water added and allowed to soak away. After settlement, soil shall be added as necessary to finished grade and water applied.

Seedlings shall be planted either mechanically with power-drawn tree planters or by hand with dibble bars and/or spades.

3.3.7.4 Mulch/Ground Cloth

Install ground cloth around tree and secure with no less than 4 turf staples (6-inch, U-Shape, 11 gage steel) at the fabric corners. Install no less than 2.5 cubic feet of hardwood mulch (2 inches deep, 48-inch circumference) for APM trees, and no less than 1.25 cubic feet of hardwood mulch (2-inches deep, 24-inch circumference) for BR stock.

3.3.7.5 Mycorrhizal Inoculant

APM and BR materials shall be planted with a tablet source of the specifeid mycorrhizal inoculant. The quantity of tablets shall be no less than six, 7-gram tablets for each APM plant, and two 7-gram tablets for BR plants. The tablets shall be placed beneath each APM and BR plant during the installation process.

3.3.8 Clean-Up

As planting operations proceed, all rope, wire, burlap, empty containers, rocks, clods and all other debris shall be removed daily and shall not be allowed to accumulate. The site shall be kept as tidy as possible at all

times. Any excess excavated topsoil or rich loam shall be placed where and as directed by the COR. Other excess soil shall be disposed of onsite. After planting operations are finished, all paved areas which may have become strewn with soil or other material shall be thoroughly cleaned by sweeping and washing, if necessary.

3.4 PRUNING AND SPRAYING OF PROPOSED TREES

Each tree shall be pruned to preserve the natural shape and character of the plant. Approximately 25% of the branches shall be removed to compensate for root loss.

All soft wood or sucker growth and all broken or badly bruised branches shall be removed with a clean cut. All pruning cuts shall be sharp and clean.

Immediately after planting and staking, all plant material must be sprayed with an antidesiccant, if required, using an approved power sprayer for applying an adequate film over trunks, branches and foliage. Antidesiccant paint shall be delivered in the manufacturer's sealed containers and used in accordance with their recommendations.

3.5 TREE ESTABLISHMENT PERIOD

As stated earlier in this Section, the Contractor shall guarantee that one year after the planting of all trees, 80% of the BR tree/shrub seedlings and 90% of the APM tree seedlings have survived or shall be replanted in kind in accordance with all conditions of this Section. The Contractor shall replant any area that does not meet these criteria at no cost to the Government. The COR, PM-PR (Mr. Schuettpelz), and the Contractor shall determine what constitutes stand of trees.

-- End of Section --

PHASE I

DIVISION 3 – CONCRETE

03101	Formwork for Concrete
03150	Expansion Joints, Contraction Joints, and Waterstops
03200	Concrete Reinforcement
03301	Cast-in-Place Structural Concrete for Civil Works

SECTION 03101

FORMWORK FOR CONCRETE
12/92

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 basic designation only.

ACI INTERNATIONAL (ACI)

ACI 301	(1996) Standard Specification for Concrete
ACI 347R	(1994) Guide for Formwork for Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31	(1994) Making and Curing Concrete Test Specimens in the Field
ASTM C 39	(1993a) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 1074	(1993) Estimating Concrete Strength by the Maturity Method
ASTM C 1077	(1995a) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1	(1983) Construction and Industrial Plywood

1.2 DESIGN REQUIREMENTS

The design, engineering, and construction of the formwork shall be the responsibility of the Contractor. The formwork shall be designed for anticipated live and dead loads and shall comply with the tolerances specified in Section 03301 CAST-IN-PLACE STRUCTURAL CONCRETE, paragraph CONSTRUCTION TOLERANCES. However, for surfaces with an ACI Class A surface designation, the allowable deflection for facing material between studs, for studs between walers and walers between bracing shall be limited to 0.0025 times the span. The formwork shall be designed as a complete system with consideration given to the effects of cementitious materials and mixture additives such as fly ash, cement type, plasticizers, accelerators, retarders, air entrainment, and others, and placement and vibratory effects. The adequacy of formwork design and construction shall be

monitored prior to and during concrete placement as part of the Contractor's approved Quality Control Plan. Formwork design shall conform to ACI 347R

1.3 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section, SUBMITTAL PROCEDURES:

SD-01 Data

Materials; FIO-RE.

Manufacturer's literature shall be submitted for plywood, concrete form hard board, form accessories, prefabricated forms, and form coating

SD-04 Drawings

Shop Drawings; FIO-RE.

Drawings and design computations for all formwork required shall be submitted at least 30 days either before fabrication on site or before delivery of prefabricated forms.

SD-08 Statements

Shop Drawings; FIO-RE.

If reshoring is permitted, the method, including location, order, and time of erection and removal shall also be submitted for review.

SD-09 Reports

Inspection; FIO-RE.

The Contractor shall submit field inspection reports for concrete forms and embedded items.

Formwork Not Supporting the Weight of Concrete; GA-RE.

If forms are to be removed in less than 24 hours on formwork not supporting the weight of concrete, the evaluation and results of the control cylinder tests shall be submitted to and approved before the forms are removed.

1.4 SHOP DRAWINGS

The shop drawings and data submitted shall include the type, size, quantity, and strength of all materials of which the forms are made, the plan for jointing of facing panels, details affecting the appearance, and the assumed design values and loading conditions.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Forms and Form Liners

Forms and form liners shall be fabricated with facing materials that will produce a finish meeting the specified construction tolerance requirements and the following surface classifications as defined in ACI 347R.

2.1.1.1 Class "A" Finish

This class of finish shall apply to all exterior surfaces which will be esposed to view. The form facing material shall be composed of new, well-matched tongue-and-groove lumber or new plywood panels conforming to DOC PS 1, Grade B-B concrete form, Class I.

2.1.1.2 Class "C" Finish

This class of finish shall apply to formed surfaces which will not be exposed to public view or day light. Such as interior surfaces of gate wells and to all below grade exposed surfaces. The form facing may be either tongue-and-groove lumber, plywood, concrete form hard board or steel. Wood form facing for curved or warped surfaces shall be composed of splines of lumber which can be bent to the required shape without splitting or cracking.

2.1.1.3 Class "D" Finish

This class of finish shall apply to formed surfaces which are required to be permanently cover by backfill. The form facing may be of wood or steel.

2.1.2 Form Coating

Form coating shall be commercial formulation that will not bond with, stain, cause deterioration, or any other damage to concrete surfaces. The coating 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. If special form liners are to be used, the Contractor shall follow the recommendation of the form coating manufacturer.

2.2 ACCESSORIES

Ties and other similar form accessories to be partially or wholly embedded in the concrete shall be of a commercially manufactured type. After the ends or end fasteners have been removed, the embedded portion of metal ties shall terminate not less than 2 inches from any concrete surface either exposed to view or exposed to water. Removable tie rods shall not be allowed in levee and levee structures and levee gatewell structures. Plastic snap ties may be used in locations where the surface will not be exposed to view. Form ties shall be constructed so that the ends or end fasteners can be removed without spalling the concrete.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Form Construction

Forms shall be constructed true to the structural design and required alignment. The form surface and joints shall be mortar tight and supported to achieve safe performance during construction, concrete placement, and form removal. The Contractor shall continuously monitor the alignment and stability of the forms during all phases to assure the finished product will meet the required surface class or classes specified in paragraph, "FORMS AND FORM LINERS" and tolerances specified in paragraph, "DESIGN REQUIREMENTS". Failure of any supporting surface either due to surface texture, deflection or form collapse shall be the responsibility of the Contractor as will the replacement or correction of unsatisfactory surfaces. When forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be re-used if there is any evidence of defects which would impair the quality of the resulting concrete surface. All surfaces of used forms shall be cleaned of mortar and any other foreign material before reuse.

3.1.2 Chamfering

All exposed joints, edges and external corners shall be chamfered by molding placed in the forms unless the drawings specifically state that chamfering is to be omitted or as otherwise specified. Chamfered joints shall not be permitted where earth or rockfill is placed in contact with concrete surfaces. Chamfered joints shall be terminatedtwelve inches outside the limit of the earth or rockfill so that the end of the chamfers will be clearly visible.

3.1.3 Construction Joints.

Grade strips shall be used on all exposed horizontal construction joints so as to obtain a straight and neat true horizontal joint. A strip of one inch square-edged lumber, bevelled to facilitaie removal and oiled, shall be tacked to the inside of the forms at the construction joint. Concrete shall be palced to a point one inch above the understide of the strip. The strip shall be removed one hour after the concrete has been placed, any irregularties in the joint line leveled off with a wood float and all laitance removed.

3.1.4 Coating

Forms for exposed or painted surfaces shall be coated with form oil or a form-release agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's instructions. Forms for unexposed surfaces may be wet with water in lieu of coating immediately before placing concrete, except that, in cold weather when freezing temperatures are anticipated, coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing

steel and construction joints shall be removed before placing concrete.

3.2 FORM REMOVAL

Forms shall not be removed without approval. The minimal time required for concrete to reach a strength adequate for removal of formwork without risking the safety of workers or the quality of the concrete depends on a number of factors including, but not limited to, ambient temperature, concrete lift heights, type and amount of concrete admixture, and type and amount of cementitious material in the concrete. It is the responsibility of the Contractor to consider all applicable factors and leave the forms in place until it is safe to remove them. In any case forms shall not be removed unless the minimum time, minimum ambient temperature, and minimum compressive strength requirements below are met, except as otherwise directed or specifically authorized. When conditions are such as to justify the requirement, forms will be required to remain in place for a longer period. All removal shall be accomplished in a manner which will prevent damage to the concrete and ensure the complete safety of the structure. Where forms support more than one element, the forms shall not be removed until the form removal criteria are met by all supported elements. Form removal shall be scheduled so that all necessary repairs can be performed in accordance with ACI 347R Guide for Formwork for Concrete. Evidence that concrete has gained sufficient strength to permit removal of forms shall be determined by tests on control cylinders. All control cylinders shall be stored in the structure or as near the structure as possible so they receive the same curing conditions and protection methods as given those portions of the structure they represent. Control cylinders shall be removed from the molds at an age of no more than 24 hours. All control cylinders shall be prepared and tested in accordance with ASTM C 31 and ASTM C 39 at the expense of the Contractor by an independent laboratory that complies with ASTM C 1077 and shall be tested within 4 hours after removal from the site.

3.2.1 Formwork Not Supporting Weight of Concrete

Formwork for walls, columns, sides of beams, gravity structures, and other vertical type formwork not supporting the weight of concrete shall not be removed in less than 24 hours after concrete placement is completed. Form removal before 24 hours will be allowed for simple floor slab, sidewalks, and driveways provided the ambient temperature during this period has not fallen below 50 degrees F at any time since placement and evidence from compressive tests on field-cured concrete control cylinders indicates that the concrete has attained a compressive strength of at least 95% of design psi. Control cylinders shall be prepared for each set of forms to be removed before 24 hours. The stability of the concrete shall be evaluated by a structural engineer prior to removal of the forms.

3.2.2 Formwork Supporting Weight of Concrete

Formwork supporting weight of concrete and shoring shall not be removed until structural members have acquired sufficient strength to safely support their own weight and any construction or other superimposed loads to which the supported concrete may be subjected. As a minimum, forms shall be left in place until control concrete test cylinders indicate

evidence the concrete has attained at least 95% percent of the compressive strength required for the structure in accordance with the quality and location requirements of Section covering the application.

3.3 INSPECTION

Forms and embedded items shall be inspected in sufficient time prior to each concrete placement by the Contractor 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.

-- End of Section --

SECTION 03150

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS
05/98

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 basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 111	(1983) Inorganic Matter or Ash in Bituminous Materials

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA ANSI/AHA A135.4	(1995) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 109	(1993) Steel, Strip, Carbon, Cold-Rolled
ASTM A 109M	(1991) Steel, Strip, Carbon, Cold-Rolled (Metric)
ASTM A 167	(1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 480/A 480M	(1996a) General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
ASTM A 570/A 570M	(1996) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM B 152	(1994) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 152M	(1995) Copper Sheet, Strip, Plate, and Rolled Bar (Metric)
ASTM B 370	(1992) Copper Sheet and Strip for Building Construction

ASTM C 919	(1984; R 1992) Use of Sealants in Acoustical Applications
ASTM C 920	(1995) Elastomeric Joint Sealants
ASTM D 4	(1986; R 1993) Bitumen Content
ASTM D 6	(1995) Loss on Heating of Oil and Asphaltic Compounds
ASTM D 395	(1989; R 1994) Rubber Property - Compression Set
ASTM D 412	(1997) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 471	(1996) Rubber Property - Effect of Liquids
ASTM D 572	(1988; R 1994) Rubber - Deterioration by Heat and Oxygen
ASTM D 624	Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D 1190	(1996) Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 1191	(1984; R 1994) Test Methods for Concrete Joint Sealers
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1854	(1996) Specification for Jet-Fuel-Resistant Concrete Joint Sealer, Hot-Poured Elastic Type
ASTM D 1855	(1989) Test Method for Jet-Fuel Resistant Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 2240	(1986) Rubber Property - Durometer Hardness (1991) Rubber Property - Durometer Hardness (1995) Rubber Property - Durometer Hardness

ASTM D 2628	(1991) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D 2835	(1989; R 1993) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements
ASTM D 5249	(1995) Backer Material for Use With Cold and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

CORPS OF ENGINEERS (COE)

COE CRD-C 513	(1974) Corps of Engineers Specifications for Rubber Waterstops
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Preformed Expansion Joint Filler; GA-RE. Sealant; GA-RE. Waterstops; GA-RE.

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.

Shop drawings and fabrication drawings provided by the manufacturer or prepared by the Contractor.

SD-04 Drawings

Waterstops; GA-RE.

Shop drawings and fabrication drawings provided by the manufacturer or prepared by the Contractor.

SD-06 Instructions

Preformed Expansion Joint Filler; GA-RE. Sealant; GA-RE. Waterstops; GA-RE.

Manufacturer's recommended instructions for installing preformed fillers, field-molded sealants; preformed compression seals; and waterstops; and for splicing non-metallic waterstops.

SD-13 Certificates

Preformed Expansion Joint Filler; GA-RE. Sealant; GA-RE. Waterstops; GA-RE.

Certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified.

SD-14 Samples

Preformed Compression Seals and Lubricants; GA-RE.

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; GA-RE.

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; GA-RE.

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.

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.

Store hydrophilic waterstops in accordance with manufacturer recommendations. Hydrophilic waterstops shall be protected from oil, dirt, sunlight and premature exposure to sunlight

PART 2 PRODUCTS

2.1 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1752

, Type 1. 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.

2.2 Rubber J-Seals

Rubber seals shall be of the molded type only, shall be compounded of natural rubber, synthetic polyisoprene or a blend of both and shall contain reinforcing carbon black, zinc oxide, accelerators, antioxidants, vulcanizing agents and plasticizers. Physical characteristics of the seals shall meet the following requirements:

Physical Test	Test Value	Test Method Specification
Tensile Strength	2500 psi (min.)	ASTM D 412
Elongation at Break	450% (min.)	ASTM D 412
300% Modulus	900 psi (min.)	ASTM D 412
Durometer Hardness (Shore Type A)	60 to 70	ASTM D 2240
Water Absorption	5% by weight (max.)	ASTM D 471
Compression Set	30% (max.)	ASTM D 395
Tensile Strength (After aging 48 hrs)	80% of tensile strength (min.)	ASTM D 572

The "Water Absorption" test shall be performed with distilled water. The washed specimen shall be blotted dry with filter paper or other absorbent material and suspended by means of small glass rods in the oven at a temperature of 70 degrees + 2 degrees C for 22 hours + 1/4 hour. The specimen shall be removed, allowed to cool to room temperature in air and weighed. The weight shall be recorded to the nearest 1 mg as W1 (W1 is defined in ASTM D 471). The immersion temperature shall be 70 degrees + 1 degree C and the duration of immersion shall be 166 hours.

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 for horizontal joints or Type NS for vertical joints, Class 25, and Use NT. 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

Stainless steel waterstops shall conform to ASTM A 167 and ASTM A 480/A 480M, UNS S30453 (Type 304L), and 20 gauge thick strip.

2.4.2 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.

2.5 Hydrophillic Waterstops

The material will be used on closer structure Q2.

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.

Hydrophillic Waterstops shall be dual extension waterstops, 10mm thickness by 30mm width or as shown or as sized on the drawings. The Waterstop material shall be a combination of chloroprene rubber and chloroprene rubber modified to impart hydrophillic properties. The Waterstop shall have a delay coating to inhibit inital expansion due to moisture present in fresh concrete.

Physical Properties shall meet the following minimum requirements:

1. ASTM D 624 Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

2. ASTM D 2240 Hardness: 55 +/- 5 shore A.

3. Expansion ratio: Volumetric change in distilled water @ 20 degrees C, greater than 3 to 1.

Hydrophillic Waterstop Accessories.

All hydrophilic waterstop accessories be of the same manufacturer as the hydrophilic material and of type recommended by the hydrophilic manufacturer.

Provide a two component epoxy gel to secure the hydrophillic waterstop to concrete or steel. Provide a cyanacrylate adhesive at all waterstop joints

and splices. Provide a hydrophillic sealant at all joints and splices where indicated on the drawings.

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. 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 as indicated on the drawings and 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.

3.2 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 Stainless Steel

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 End Openings

End openings of Type "Y" waterstops shall be plugged with a soft rubber plug furnished by the manufacturer, prior to the placement of concrete.

3.2.3.4 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 joints 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.

3.3 CONSTRUCTION JOINTS

Construction joints are specified in Section 03301 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.

3.4 Non-Metallic Hydrophilic Waterstop Installation

Install hydrophilic waterstops in accordance with approved manufacturer recommendations.

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.

-- End of Section --

SECTION 03200

CONCRETE REINFORCEMENT
09/97

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 basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318/318R	(1995) Building Code Requirements for Structural Concrete and Commentary
ACI 315	Details and Detailing of Concrete Reinforcement

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 82	(1995a) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 184/A 184M	(1996) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	(1994) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 615/A 615M	(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 675/A 675M	(1990a; R 1995) Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A 706/A 706M	(1995b) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 767/A 767M	(1995) Zinc-Coated (Galvanized) Steel Bars in Concrete Reinforcement
ASTM A 775/A 775M	(1996) Epoxy-Coated Reinforcement Steel

	Bars
ASTM A 884/A 884M	(1996a) Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4	(1992) Structural Welding Code - Reinforcing Steel

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI MSP-2	(1997) Manual of Standard Practice

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Concrete Reinforcement System; GA-ED.

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing. Complete shop drawings shall be submitted. The shop drawings shall be prepared under the direct supervision of a licensed professional engineer. The shop drawings shall contain his seal and a statement certifying that they are in compliance with the specifications and contract drawings. The shop drawing shall include details of the bending and placing schedule of the steel reinforcement, together with bar schedules indicating the number, size, dimensions, and total length of various bars required. Bar lists and bending diagrams shall be checked for accuracy and completeness before the bars are fabricated. Details of typical supports for reinforcing steel shall be approved prior to placing any concrete. Shop drawings shall show all concrete dimensions, location of all reinforcement, elevations, reinforcing steel clearances, and the location of all construction joints shown on the drawings or proposed by the Contractor. The drawings shall show support details including types, sizes and spacing. Spacing between vertical reinforcing steel shall be shown on the wall elevations. The minimum scale used in the shop drawings shall be 3/8 -inch to the foot (1:50). Reinforcement bending details shall conform to the requirements of ACI SP-66.

SD-08 Statements

Welding; FIO-RE.

A list of qualified welders names.

SD-13 Certificates

Reinforcing Steel; FIO-RE.

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 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.

1.5 MEASUREMENT AND PAYMENT

Separate payment for work covered in this section will not be made.

PART 2 PRODUCTS

2.1 DOWELS

Dowels shall be deformed bars and conform to ASTM A615/A615M, Grade 60, or ASTM A706/A706M, Grade 60. SMOOTH DOWELS FOR CRADLE JOINTS ARE COVERED IN SECTION 02630

2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A 184/A 184M.

2.3 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M, Grade 60 or ASTM A 706/A 706M, Grade 60, and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82. In highly corrosive environments and/or when directed by the Contracting Officer, reinforcing steel shall conform to ASTM A 767/A 767M or ASTM A 775/A 775M as appropriate.

2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185. When directed by the Contracting Officer for special applications, welded wire fabric shall conform to ASTM A 884/A 884M.

2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with ACI 315, ACI Detailing Manual and CRSI MSP-2 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 supports on formed surfaces shall be wedge-shaped, not larger than 3-1/2x3-1/2 inches, of thickness equal to that indicated for concrete cover and have an embedded hooked tie-wire for anchorage. Bar supports used in concrete with formed surfaces exposed to view shall be the same quality, texture and color as the finish surfaces. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. 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.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318/318R and ACI 315 or as directed by the COR. 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 318/318R 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 318/318R. 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 318/318R and shall be made only as required or indicated. Splicing shall be by lapping or by

mechanical; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding will not be permitted except as specifically indicated on the drawings. 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. Mechanical splices required for staged construction at closure monoliths shall be an approved threaded coupling, swaged sleeve or other positive connecting type. Materials for couplers, dowel bar splicer or sleeves shall be approved, and per manufacturer's written recommendations, meeting the requirements for ASTM A615, Grade 60. Splicers shall develop in tension at least 125 percent of the yield strength of the lapped reinforcing bars. 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.

3.1.3 Hooks and Bends

Steel bars shall be mill or field-bent. All steel shall be bent cold unless authorized by the COR. No steel bars shall be bent after being partially embedded in concrete unless indicated on the drawings or authorized by the COR.

3.1.4 Welding of reinforcing steel

Welding of reinforcing steel to be welded shall conform to ASTM A 706/A 706M. Reinforced steel welded to structural steel shall be in accordance with AWS D1.4

3.1.5 Placing Tolerances

3.1.5.1 Spacing

The spacing between adjacent bars and the distance between layers of bars may not vary from the indicated position by more than one bar diameter nor more than 1 inch.

3.1.5.2 Concrete Cover

The minimum concrete cover of main reinforcement steel bars shall be as shown on the drawings. The allowable variation for minimum cover shall be as follows:

Minimum Cover	Variation
8"	+1/2"
6"	+1/2"
4"	+3/8"
3"	+3/8"

2"	+1/4"
1-1/2"	+1/4"
1"	+1/8"
3/4"	+1/8"

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 at locations indicated. Dowels shall be accurately positioned and aligned before concrete placement. Dowels shall be rigidly supported during concrete placement.

-- End of Section --

SECTION 03301A

CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS
09/01

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 basic designation only.

ACI INTERNATIONAL (ACI)

ACI 117/117R	(1990; Errata) Standard Tolerances for Concrete Construction and Materials
ACI 207	(1996) Mass Concrete
ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 214	(1977; R 1997) Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 229	(1994) Controlled Low Strength Materials (CLSM)
ACI 303R	(1991) Guide to Cast-in-Place Architectural Concrete Practice
ACI 305R	(1999) Hot Weather Concreting
ACI 318/318R	(1992; Rev 1992; Errata) Building Code Requirements for Reinforced Concrete
ACI 318M/318RM	(1995) Building Code Requirements for Structural Concrete and Commentary (Metric)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31/C 31M	(2000) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1999 ae1) Concrete Aggregates
ASTM C 39/C 39M	(1999) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 40	(1999) Organic Impurities in Fine Aggregates for Concrete
ASTM C 42/C 42M	(1999) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

ASTM C 87	(1983; R 1995e1) Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
ASTM C 94/C 94M	(2000) Ready-Mixed Concrete
ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 123	(1998) Lightweight Particles in Aggregate
ASTM C 127	(1988; R 1993el) Specific Gravity and Absorption of Coarse Aggregate
ASTM C 128	(1997) Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 142	(1978; R 1997) Clay Lumps and Friable Particles in Aggregates
ASTM C 143/C 143M	(2000) Slump of Hydraulic Cement Concrete
ASTM C 150	(1999a) Portland Cement
ASTM C 171	(1997a) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 192/C 192M	(2000) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2000) Air-Entraining Admixtures for Concrete
ASTM C 295	(1998) Petrographic Examination of Aggregates for Concrete
ASTM C 309	(1998a) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 441	(1997e1) Effectiveness of Mineral Admixtures or Ground Blast-Furnace Slag in Preventing Excessive Expansion of Concrete Due to the Alkali-Silica Reaction
ASTM C 494/C 494M	(1999a) Chemical Admixtures for Concrete

ASTM C 535	(1996e1) Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 566	(1997) Total Evaporable Moisture Content of Aggregate by Drying
ASTM C 595	(2000a) Blended Hydraulic Cements
ASTM C 597	(1983; R 1997) Pulse Velocity Through Concrete
ASTM C 618	(2000) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 666	(1997) Resistance of Concrete to Rapid Freezing and Thawing
ASTM C 803/C 803M	(1997e1) Penetration Resistance of Hardened Concrete
ASTM C 805	(1997) Rebound Number of Hardened Concrete
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 989	(1999) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1017/C 1017M	(1998) 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	(1999) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1107	(1999) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1260	(1994) Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM E 1155	(1996) Determining Floor Flatness and Levelness Using the F-Number System
ASTM E 1155M	(1996) Determining Floor Flatness and Levelness Using the F-Number System (Metric)

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 94	(1995) Surface Retarders
COE CRD-C 100	(1975) Method of Sampling Concrete Aggregate and Aggregate Sources, and Selection of Material for Testing
COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 114	(1997) Test Method for Soundness of Aggregates by Freezing and Thawing of Concrete Specimens
COE CRD-C 130	(1989) Scratch Hardness of Coarse Aggregate Particles
COE CRD-C 143	(1962) Specifications for Meters for Automatic Indication of Moisture in Fine Aggregate
COE CRD-C 318	(1979) Cloth, Burlap, Jute (or Kenaf)
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

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(1997) NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1996) Concrete Plant Standards

1.2 MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for work covered under this Section and all costs shall be included in the contract unit or lump sum price for the item of work to which the materials and work is incidental.

1.3 SUBMITTALS

Item numbers within submittal packages shall be clearly identified. Information, including letters, test results, and certifications, shall be presented with headings relevant to this project.

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The

following shall be submitted in accordance with Section, SUBMITTAL PROCEDURES.

SD-08 Statements

Concrete Mixture Proportioning; GA-EC .

Requirements outlined in this paragraph shall be included in one transmittal. Concrete mixture proportions shall be determined by the Contractor, in accordance with the requirements in paragraphs, "MATERIALS" and "CONCRETE MIXTURE PROPORTIONING," and submitted for review. The concrete mixture quantities of all ingredients per cubicyard and nominal maximum coarse aggregate size that will be used in the manufacture of each quality of concrete shall be stated. Statements regarding cementious materials, aggregates, and chemical admixtures shall address all requirements specified. Proportions shall indicate the mass of cement, pozzolan and ground granulated blast-furnace (GGBF) slag, and water; the mass of fine and coarse aggregates in a saturated surface-dry condition; and the quantities of admixtures. The submission shall be accompanied by test reports from a laboratory complying with ASTM C 1077 which show that proportions thus selected will produce concrete of the qualities indicated. No substitution shall be made in the source or type of materials used in the work without additional tests to show that the quality of the new materials and concrete are satisfactory.

Batch Plant; GA-EC .

The Contractor shall submit batch plant data to the Contracting Officer for review for conformance with applicable specifications.

Concrete Mixers; GA-EC .
Capacity; GA-RE.

The Contractor shall submit concrete mixer data which includes the make, type, and capacity of concrete mixers proposed for mixing concrete in conformance with the paragraphs, "CAPACITY" and "CONCRETE MIXERS."

Conveying Equipment and Methods; FIO-EC .

The conveying equipment and methods for transporting, handling, and depositing the concrete shall be submitted for review by the Contracting Officer for conformance with paragraphs, "CAPACITY" and "CONVEYING EQUIPMENT."

Placing Equipment and Methods; FIO-EC .

All placing equipment and methods shall be submitted for review by the Contracting Officer for conformance with paragraph, "CAPACITY."

The previous four submittals (Batch Plant, Concrete Mixers, Conveying Equipment, and Placing Equipment) shall be submitted in a single packet.

Testing Technicians; FIO-EC . Concrete Transportation Construction Inspector (CTCI); FIO-RE.

The Contractor shall submit statements that the concrete testing technicians and the concrete inspectors meet the requirements of paragraph, "TESTS AND INSPECTIONS."

Construction Joint Treatment; GA-EC .

The method and equipment proposed for joint cleanup and waste disposal shall be submitted for review and approval for conformance with paragraph, "CONSTRUCTION JOINT TREATMENT."

Curing and Protection; GA-EC .

The curing medium and methods to be used shall be submitted for review and approval for conformance with paragraph, "CURING AND PROTECTION."

Cold-Weather Placing; GA-EC .

If concrete is to be placed under cold-weather conditions, the proposed materials, methods, and protection meeting the requirements of paragraph, "COLD-WEATHER PLACING" shall be submitted for approval.

Hot-Weather Placing; GA-EC .

If concrete is to be placed under hot-weather conditions, the proposed materials and methods, meeting the requirements of paragraph, "HOT-WEATHER PLACING" and paragraph, "FINISHING," shall be submitted for review and approval.

The previous four submittals (Construction Joint Treatment, Curing and Protection, Cold-Weather Placing, and Hot-Weather Placing) shall be submitted in a single packet.

SD-09 Reports

Aggregate Quality; GA-EC .

Aggregate quality tests shall be submitted at least 30 days prior to start of concrete placement, in accordance with paragraph, "QUALITY OF AGGREGATES."

Uniformity of Concrete Mixing; GA-EC .

The results of the initial mixer uniformity tests as required in paragraph, "MIXER UNIFORMITY" shall be submitted at least 5 days prior to the initiation of placing.

Tests and Inspections; GA-EC .

Test results and inspection reports shall be submitted daily and weekly as required in paragraph, "REPORTS."

SD-13 Certificates

All certificates shall be submitted in a single packet.

Cementitious Materials; GA-EC

Cementitious Materials, including Cement and Pozzolan, and Ground Granulated Blast-Furnace Slag will be accepted on the basis of the manufacturer's certification of compliance, accompanied by mill test reports that materials meet the requirements of the specification under which they are furnished. Certification and

mill test reports shall be from samples taken from the particular lot furnished. No cementitious materials shall be used until notice of acceptance has been given by the Contracting Officer. Cementitious materials will be subject to check testing from samples obtained at the source, at transfer points, or at the project site, as scheduled by the Contracting Officer, and such sampling will be by or under the supervision of the Government at its expense. Material not meeting specifications shall be promptly removed from the site of work.

Impervious-Sheet Curing Materials; GA-EC

Impervious-Sheet Curing Materials shall be certified for compliance with all specification requirements.

Air-Entraining Admixture; GA-EC

Air-Entraining Admixture shall be certified for compliance with all specification requirements.

Other Chemical Admixtures; GA-EC

Other Chemical Admixtures shall be certified for compliance with all specification requirements.

Membrane-Forming Curing Compound; GA-EC

Membrane-Forming Curing Compound shall be certified for compliance with all specification requirements.

Epoxy Resin; GA-EC

Epoxy Resin Bonding Compound shall be certified for compliance with all specification requirements.

Nonshrink Grout; GA-EC .

Descriptive literature of the Nonshrink Grout proposed for use shall be furnished together with a certificate from the manufacturer stating that it is suitable for the application or exposure for which it is being considered.

SD-14 Samples

Aggregates; GA-EC .

Samples of materials for government testing and approval shall be submitted as required in paragraph, "PRECONSTRUCTION SAMPLING AND TESTING."

1.4 GOVERNMENT TESTING AND SAMPLING

The Government will sample and test aggregates and concrete to determine compliance with the specifications. 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. Concrete will be sampled in accordance with ASTM C 172.

1.4.1 Preconstruction Sampling and Testing

1.4.1.1 Aggregates

The aggregate sources listed at the end of this section for aggregates have been previously tested and at the time testing was performed were capable of producing materials of a quality required for this project provided suitable processing is performed. The Contractor may furnish materials from a listed source or from a source not listed. Coarse ggregates shall be produced from Burlington Limestone. Samples from any source of coarse aggregate and any source of fine aggregate selected by the Contractor, consisting of not less than 2000 pounds of each size coarse aggregate and 1500 pounds of fine aggregate taken under the supervision of the Contracting Officer in accordance with COE CRD-C 100 shall be delivered to the Corps of Engineer's Quality Control Labratory within 15 days after notice to proceed. (Unless otherwise directed, send the samples to the Corps Quality Control Labratory, located at 3909 Halls Ferry Road, Vicksburg, MS, 39180-6199, attention CEERD-GM-C. Telephone No. 601-634-3278). Sampling and shipment of samples shall be at the Contractor's expense. 90 days will be required to complete evaluation of the aggregates. Testing will be performed by and at the expense of the Government in accordance with the applicable COE CRD-C or ASTM test methods. The cost of testing one source for each size of aggregate will be borne by the Government. If the Contractor selects more than one source for each aggregate size or selects a substitute source for any size aggregate after the original source was tested, the cost of that additional testing will be borne by the Contractor. Tests to which aggregate may be subjected are listed in paragraph QUALITY. The material from the proposed source shall meet the quality requirements of this paragraph. Testing of aggregates by the Government does not relieve the Contractor of the requirements outlined in paragraph TESTS AND INSPECTIONS.

1.4.2 Construction Testing by the Government

Sampling and testing will be performed by and at the expense of the Government except as otherwise specified. No material shall be used until notice has been given by the Contracting Officer that test results are satisfactory.

1.4.2.1 Chemical Admixtures Storage

Chemical admixtures that have been in storage at the project site for longer than 6 months or that have been subjected to freezing shall be retested at the expense of the Contractor when directed by the Contracting Officer and shall be rejected if test results are not satisfactory. Chemical admixtures will be accepted based on compliance with the requirements of paragraph, "CHEMICAL ADMIXTURES."

1.4.2.2 Concrete Strength

Compressive strength test specimens will be made by the Government and cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39. 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 than500 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 nondestructive testing, 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.

a. Investigation of Low-Strength Test Results - When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than500 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. Nondestructive testing in accordance with ASTM C 597, ASTM C 803, or ASTM C 805 may be permitted by the Contracting Officer to estimate the relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests shall not be used as a basis for acceptance or rejection.

b. Testing of Cores - When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. 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 Contracting Officer to least impair the performance 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.

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 318/318R. Concrete work evaluated by structural analysis or by results of a load test shall be corrected in a manner satisfactory to the Contacting Officer. All investigations, testing, load tests, and correction of deficiencies will be performed and approved by the Contracting Officer at the expense of the Contractor, except that if all concrete is in compliance with the plans and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

1.5 DESIGN REQUIREMENTS

1.5.1 Concrete Strength

Specified compressive strength f'c shall be as follows:

COMPRESSIVE STRENGTH (PSI)	STRUCTURE OR PORTION OF STRUCTURE
4,000 @ 7 days	Pile cap at Q1 and Q3
4,000 @ 28 days	Remaining structures not listed above

1.5.2 Maximum Water-Cement (W/C) Ratio

Maximum W/C shall be 0.45 by mass. The W/C ratio may cause higher

strengths than that required by paragraph "Concrete Strength" of this section.

1.6 CONSTRUCTION TOLERANCES

1.6.1 General

The definitions of the terms used in the following tables shall be as defined in 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. Tolerances are not cumulative. The most restrictive tolerance controls. Tolerances shall not extend the structure beyond legal boundaries. Except as specified otherwise, plus tolerance increases the amount or dimension to which it applies, or raises a level alignment, and minus tolerance decreases the amount or dimension to which it applied, or lowers a level alignment. A tolerance without sign means plus or minus. Where only one signed tolerance is specified, there is no limit in the other direction. The application of the tolerances shall not be allowed to result in a reduction in the mininum required concrete clear cover over reinforcement or other metal embedment.

TOLERANCES FOR STRUCTURES (Includes Gatewells)

(1) Vertical alignment

For heights 100 feet or less

Lines, surfaces, and arrises..... 1 in

Outside corner of exposed corner columns and control joint grooves in concrete exposed. to view ..... 1/2 in

Sealing surfaces ..... 1/16 in

(2) Lateral alignment

In slabs, centerline location of openings 12 inches or smaller and edge location of larger openings ..... 1/2 in

Sawcuts, joints, and weakened plane embedment in slabs ..... 3/4 in

Sealing surfaces ..... 1/16 in

(3) Level alignment
Top of slabs

Elevation of slabs-on-grade ..... 3/4 in

Lintels, parapets, horizontal grooves, and other

lines exposed to view ..... 1/2 in

Sealing surfaces of sills and postwells.....1/16 in

(4) Cross-sectional dimensions
Members, such as abutments, postwells, pedestals, walls (thickness only), and slabs (thickness only)

12-in. dimension or less ..... +3/8 in
..... -1/4 in
More than 12 in. but not over 3 ft. dimension .... +1/2 in
..... -3/8 in
Over 3 ft. dimension ..... +1 in
..... -3/4 in
Dimensions of unformed members cast against soil
..... +3 in
..... -1/2 in

(5) Deviations from a planar surface measured with a 10-foot straight edge placed on high points:

General ..... 3/8 in
Sealing surface ..... 1/16 in

(6) The offset between adjacent pieces of formwork facing material shall not exceed:

Class A ..... 1/8 in
Class B ..... 1/4 in
Class C ..... 1/2 in
Class D ..... 1 in

TOLERANCES FOR TUNNEL LININGS, CONDUITS, PRECAST CONCRETE PIPE, FILLING AND EMPTYING CULVERTS AND INLET AND OUTLET STRUCTURES

(1) Lateral alignment

Centerline alignment

Water conveying, conduits, and culverts ..... 1/2 in

Others ..... 1 in

Inside dimensions ..... 0.005 times inside dimension

(2) Level alignment

Profile grade

Water conveying , conduits, and culverts 1/2in

Others ..... 1 in

Surface of invert ..... 1/4 in

Surface of side slope ..... 1/2 in

(3) Cross-sectional dimension

Thickness at any point

Conduits ..... +5 percent thickness but not less than 1/2 in.
..... -2.5 percent thickness but not less than 1/4 in.

1.6.2 Slabs on grade

Tolerances for finished surfaces of slabs on grade shall conform to the requirements specified herein, and in SECTION 02754 - CONCRETE PAVEMENTS FOR SMALL PROJECTS. The stricter tolerance requirement shall be used. Measurements shall be accomplished along the alignment of each paving direction (slabs on grade) for gates, railroad crossings, and street pavements. The measurements in the transverse direction shall be accomplished at slab joints and at 5-foot intervals along the alignment. Measurements in the longitudinal direction shall be accomplished continuously along the alignment at the centerline and edges of each paving lane or row of slabs. Measurements shall be accomplished across joints in slabs on grade to determine gradual and abrupt variations in surface elevations across joints.

1.6.3 Appearance

Permanently exposed surfaces shall be cleaned, if stained or otherwise discolored, by a method that does not harm the concrete and that is approved by the Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Cementitious Materials

Cementitious materials shall be portland cement, portland cement in combination with pozzolan or GGBF slag and shall conform to appropriate specifications listed below. Use of cementitious materials in architectural concrete shall be restricted to one color, one source, and one type.

2.1.1.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type I or II, except that the maximum amount of C3A in Type I cement shall be limited to a maximum of 15 percent, Type I and II shall meet the low alkali requirement. The same

types and source of Portland cement shall be used throughout the entire project. White Portland cement shall meet the above requirements, and may only be used when specifically approved in writing.

2.1.1.2 High-Early-Strength Portland Cement

ASTM C 150, Type III, with C3A limited to 8 percent, meeting the low alkali requirement may be used only when specifically approved in writing.

2.1.1.3 Pozzolan, Other than Silica Fume

Pozzolan shall conform to ASTM C 618, Class C or F, Tables 1 and 3, including the Supplementry Optional Chemical Requirements in Table 2 for available alkalies, and the Supplementary Optional Physical Reqirements in Table 4.

2.1.1.4 Ground Granulated Blast-Furnace Slag

Ground Granulated Blast-Furnace Slag shall conform to ASTM C 989, Grade 100 or 120.

2.1.2 Aggregates

2.1.2.1 General

Concrete aggregates may be furnished from any source capable of meeting the quality requirements as stated in paragraph QUALITY. Coarse aggregates shall be produced from Burlington limestone. The sources listed at the end of this section were previously evaluated and were found at that time capable of meeting the quality requirements when suitably processed. No guarantee is given or implied that any of the listed sources are currently capable of producing aggregates that meet the required quality stated in paragraph QUALITY. Fine and coarse aggregates shall conform to the grading requirements of ASTM C 33. The nominal maximum size shall be as listed in paragraph NOMINAL MAXIMUM-SIZE COARSE AGGREGATE.

In addition to the grading limits in ASTM C 33, the fine aggregate, as delivered to the mixer shall have a fineness modulus of not less than 2.40 nor greater than 3.10. The grading of the fine aggregate shall also be controlled so that the fineness moduli of at least four of any five consecutive test samples of the fine aggregate as delivered to the mixer shall not vary more than 0.15 from the average fineness modulus of all samples taken during the first 30 days of concrete placement unless otherwise directed. The fineness modulus shall be determined by dividing by 100, the sum of the cumulative percentages retained on U.S. Standard Sieves Nos. 4, 8, 16, 30, 50, and 100. At the option of the Contractor, fine aggregate may be separated into two or more sizes or classifications, but the uniformity of grading of the separate sizes shall be controlled so that they may be combined throughout the job in fixed proportions established during the first 30 days of concrete placement.

2.1.2.2 Concrete Aggregate Sources

After the award of the contract, the Contractor shall designate in writing only one source or combination of sources from which he proposes to furnish

aggregates. If the Contractor proposes to furnish aggregates from a source or from sources not listed at the end of this section, he may designate only a single source or single combination of sources for aggregates. Regardless of the source, selected samples for acceptance testing shall be provided as required by paragraph GOVERNMENT TESTING AND SAMPLING. If a source for coarse or fine aggregates so designated by the Contractor does not meet the quality requirements stated in paragraph QUALITY, the Contractor may not submit for approval other non-listed sources but shall furnish the coarse or fine aggregate, as the case may be, from sources listed at the end of this section at no additional cost to the Government.

2.1.2.3 Quality

Fine aggregates shall conform to the aggregate quality requirements of ASTM C 33, except as modified herein. Coarse aggregates shall conform to the aggregate quality requirements of ASTM C 33, Class 5S, except as modified herein. Aggregate particles shall be sound and durable and free from objectionable coatings. Coarse agggregate shall not contain more than 0.5 percent by weight of white tripolitic chert that has a specific gravity, saturated surface dry, of less than 2.40. Tripolitic chert is the white porous siliceous form of weathered chert found in nodules and beds within some Burlington limestone sources. The total amount of all types of chert shall not exceed 3 percent by weight. To keep chert from exceeding these specified maximum limits, it may be necessary to employ selective quarrying to utilize the lesser cherty portions of the limestone deposit and to remove cherty particles by processing, loading, and handpicking from the quarried material before and during final processing into finished aggregate sizes.

Aggregates shall have a specific gravity, saturated surface dry of not less than 2.60, and an absorption of not more than 2.0 percent, as determined by ASTM C 127and ASTM C 128. The aggregates shall be tested in accordance with ASTM C 1260 and shall have an expansion of lesss than 0.1 percent at 16 days.

In addition, aggregates delivered to the mixer shall meet the following requirements:

PROPERTY TEST	TEST LIMITS FINE AGGREGATE	TEST LIMITS COARSE AGGREGATE	
Durability Factor using (Procedure A)	Greater than 50	Greater than 50	COE CRD-C 114 ASTM C 666
Clay Lumps and Friable Particles	1	2	ASTM C 142
Material Finer than 75-µm (No. 200) Sieve	3	1	ASTM C 117
Organic Impurities	Not darker than No. 3		ASTM C 40
	Not less than 95 percent		ASTM C 87
Test Limits L.A. Abrasion		40	ASTM C 131 ASTM C 535

PROPERTY	TEST LIMITS FINE AGGREGATE	TEST LIMITS COARSE AGGREGATE	TEST
Total Lignite	0.1		ASTM C 123
Total Chert, than less 2.40 specific gravity		0.5	ASTM C 123

PROPERTY TEST	TEST LIMITS FINE AGGREGATE	COARSE AGGREGATE	
Coal and Lignite, less than 2.00 specific gravity	0.25	0.25	ASTM C 123
Petrographic Examination	Presence and types of Chert, Coal, Lignite, Shale and Alkali-Silica reactive aggregates		ASTM C 295

2.1.2.4 Particle Shape

The shape of the particles in the fine aggregate and in the coarse aggregate shall be generally spherical or cubical. The quantity of flat and elongated particles in the separated size groups of coarse aggregate, as defined and determined by CE specification CRD-C 119 shall not exceed 25 precent in any size group.

2.1.3 Chemical Admixtures

Chemical admixtures to be used, when required or permitted, shall conform to the appropriate specification listed.

2.1.3.1 Air-Entraining Admixture

The air-entraining admixture shall conform to ASTM C 260 and shall consistently cause the concrete to have an air content in the specified ranges under field conditions.

2.1.3.2 Accelerating Admixture

Accelerators shall meet the requirements of ASTM C 494/C 494M, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

2.1.3.3 Water-Reducing or Retarding Admixture

a. Water-Reducing or Retarding Admixtures: ASTM C 494/C 494M, Type A, B, or D, except that the 6-month and 1-year compressive strength tests are waived.

b. High-Range Water Reducing Admixture: ASTM C 494/C 494M, Type F or G except that the 6-month and 1-year strength requirements shall be waived. The admixture may be used only when approved by the Contracting Officer, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan.

2.1.3.4 Other Chemical Admixtures

Other chemical admixtures for use in producing flowing concrete shall comply with ASTM C 1017/C 1017M, Type 1 or 2. These admixture shall be used only for concrete listed in paragraph SLUMP.

2.1.4 Curing Materials

2.1.4.1 Impervious-Sheet Curing Materials

Impervious-sheet curing materials shall conform to ASTM C 171, type optional, except polyethylene film shall not be used.

2.1.4.2 Membrane-Forming Curing Compound

The membrane-forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except 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 flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, coating, or flooring specified. Nonpigmented compound shall contain a fugitive dye and shall have the reflective requirements in ASTM C 309 waived.

2.1.4.3 Burlap

Burlap used for curing shall conform to COE CRD-C 318.

2.1.5 Water

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, alkali, or organic compounds, except that nonpotable water may be used if it meets the requirements of COE CRD-C 400.

2.1.6 Nonshrink Grout

Nonshrink grout shall conform to ASTM C 1107 and shall be a commercial formulation suitable for the application proposed.

2.1.7 Epoxy Resin

Epoxy resin for use in repairs shall conform to ASTM C 881, Type III, Grade I or II.

2.2 CONCRETE MIXTURE PROPORTIONING

2.2.1 Quality of Mixture

For each portion of the structure, mixture proportions shall be selected so that the strength and W/C requirements listed in paragraph DESIGN REQUIREMENTS are met.

2.2.2 Cement Content

Cement Content shall be measured by weight. Cement content per cubic yard of concrete shall be 564 pounds, minimum.

2.2.3 Aggregate

The aggregate portion of the concrete mixtures shall contain at least 50 percent crushed Burlington limestone coarse aggregate.

2.2.4 Nominal Maximum-Size Coarse Aggregate

Nominal maximum-size coarse aggregate shall be 3/4 inch. .

2.2.5 Air Content

Air content as delivered to the forms and as determined by ASTM C 231 shall be between between 4-1/2 and 7-1/2 percent.

2.2.6 Slump

The slump shall be determined in accordance with ASTM C 143/C 143M and shall be within the range of 1 to 4 inch. Where placement by pump is approved, the slump shall not exceed 6 inches. The slump of pumped concrete shall be determined at the discharge side of the pump. Controlled Low Strength Material (CLSM) may contain a chemical admixture for use in producing a flowable concrete mixture in accordance with ASTM C 1017/C 1017M. The slump of flowable concrete shall not exceed 8-inches.

2.2.7 Concrete Proportioning

Trial batches and testing requirements for various qualities of concrete specified shall be the responsibility of the Contractor. Samples of aggregates shall be obtained in accordance with the requirements of ASTM D 75. Samples of materials other than aggregate shall be representative of those proposed for the project and shall be accompanied by the manufacturer's test reports indicating compliance with applicable specified requirements. 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, which will produce a range of strength encompassing those required for the work. The maximum water-cement ratios required in paragraph MAXIMUM WATER-CEMENT RATIO will be converted to a weight ratio of water to cement plus pozzolan by mass, or GGBF slag by mass equivalency as described in ACI 211.1. In the case where GGBF slag is used, the weight of the slag shall be included in the equations for the term P, which is used to denote the mass of pozzolan. If pozzolan (Fly Ash)is used in the concrete mixture, the pozzolan content shall be 20 percent of the total cementitious material. Trial mixtures shall be proportioned for maximum permitted slump and air content with due consideration to the approved conveying and placement method. 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 days and at the design age specified in paragraph DESIGN REQUIREMENTS in accordance with ASTM C 39/C 39M. From these test results, a curve will be plotted showing the relationship between water-cement ratio and strength.

2.2.8 Required Average Compressive Strength

In meeting the strength requirements specified in paragraph CONCRETE STRENGTH, the selected mixture proportion shall produce a required average compressive strength f'cr exceeding the specified strength f'c by the amount indicated below.

2.2.8.1 Average Compressive Strength 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. 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 or at another test age designated for determination of f'c.

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:

$$f'cr = f'c + 1.34S$$
$$f'cr = f'c + 2.33S - 500$$

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
less than 15	Use tabulation in paragraph DETERMINING REQUIRED AVERAGE STRENGTH
15	1.16
20	1.08
25	1.03
30 or more	1.00

*Interpolate for intermediate numbers of tests.

2.2.8.2 Average Compressive Strength 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 fcr shall be determined as follows:

If the specified compressive strength f'c is less than 3,000 psi,

$$f'cr = f'c + 1{,}000 \text{ psi}$$

If the specified compressive strength f'c is 3,000 to 5,000 psi,

$$f'cr = f'c + 1{,}200 \text{ psi}$$

If the specified compressive strength f'c is over 5,000 psi,

$$f'cr = f'c + 1{,}400 \text{ psi}$$

PART 3 EXECUTION

3.1 EQUIPMENT

3.1.1 Capacity

The batching, mixing, conveying, and placing equipment shall have a capacity of at least 40 cubic yards per hour.

3.1.2 Batch Plant

Batch plant shall conform to the requirements of NRMCA CPMB 100and as specified; however, rating plates attached to batch plant equipment are not required. The batch plant may be located on or off the project site.

3.1.2.1 Batching Equipment

The batching controls shall be semiautomatic or automatic. The semiautomatic batching system shall be provided with interlocks such that the discharge device cannot be actuated until the indicated material is within the applicable tolerance. The batching system shall be equipped with an accurate recorder or recorders that meet the requirements of NRMCA CPMB 100. Separate bins or compartments shall be provided for each size group of aggregate and cement, pozzolan, and GGBF slag. Aggregates shall be weighed either in separate weigh batchers with individual scales or cumulatively in one weigh batcher on one scale. Aggregate shall not be weighed in the same batcher with cement, pozzolan, or GGBF slag. If both cement and pozzolan or GGBF slag are used, they may be batched cumulatively provided that the portland cement is batched first. If measured by mass, the mass of the water shall not be weighed cumulatively with another ingredient. Water batcher filling and discharging valves shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. An accurate mechanical device for measuring and dispensing each admixture shall be provided. Each dispenser shall be interlocked with the batching and discharging operation of the water so that each admixture is separately batched and discharged automatically in a manner to obtain uniform distribution throughout the batch in the specified mixing period. Admixtures shall not be combined prior to introduction in water. The plant shall be arranged so as to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of aggregates from each bin or compartment. All filling ports for cementitious materials bins or silos shall be clearly marked with a permanent sign stating the contents.

3.1.2.2 Scales

The equipment for batching by mass shall conform to the applicable requirements of NIST HB 44, except that the accuracy shall be plus or minus 0.2 percent of scale capacity. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring devices. Tests shall be made at the frequency required in paragraph TESTS AND INSPECTIONS, and in the presence of a government inspector.

3.1.2.3 Batching Tolerances

a. Weighing Tolerances

MATERIAL	PERCENT OF REQUIRED MASS
Cementitious materials	0 to plus 2
Aggregate	plus or minus 2

MATERIAL	PERCENT OF REQUIRED MASS
Water	plus or minus 1
Chemical admixture	0 to plus 6

b. Volumetric Tolerances - For volumetric batching equipment, the following tolerances shall apply to the required volume of material being batched:

Water: ..... Plus or minus 1 percent.
Chemical admixtures: ..... Zero to plus 6 percent.

3.1.2.4 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the masses of the materials being batched. An electric moisture meter complying with the provisions of COE CRD-C 143 shall be provided for measuring moisture in the fine aggregate. The sensing element shall be arranged so that the measurement is made near the batcher charging gate of the sand bin or in the sand batcher.

3.1.3 Concrete Mixers

The concrete mixers shall not be charged in excess of the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired.

3.1.3.1 Stationary Mixers

Concrete plant mixers shall be tilting, nontilting, horizontal-shaft, vertical-shaft, or pugmill and shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. The mixing time and uniformity shall conform to all the requirements in ASTM C 94/C 94M applicable to central-mixed concrete.

3.1.3.2 Truck Mixers

Truck mixers, the mixing of concrete therein, and concrete uniformity shall conform to the requirements of ASTM C 94/C 94M. A truck mixer may be used either for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer (shrink-mixed). Each truck shall be equipped with two counters from which it will be possible to determine the number of revolutions at mixing speed and the number of revolutions at agitating speed.

3.1.4 Conveying Equipment

The conveying equipment shall conform to the following requirements.

3.1.4.1 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 five 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.

3.1.4.2 Transfer Hoppers

Concrete may be charged into nonagitating hoppers for transfer to other conveying devices. Transfer hoppers shall be capable of receiving concrete directly from delivery vehicles and have conical-shaped discharge features. The transfer hopper shall be equipped with a hydraulically operated gate and with a means of external vibration to effect complete discharge. Concrete shall not be held in nonagitating transfer hoppers more than 30 minutes.

3.1.4.3 Trucks

Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94/C 94M. Nonagitating equipment may be used for transporting plant-mixed concrete over a smooth road when the hauling time is less than 15 minutes. Bodies of nonagitating equipment shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

3.1.4.4 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

3.1.4.5 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 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 trunk that is long enough to extend through the reinforcing bars.

3.1.4.6 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least three 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.

3.1.5 Vibrators

Vibrators of the proper size, frequency, and amplitude shall be used for the type of work being performed in conformance with the following requirements:

APPLICATION	HEAD DIAMETER INCHES	FREQUENCY VPM	AMPLITUDE INCHES
Thin walls, beams, etc.	1-1/4 to 2-1/2	9,000 to 13,500	0.02 to 0.04
General construction	2 to 3-1/2	8,000 to 12,000	0.025 to 0.05

The frequency and amplitude shall be determined in accordance with COE CRD-C 521.

3.2 PREPARATION FOR PLACING

3.2.1 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. Embedded items shall be 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. Welding, including tack welding, will not be permitted on embedded metals within 2 feet of the surface of the concrete.

3.2.2 Concrete on Earth Foundations

Earth 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 earth foundation shall have been satisfactorily compacted in accordance with Section 02331 - EARTHWORK.

3.2.3 Concrete on Rock Foundations

Rock surfaces upon which concrete is to be placed shall be clean, 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, all rock surfaces shall be cleaned thoroughly by the use of air-water jets or sandblasting as described in paragraph CONSTRUCTION JOINT TREATMENT. All rock surfaces shall be kept continuously wet for at least 24 hours immediately prior to placing concrete thereon. All 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. The mortar shall be covered with concrete before the time of initial setting of the mortar.

3.2.4 Construction Joint Treatment

Construction joint treatment shall conform to the following requirements.

3.2.4.1 Joint Preparation

Concrete surfaces to which additional concrete is to be bonded shall be prepared for receiving the next lift or adjacent concrete by cleaning with either air-water cutting, sandblasting, high-pressure water jet, or other approved method. Air-water cutting will not be permitted on formed surfaces or surfaces congested with reinforcing steel. Regardless of the method used, the resulting surfaces shall be free from all laitance and inferior concrete so that clean, well bonded coarse aggregate is exposed uniformly throughout the lift surface. The edges of the coarse aggregate shall not be undercut. The surface shall be washed clean again as the last operation prior to placing the next lift. There shall be no standing water on the surface upon which concrete is placed.

3.2.4.2 Air-Water Cutting

Air-water cutting of a construction joint shall be performed at the proper time and only on horizontal construction joints. The air pressure used in the jet shall be 90 to 110 psi, and the water pressure shall be just sufficient to bring the water into effective influence of the air pressure. When approved by the Contracting Officer, a retarder complying with the requirements of COE CRD-C 94 may be applied to the surface of the lift to prolong the period of time during which air-water cutting is effective. Prior to receiving approval, the Contractor shall furnish samples of the material to be used and shall demonstrate the method to be used in applications. After cutting, the surface shall be washed and rinsed as long as there is any trace of cloudiness of the wash water. Where necessary to remove accumulated laitance, coatings, stains, debris, and other foreign material, high-pressure water jet or sandblasting will be required as the last operation before placing the next lift.

3.2.4.3 High-Pressure Water Jet

A stream of water, under a pressure of not less than 3,000 psi, may be used for cleaning. Its use shall be delayed until the concrete is sufficiently hard so that only the surface skin or mortar is removed and there is no undercutting of coarse-aggregate particles. If the water jet is incapable of a satisfactory cleaning, the surface shall be cleaned by sandblasting.

3.2.4.4 Wet Sandblasting

This method may be used when the concrete has reached sufficient strength to prevent undercutting of the coarse aggregate particles. The surface of the concrete shall then be washed thoroughly to remove all loose materials.

3.2.4.5 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.

3.3 PLACING

3.3.1 Placing Procedures

The surfaces of horizontal construction joints shall be kept continuously wet for the first 12 hours during the 24-hour period prior to placing

concrete. Surfaces may be dampened immediately before placement if necessary. Concrete placement will not be permitted when, in the opinion of the Contracting Officer, weather conditions prevent proper placement and consolidation. Concrete shall be deposited as close as possible to its final position in the forms and, in so depositing, 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 may be effectively consolidated in horizontal layers 2.0 feet or less in thickness with a minimum of lateral movement. The amount deposited in each location shall be that which can be readily and thoroughly consolidated. Sufficient placing capacity shall be provided so that concrete placement can be kept plastic and free of cold joints while concrete is being placed. Concrete shall be placed by methods that will prevent segregation or loss of ingredients. Any concrete transferred from one conveying device to another shall be passed through a hopper that is conical in shape. The concrete shall not be dropped vertically more than 5 feet, except where a properly designed and sized elephant truck with rigid drop chute bottom section is provided to prevent segregation and where specifically authorized. In no case will concrete be discharged to free-fall through reinforcing bars.

3.3.2 Placement by Pump

When concrete is to be placed by pump, the nominal maximum-size coarse aggregate shall not be reduced to accommodate the pumps. The distance to be pumped shall not exceed limits recommended by the pump manufacturer. The concrete shall be supplied to the concrete pump continuously. When pumping is completed, concrete remaining in the pipeline shall be ejected without contamination of concrete in place. After each operation, equipment shall be thoroughly cleaned, and flushing water shall be wasted outside of the forms. Grout used to lubricate the pumping equipment at the beginning of the placement will not be incorporated into the placement.

3.3.3 Time Interval Between Mixing and Placing

Concrete shall be placed within 30 minutes after discharge into nonagitating equipment. When concrete is truck-mixed or when a truck mixer or agitator is used for transporting concrete mixed by a concrete plant mixer, the concrete shall be delivered to the site of the work, and discharge shall be completed within 1-1/2 hours after introduction of the cement to the aggregates. When the length of haul makes it impossible to deliver truck-mixed concrete within these time limits, batching of cement and a portion of the mixing water shall be delayed until the truck mixer is at or near the construction site.

3.3.4 Cold-Weather Placing

When cold-weather placing of concrete is likely to be subjected to freezing temperatures before the expiration of the curing period, it shall be placed in accordance with procedures previously submitted in accordance with paragraph SUBMITTALS. The ambient temperature of the space adjacent to the concrete placement and surfaces to receive concrete shall be above 32 degrees F. The placing temperature of the concrete having a minimum dimension less than 12 inches shall be between 55 and 75 degrees F when measured in accordance with ASTM C 1064/C 1064M. The placing temperature of the concrete having a minimum dimension greater than 12 inches shall be between 50 and 70 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete-placing temperatures. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt,

chemicals, or other materials shall not be mixed with the concrete to prevent freezing. Concrete placements with a least dimension of 2.5 feet shall be protected from damaging thermal gradients and temperature conditions as recommended in ACI 207, except as otherwise specified or directed.

3.3.5 Hot-Weather Placing

Concrete shall be properly placed and finished with procedures previously submitted in accordance with paragraph SUBMITTALS. The concrete-placing temperature shall not exceed 85 degrees F when measured in accordance with ASTM C 1064/C 1064M. Cooling of the mixing water and aggregates, or both, may be required to obtain an adequate placing temperature. A retarder meeting the requirements of paragraph WATER-REDUCING OR RETARDING ADMIXTURES may be used to facilitate placing and finishing. Steel forms and reinforcement shall be cooled 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. Concrete palcements with a least dimension of 2.5 feet shall be protected from damaging thermal gradients and temperature conditions as recommended in ACI 207, except as otherwise specified or directed.

3.3.5.1 Large Placements

The concrete placing temperature, for placements with a least dimension of 2.5 feet shall be less than 70 degrees F. The temperature determination shall be made in the freshly placed concrete. Shaved ice may be used to replace a portion of the mixing water requirement on a direct weight substitution basis. Liquid nitrogen injection in the mixer may also be used. Methods of temperature control proposed for use in hot weather concreting shall be submitted for approval.

3.3.6 Consolidation

Immediately after placement, each layer of concrete, including Controlled Low Strength Material (CLSM) and flowable fill concrete, shall be consolidated by internal vibrating equipment. Vibrators shall not be used to transport concrete within the forms. Hand spading may be required, if necessary, with internal vibrating along formed surfaces permanently exposed to view. Form or surface vibrators shall not be used unless specifically approved. The vibrator shall be inserted vertically at uniform spacing over the entire area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding unhardened layer if such exists. It shall be held stationary until the concrete is consolidated and then withdrawn slowly.

3.3.7 Placing Concrete Underwater

Concrete, used to seal the concrete caisions and other placements required in water, shall be deposited in water by a tremie or concrete pump. The methods and equipment used shall be subject to approval. Concrete buckets will not be permitted for underwater placement of concrete except to deliver concrete to the tremie. The tremie shall be watertight and sufficiently large to permit a free flow of concrete. The discharge end of the pump line or tremie shaft shall be kept continuously submerged in the concrete. The underwater seal shall be effected in a manner that will not

produce undue turbulence in the water. The tremie shaft shall be kept full of concrete to a point well above the water surface. Placement shall proceed without interruption until the concrete has been brought to the required height. The tremie shall not be moved horizontally during a placing operation, and a sufficient number of tremies shall be provided so that the maximum horizontal flow will be limited to 15 feet.

3.4 FINISHING

The ambient temperature of spaces adjacent to surfaces being finished shall be not less than 40 degrees F. In hot weather when the rate of evaporation of surface moisture, as determined by use of Figure 2.1.5 of ACI 305R, may reasonably be expected to exceed 0.2 pounds per square foot per hour. Provisions for windbreaks, shading, fog spraying, or wet covering with a light-colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as finishing operations will allow. All unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish. Additional finishing shall be as specified below and shall be true to the elevation shown in the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings and left true and regular. Exterior surfaces shall be sloped for drainage unless otherwise shown in the drawing or as directed. 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.

3.4.1 Unformed Surfaces

3.4.1.1 Float Finish

All unformed surfaces shall be screeded and darbied or bullfloated to bring the surface to the required finish level with no coarse aggregate visible. No water, cement, or mortar shall be added to the surface during the finishing operation. The concrete, while still green but sufficiently hardened to bear a man's weight without deep imprint, shall be floated to a true and even plane. Floating may be performed by use of suitable hand floats or power-driven equipment. Hand floats shall be made of magnesium or aluminum.

3.4.1.2 Trowel Finish

A trowl finish shall be applied to unformed surfaces where indicated. Concrete surfaces shall be finished with a float finish, and after surface moisture has disappeared, the surface shall be troweled to a smooth, even, dense finish free from blemishes including trowel marks.

3.4.1.3 Broom Finish

A broom finish shall be applied as the final surface texturing for slabs on grade which will be subject to vehicle or pedestrian traffic. The concrete surface shall be given a float finish. The floated surface shall be broomed with a fiber-bristle brush in a direction transverse to that of the main traffic

3.4.2 Formed Surfaces

Unless another finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired as

described in paragraph FORMED SURFACE REPAIR. 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 is exposed to view or on which a special finish is required. The form panels used to produce the finish shall be orderly in arrangement, with joints between panels planned in approved relation to openings, building corners, and other architectural features. The finished surface of textured, tooled, and other archetectural finishes shall duplicate the preapproved sample panel. The sample panel shall be prepared in accordance with Section 03101 FORMWORK FOR CONCRETE. Forms shall not be reused if there is any evidence of surface wear or defects that would impair the quality of the surface.

3.4.2.1 Textured Finish

Textured finish shall be applied where specified or indicated, unless otherwise directed. This type of finish shall be applied where specified to conform to details shown in the drawings by use of approved textured form liners. Liner panels shall be secured in the forms by methods recommended by the manufacturer but not by methods that will permit impressions of nail heads, screw heads, washers, or the like to be imparted to the surface of the concrete. Edges of textured panels shall be sealed to each other to prevent grout leakage. The sealant used shall be nonstaining to the surface. The finish shall be similar to and shall closely match the finish on the sample panel.

3.4.2.2 Tooled Finish

Tooled finish shall be applied where specified or indicated, unless otherwise directed. The thoroughly cured concrete shall be dressed with electric, air, or hand tools to a uniform texture and shall be given a hand-tooled surface texture. The finish shall be similar to and shall closely match the finish on the sample panel.

3.4.3 Formed Surface Repair

After removal of forms, all ridges, lips, and bulges on surfaces permanently exposed shall be removed. All repairs shall be completed within 48 hours after form removal.

3.4.3.1 Class A Finish

Surfaces listed in Section 03101 FORMWORK FOR CONCRETE and as shown to have a class A finish shall have surface defects repaired as follows: defective areas, voids, and honeycombs smaller than 16 square inches in area and less than 1/2 inch deep and bug holes exceeding 1/2 inch in diameter shall be chipped and filled with dry-packed mortar. Holes left by removal of tie rods shall be reamed and filled with dry-packed mortar as specified in paragraph MATERIAL AND PROCEDURE FOR REPAIRS. Defective and unsound concrete areas larger than described shall be defined by 1/2 inch deep dovetailed saw cuts in a rectangular pattern with lines parallel to the formwork, the defective concrete removed by chipping, and the void repaired with replacement concrete. The prepared area shall be brush-coated with an epoxy resin meeting the requirements of paragraph EPOXY RESIN, or a neat cement grout after dampening the area with water. The void shall be filled with replacement concrete in accordance with paragraph MATERIAL AND PROCEDURE FOR REPAIRS.

3.4.3.2 Class C and Class D Finishes

Surfaces listed in Section 03101 FORMWORK FOR CONCRETE and as shown shall have defects repaired as follows: defective areas, voids, and honeycombs smaller than 24 square inches and less than 2 inches deep; bug holes exceeding 1-1/2 inches in diameter shall be chipped and filled with dry-packed mortar; and holes left by removal of the tie rods shall be chipped and filled with dry-packed mortar. Defective and unsound concrete areas larger than 24 square inches and deeper than 1-1/2 inches shall be defined by 1/2 inch deep dovetailed saw cuts in a rectangular pattern, the defective concrete removed by chipping, and the void repaired with replacement concrete. The prepared area shall be brush-coated with an epoxy resin meeting the requirements of paragraph EPOXY RESIN, or a neat cement grout after dampening the area with water. The void shall be filled with replacement concrete in accordance with paragraph MATERIAL AND PROCEDURE FOR REPAIRS.

3.4.3.3 Material and Procedure for Repairs

The cement used in the dry-packed mortar or replacement concrete shall be a blend of the cement used for production of project concrete and white portland cement properly proportioned so that the final color of the mortar or concrete will match adjacent concrete. Trial batches shall be used to determine the proportions required to match colors. Dry-packed mortar shall consist of one part cement to two and one-half parts fine aggregate. The fine aggregate shall be that used for production of project concrete. The mortar shall be remixed over a period of at least 30 minutes without addition of water until it obtains the stiffest consistency that will permit placing. Mortar shall be thoroughly compacted into the prepared void by tamping, rodding, ramming, etc. and struck off to match adjacent concrete. Replacement concrete shall be produced using project materials and shall be proportioned by the Contracting Officer. It shall be thoroughly compacted into the prepared void by internal vibration, tamping, rodding, ramming, etc. and shall be struck off and finished to match adjacent concrete. Forms shall be used to confine the concrete. If an expanding agent is used in the repair concrete, the repair shall be thoroughly confined on all sides including the top surface. Metal tools shall not be used to finish permanently exposed surfaces. The repaired areas shall be cured for 7 days. The temperature of the in situ concrete, adjacent air, and replacement mortar or concrete shall be above 40 degrees F during placement, finishing, and curing. Other methods and materials for repair may be used only when approved in writing by the Contracting Officer. Repairs of the so called "plaster-type" will not be permitted.

3.5 CURING AND PROTECTION

3.5.1 Duration

All concrete shall be cured by an approved method. Curing effectiveness and methods shall be continuously maintained to ensure that concrete curing is uninterrupted for the entire curing period.

Concrete produced with Type I or III Portland cement shall be cured for at least 7 days.

Concrete containing Type II Portland cement, or fly ash shall be cured for at least 14 days.

Concrete containing GGBF slag shall be cured for at least 21 days.

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, and mechanical damage. All materials and equipment needed for adequate curing and protection shall be available and at the placement site prior to the start of concrete placement. Concrete shall be protected from the damaging effects of rain for 12 hours and from flowing water for 14 days. No fire or excessive heat including welding shall be permitted near or in direct contact with concrete or concrete embedments at any time.

3.5.2 Moist Curing

Moist-cured concrete shall be maintained continuously, not periodically, wet for the entire curing period. If water or curing materials stain or discolor concrete surfaces that are to be permanently exposed, they shall be cleaned as required in paragraph APPEARANCE. Where wooden form sheathing is left in place during curing, the sheathing shall be kept wet at all times. Where steel forms are left in place during curing, the forms shall be carefully broken loose from the hardened concrete and curing water continuously applied into the void so as to continuously saturate the entire concrete surface. Horizontal surfaces may be moist cured by ponding, by covering with a minimum uniform thickness of 2 inches of continuously saturated sand, or by covering with saturated nonstaining burlap or cotton mats. Horizontal construction joints may be allowed to dry for 12 hours immediately prior to the placing of the following lift.

3.5.3 Membrane-Forming Curing Compound

Concrete may be cured with an approved membrane-forming curing compound in lieu of moist curing except that membrane curing will not be permitted on any surface to which a grout-cleaned finish is to be applied or other concrete is to be bonded, on any surface containing protruding steel reinforcement, on an abrasive aggregate finish, or any surface maintained at curing temperature by use of free steam. A styrene acrylate or chlorinated rubber compound may be used for surfaces that are to be painted or are to receive bituminous roofing or waterproofing, or for 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.

3.5.3.1 Pigmented Curing Compound

A pigmented curing compound meeting the requirements of the above paragraph MEMBRANE-FORMING CURING COMPOUND may be used on surfaces that will not be exposed to view when the project is completed.

3.5.3.2 Nonpigmented Curing Compound

A nonpigmented curing compound containing a fugitive dye may be used on surfaces that will be exposed to view when the project is completed. Concrete cured with nonpigmented curing compound must be shaded from the sun for the first 3 days when the ambient temperature is 90 degrees F or higher.

3.5.3.3 Application

The 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. The surfaces shall be thoroughly moistened with water, and the curing

compound applied as soon as free water disappears. The curing compound shall be applied to unformed surfaces as soon as free water has disappeared and bleeding has stopped. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 75 psi, at a uniform coverage of not more than 400 square feet per gallon for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces that 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. All concrete surfaces on which the curing compound has been applied shall be adequately protected for the duration of the entire curing period from pedestrian and vehicular traffic and from any other cause that will disrupt the continuity of the curing membrane.

3.5.4 Evaporation Retardant

Sheet curing shall not be used on vertical or near-vertical surfaces. All surfaces shall be thoroughly wetted and be completely covered with waterproof paper or polyethylene-coated burlap having the burlap thoroughly water-saturated before placing. 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.

3.5.5 Cold-Weather Curing and Protection

When the daily outdoor low temperature is less than 32 degrees F, the temperature of the concrete shall be maintained above 40 degrees F for the first 7 days after placing. In addition, 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 observation of ambient and concrete temperatures indicated by suitable temperatures measuring devices furnished by the Government 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 at such locations as may be directed.

3.5.6 Hot Weather Curing and Protection

When the rate of evaporation of surface moisture, as determined by use of Fig. 2.1.5 of ACI 305, may reasonably be expected to exceed 0.2 pounds per square foot per hour, provisions for windbreaks, shading, fog spraying, or wet covering with a light colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as finishing operations will allow.

3.6 SETTING OF BASE PLATES AND BEARING PLATES

3.6.1 Setting of Plates

After being plumbed and properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and

equipment base plates shall be provided with full bearing with nonshrink grout. The space between the top of concrete or masonry-bearing surface and the bottom of the plate shall be approximately 1/24 of the width of the plate, but not less than 1/2 inch for plates less than 12 inches wide. Concrete surfaces shall be rough, clean, and free of oil, grease, and laitance, and they shall be damp. Metal surfaces shall be clean and free of oil, grease, and rust.

3.6.2 Nonshrink Grout Application

Nonshrink grout shall conform to the requirements of paragraph NONSHRINK GROUT. Water content shall be the minimum that will provide a flowable mixture and fill the space to be grouted without segregation, bleeding, or reduction of strength.

3.6.2.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified. 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 masonry-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for retaining the grout and shall be removed after the grout has set. If grade "A" grout as specified in ASTM C 1107 is used, all surfaces shall be formed to provide restraint. The placed grout shall be worked 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 at 65 to 85 degrees F until after setting.

3.6.2.2 Treatment of Exposed Surfaces

After the grout has set, those types containing metallic aggregate shall have the exposed surfaces cut back 1 inch and immediately covered with a parge coat of mortar proportioned by mass of one part portland cement, two parts sand, and sufficient water to make the mixture placeable. The parge coat shall have a smooth, dense finish. The exposed surface of other types of nonshrink grout shall have a smooth, dense finish.

3.6.2.3 Curing

Grout and parge coats shall be cured in conformance with paragraph CURING AND PROTECTION.

3.7 TESTS AND INSPECTIONS

Tests and inspections shall conform to the following requirements.

3.7.1 General

The Contractor shall perform the inspections and tests described below, and, based upon the results of these inspections and tests, he shall take the action required and submit reports as required. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease. The laboratory performing the tests shall

conform with ASTM C 1077. The laboratory shall be located onsite. (An offsite laboratory may be used, subject to the approval of the Contracting Officer.) The individuals who sample and test concrete or the constituents of concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I. The individuals who perform the inspection of concrete construction shall have demonstrated a knowledge and ability equivalent to the ACI minimum guidelines for certification of Concrete Transportation Construction Inspector (CTCI). The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per year thereafter for conformance with ASTM C 1077.

3.7.2 Testing and Inspection Requirements

3.7.2.1 Fine Aggregate

a. Grading - At least once during each shift 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 size range of 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.

b. Corrective Action for Fine Aggregate Grading - 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 be reported to the Contracting Officer.

c. Moisture Content Testing - When in the opinion of the Contracting Officer the electric moisture meter is not operating satisfactorily, there shall be at least four tests for moisture content in accordance with ASTM C 566 during each 8-hour period of mixing plant operation. The times for the tests shall be selected randomly within the 8-hour period. An additional test shall be made whenever the slump is shown to be out of control or excessive variation in workability is reported by the placing foreman. When the electric moisture meter is operating satisfactorily, at least two direct measurements of moisture content shall be made per week to check the calibration of the meter. The results of tests for moisture content shall be used to adjust the added water in the control of the batch plant.

d. Moisture Content Corrective Action - Whenever the moisture content of the fine aggregate changes by 0.5 percent or more, the scale settings for the fine-aggregate batcher and water batcher shall be adjusted (directly or by means of a moisture compensation device) if necessary to maintain the specified slump.

3.7.2.2 Coarse Aggregate

a. Grading - At least once during each consecutive 8 hours of operations 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 graduation control which are coarser than the specification limits for samples taken at locations other than as delivered to the mixer to allow for degradation during handling.

b. Corrective Action for Grading - 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 Contracting Officer. Where two consecutive averages of five 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.

c. Coarse Aggregate Moisture Content - A test for moisture content of each size group of coarse aggregate shall be made at least twice per week. When two consecutive readings for smallest size coarse aggregate differ by more than 1.0 percent, frequency of testing shall be increased to that specified above for fine aggregate, until the difference falls below 1.0 percent.

d. Coarse Aggregate Moisture Corrective Action - Whenever the moisture content of any size of coarse aggregate changes by 0.5 percent or more, the scale setting for the coarse aggregate batcher and the water batcher shall be adjusted if necessary to maintain the specified slump.

3.7.2.3 Quality of Aggregates

a. Frequency of Quality Tests - Thirty days prior to the start of concrete placement the Contractor shall perform all tests for aggregate quality listed below. In addition, after the start of concrete placement, the Contractor shall perform tests for aggregate quality in accordance with the frequency schedule shown below. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

PROPERTY	FREQUENCY FINE AGGREGATE	FREQUENCY COARSE AGGREGATE	TEST
Specific Gravity	Every 3 months	Every 3 months	ASTM C 127 ASTM C 128
Absorption	Every 3 months	Every 3 months	ASTM C 127 ASTM C 128
Durability Factor Using, (Procedure A)	Every 12 months	Every 12 months	COE CRD-C 114 ASTM C 666
Alkali Reactivity	Every 3 months	Every 3 months	ASTM C 1260
Clay Lumps and Friable Particles	Every 3 months	Every 3 months	ASTM C 142

PROPERTY	FREQUENCY FINE AGGREGATE	FREQUENCY COARSE AGGREGATE	TEST
Material Finer than the 75-µm (No. 200) Sieve	Not applicable	Every 3 months	ASTM C 117
Impurities	Every 3 months	Not applicable	ASTM C 40 ASTM C 87
L.A. Abrasion	Not applicable	Every 6 months	ASTM C 131 ASTM C 535
Petrographic Examination	Every 6 months	Every 6 months	ASTM C 295
Total Chert, than less 2.40 specific gravity	Every 6 months	Every 4 hours	ASTM C 123
Coal and Lignite, less than 2.00 gravity	Every 3 months	Every 3 months	ASTM C 123

b. Corrective Action for Aggregate Quality - If the result of a quality test fails to meet the requirements for quality immediately prior to start of concrete placement, production procedures or materials shall be changed and additional tests shall be performed until the material meets the quality requirements prior to proceeding with either mixture proportioning studies or starting concrete placement. After concrete placement commences, whenever the result of a test for quality fails the requirements, the test shall be rerun immediately. If the second test fails the quality requirement, the fact shall be reported to the Contracting Officer and immediate steps taken to rectify the situation.

3.7.2.4 Scales

a. Weighing Accuracy - The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every 3 months for conformance with the applicable requirements of paragraph BATCHING EQUIPMENT. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors.

b. Batching and Recording Accuracy - 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. The Contractor shall confirm that the calibration devices described in paragraph BATCH PLANT for checking the accuracy of dispensed admixtures are operating properly.

c. Scales Corrective Action - 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.

3.7.2.5 Batch-Plant Control

The measurement of all constituent 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 plant operation.

3.7.2.6 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 quality assurance representative. Tests shall be made in accordance with ASTM C 231. Test results shall be plotted on control charts which shall at all times be readily available to the Government. Copies of the current control charts shall be kept in the field by the Contractor's quality control representatives 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 control chart for air content and the control chart for range, and for determining the need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph AIR CONTENT. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line. 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 control chart for range where an upper warning limit is set at 2.0 percentage points and up 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 is practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the control chart 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. All this shall be at no extra cost to the Government.

c. Slump Testing - In addition to slump tests which shall be made when test specimens are fabricated, at least four 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's quality assurance representative. Test results shall be plotted on control charts which shall at all times be readily available to the Government. Copies of the current control charts shall be kept in the field by the Contractor's quality control representatives 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 on the same batch of concrete. 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 chart for percent air and the chart for range, and for determining the need for any remedial action. An upper warning limit shall be set at 1/2 inch below the maximum allowable slump on separate control charts for percent air used for each type of mixture as specified in paragraph SLUMP, 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 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 chart for slump reach the upper warning limit, an adjustment shall be immediately 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 specified, based upon 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 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. Also, additional slump tests shall be made as directed. All this shall be at no additional cost to the Government.

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. During hot weather conditions, mass or large placements with a least dimension of 2.5 feet shall have a temperature meassurement made for each batch or delivery at the placement location, prior to placement.

f. Compressive-Strength Specimens - At least one set of test specimens shall be made each day on each different concrete mixture placed during the day. Additional sets of test cylinders shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A random 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 DESIGN REQUIREMENTS shall consist of four cylinders, two to be tested at 7 days and two at 28 days. A set of test specimens for concrete with a 7-day strength per specified paragraph DESIGN REQUIREMENTS shall consist of six cylinders, two tested at 3 days, two 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. All compressive-strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength tests, moving average for strength, and moving average for range for each mixture. The charts shall be similar to those found in ACI 214.

3.7.2.7 Inspection Before Placing

Foundation or construction joints, forms, and embedded items shall be inspected for quality by the Contractor in sufficient time prior to each concrete placement to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.7.2.8 Placing

a. Placing Inspection - The placing foreman shall supervise all placing operations, shall determine that the correct quality of concrete or grout is placed in each location as directed and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, yardage placed, and method of placement.

b. Placing Corrective Action - The placing foreman shall not permit batching and placing to begin until he has 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.

3.7.2.9 Vibrators

a. Vibrator Testing and Use - The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521prior 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 at the same time the vibrator is operating in concrete with the tachometer 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.

b. Vibrator Corrective Action - Any vibrator not meeting the requirements of paragraph VIBRATORS shall be immediately removed from service and repaired or replaced.

3.7.2.10 Curing

a. Moist-Curing Inspections - At least once each shift, and once per day on nonwork 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 such areas shall be extended by one (1) day.

c. Membrane-Curing Inspection - No curing compound shall be applied until the Contractor's authorized representative has verified that the compound is properly mixed and ready for spraying. At the end of each operation, he shall estimate the quantity of compound used by measurement of the container and the area of concrete surface covered and compute the rate of coverage in square feet per gallon. He 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 nonwork days, an inspection shall be made of all areas being cured using material 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 one (1) day.

3.7.2.11 Cold-Weather Protection and Sealed Insulation Curing

At least once each shift and once per day on nonwork days, an inspection shall be made of all areas subject to cold-weather protection. The protection system shall be inspected for holes, tears, unsealed joints, or other deficiencies that could result in damage to the concrete. Special attention shall be taken at edges, corners, and thin sections. Any deficiencies shall be noted, corrected, and reported.

3.7.2.12 Cold-Weather Protection Corrective Action

When a daily inspection report lists any holes, tears, unsealed joints, or other deficiencies, the deficiency shall be corrected immediately and the period of protection extended 1 day.

3.7.2.13 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 longest 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 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.

3.7.2.14 Mixer Uniformity Corrective Action

When a mixer fails to meet mixer uniformity requirements, either the mixer shall be removed from service on the work, the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

3.7.3 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 test and inspection records.

LIST OF COARSE AGGREGATE SOURCES

QUARRIES	COUNTY	STATE	APPROVED LEDGE
LaFarge (Menefee) - Dresden Quarry Sec. 23, T.46N, R22W Sedalia, MO 816-826-0328	Pettis	MO	Burlington LS
Fischer Quarries Sec 17, T46, R21 Hughesville, MO 660-829-5555, 800-352-1517	Pettis	MO	Burlington LS
Hilty Quarries - Snyder QuarrY Sec. 16, T39N, R25W Clinton, MO 816-855-8135	St. Clair	MO	Burlington LS
Hilty Quarries - Tightwad Quarry Sec. 3 & 34, T41N, R24W Clinton, MO 816-855-8135	Benton	MO	Burlington LS
Hilty Quarries - Warsaw North Quarry Sec. 15, T41N, R23W Clinton, MO 816-855-8135	Benton	MO	Burlington LS
Hilty Quarries - Warsaw South Quarry Sec. 4 T39N, R22W Clinton, MO 816-855-8135	Benton	MO	Burlington LS
Ash Grove Aggregates - Wheatland QRY Sec. 2, T37N, R23W Butler, MO 816-679-4128	Hickory	MO	Burlington LS
Ag Rock Quarries SW1/4 Sec. 20, T37N, R22W Wheatland, MO	Hickory	MO	Burlington LS
Franklin Quarry Sec 34, T53N, R20W	Saline	MO	Burlington LS
Malan Quarry (Milan) Sec 5, T52N, R21W	Saline	MO	Burlington LS

LIST OF COARSE AGGREGATE SOURCES

Howard Quarry	Saline	MO	Burlington LS
Sec 5, T52N, R21W			

Listing of a source is not to be construed as approval of all material from the source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels when such materials are unsuitable as determined by the Contracting Officer. A winter quarrying prohibition is in effect for this Contract.

Materials may be furnished from any of the above listed sources or, at the option of the Contractor, may be furnished from any other source designated by the Contractor and approved by the Contracting Officer.

-- End of Section --

PHASE I

DIVISION 4 – MASONRY

NOT APPLICABLE

PHASE I

DIVISION 5 – METALS

05055	Metalwork Fabrication, Machine Work, Miscellaneous Provisions
05120	Structural Steel
05502	Miscellaneous Metalwork
05615	Stoplogs
05650	Railroads
05700	Metal Sheet Piling

SECTION 05055

METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS
12/92

PART 1 GENERAL

1.1 SCOPE

The work required by this section consists of the general workmanship and standards which are applicable to the fabrication, assembly and erection of the various items of metalwork covered by this contract work to ensure conformity with the specifications and miscellaneous requirements incidental to the work. These requirements are additional to those contained in the section pertaining to a specific item of work or to a requirement indicated on the contract drawings.

1.2 REFERENCES

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

ALUMINUM ASSOCIATION

ADM	Aluminum Design Manual

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

(1978)	Guide Specifications for Fracture Critical Non-Redundant Steel Bridge Members

AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)

AGMA 2005-B	(1988) Design Manual for Bevel Gears
AGMA 6001-C	(1988) Design and Selection of Components for Enclosed Gear Drives

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 325	(1994) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 325M	(1993) High-Strength Bolts for Structural Steel Joints (Metric)
ASTM A 380	(1994a) Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems
ASTM A 490	(1993) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength

ASTM A 490M	(1993) High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A 514/A 514M	(1994a) High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM B 177	(1993) Chromium Electroplating on Steel for Engineering Use
ASTM B 766	(1986; R 1993) Electrodeposited Coatings of Cadmium
ASTM A 780	(1993a) Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM D 962	(1981; R 1994) Aluminum Powder and Paste Pigments for Paints
ASTM E 94	(1993) Radiographic Testing
ASTM E 165	(1995) Liquid Penetrant Examination Inspection Method
ASTM E 446	(1993) Radiographs for Steel Casting up to 2 in. (51 mm) in Thickness
ASTM E 709	(1995) Magnetic Particle Examination

ASME INTERNATIONAL (ASME)

ASME B4.1	(1967; R 1994) Preferred Limits and Fits for Cylindrical Parts
ASME B46.1	(1985) Surface Texture (Surface Roughness, Waviness, and Lay)
ASME BPV IX	(1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	Structural Welding Code - Steel
AWS D1.2	Structural Welding Code - Aluminum

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 3110	(1992; Rev G) Primer Zinc Chromate
SAE AMS 3132	(1994; Rev F) Varnish, Phenolic Resin Corrosion-Preventive

1.3 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The

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

SD-04 Drawings

Detail Drawings; GA.

Detail drawings for metalwork and machine work shall be submitted and approved prior to fabrication.

materials list; GA.

SD-08 Statements

Welding Procedures for Structural Steel; GA.

Schedules of welding procedures for steel structures shall be submitted and approved prior to commencing fabrication.

Welding of Aluminum; GA.

Schedules of welding processes for aluminum fabrications shall be submitted and approved prior to commencing fabrication.

Structural Steel Welding Repairs; GA.

Welding repair plans for steel shall be submitted and approved prior to making repairs.

SD-09 Reports

Tests, Inspections, and Verifications; FIO.

Certified test reports for materials shall be submitted with all materials delivered to the site.

Test Reports for Fracture Critical Members (FCMO)

Bound report shall contain test results on all fracture critical members and shall include record of personnel qualifications, equipment, procedures, and analysis of results along with all the test records. Report shall cover the Charpy V-notch tests, all welding tests, and chemical and mechanical properties of the steel.

SD-13 Certificates

Qualification of Welders and Welding Operators; FIO.

Certifications for welders and welding operators shall be submitted prior to commencing fabrication.

Application Qualification for Steel Studs; GA.

Certified reports for the application qualification for steel studs shall be submitted and approved prior to commencing fabrication.

Welding of Aluminum; GA.

Certified report for aluminum welding qualification tests shall be

submitted and approved prior to commencing welding.

SD-18 Records

Materials Disposition Records; FIO.

Materials disposition records shall be submitted before completion of contract.

1.4 METALWORK AND MACHINE WORK DETAIL DRAWINGS

Detail drawings for metalwork and machine work shall include catalog cuts, templates, fabrication and assembly details and type, grade and class of material as appropriate. Elements of fabricated items inadvertently omitted on contract drawings shall be detailed by the fabricator and indicated on the detail drawings.

1.5 QUALIFICATION OF WELDERS AND WELDING OPERATORS

The Contractor shall certify that the qualification of welders and welding operators and tack welders who will perform welding have been qualified for the particular type of work to be done in accordance with the requirements of AWS prior to commencing fabrication. The certificate shall list the qualified welders by name and shall specify the code and procedures under which qualified and the date of qualification. Prior qualification will be accepted if welders have performed satisfactory work under the code for which qualified within the preceding three months. The Contractor shall require welders to repeat the qualifying tests when their work indicates a reasonable doubt as to proficiency. Those passing the requalification tests will be recertified. Those not passing will be disqualified until passing. All expenses in connection with qualification and requalification shall be borne by the Contractor.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Materials List

The Contractor shall furnish a materials list of the materials to be used in the fabrication of each item.

2.2 FABRICATION

2.2.1 Structural Fabrication

Fabrication of all parts of the work shall be carefully done in strict accordance with the approved shop drawings. Material must be straight before being laid off or worked. If straightening is necessary it shall be done by methods that will not impair the metal. Sharp kinks or bends shall be cause for rejection of the material. Material with welds will not be accepted except where welding is definitely specified, indicated or otherwise approved. Bends shall be made by approved dies, press brakes or bending rolls. Where heating is required, precautions shall be taken to avoid overheating the metal and it shall be allowed to cool in a manner that will not impair the original properties of the metal. Proposed flame cutting of material other than structural steel shall be subject to approval and shall be indicated on detail drawings. Shearing shall be accurate and all portions of the work shall be neatly finished. Corners

shall be square and true unless otherwise shown. Re-entrant cuts shall be filleted to a minimum radius of 3/4 inch unless otherwise approved. Finished members shall be free of twists, bends and open joints. Bolts, nuts and screws shall be tight.

2.2.1.1 Dimensional Tolerances for Structural Work

Dimensions shall be measured by an approved calibrated steel tape of approximately the same temperature as the material being measured. The overall dimensions of an assembled structural unit shall be within the tolerances indicated on the drawings or as specified in the particular section of these specifications for the item of work. Where tolerances are not specified in other sections of these specifications or shown, an allowable variation of 1/32 inch is permissible in the overall length of component members with both ends milled and component members without milled ends shall not deviate from the dimensions shown by not more than 1/16 inch for members 30 feet or less in length and by more than 1/8 inch for members over 30 feet in length. Where specific tolerances for an assembled unit are not specified or are not shown on the contract drawings, the Contractor will be held responsible for providing such tolerances that the unit will fit properly and perform the required functions to the satisfaction of the COR. Where the above tolerances for individual component members are not applicable, care shall be taken such that there will not be sufficient cumulative error that the assembled unit does not fit and/or function properly.

2.2.1.2 Structural Steel Fabrication

Structural steel may be cut by mechanically guided or hand-guided torches, provided an accurate profile with a surface that is smooth and free from cracks and notches is obtained. Surfaces and edges to be welded shall be prepared in accordance with AWS D1.1. Where structural steel is not to be welded, chipping or grinding will not be required except as necessary to remove slag and sharp edges of mechanically guided or hand-guided cuts not exposed to view. Hand-guided cuts which are to be exposed or visible shall be chipped, ground or machined to sound metal.

2.2.1.3 Fracture Critical Members (FCMO)

All steel used in FCM shall have the following notch toughness requirements.

Grade Yield Strength (KSI)	Thickness (inches)	Charpy V-notch (foot-pounds at degrees Fahrenheit)
36	<4.0	25 at 40
50	<2.0	25 at 40
70	<2.5	30 at 20
100	<2.5	35 at 0

2.2.1.4 Structural Aluminum Fabrication

Laying out and cutting of aluminum shall be in accordance with the ADM Aluminum Design Manual and AWS D1.2.

2.2.2 Welding

2.2.2.1 Welding of Structural Steel

a. Welding Procedures for Structural Steel - Welding procedures for

structural steel shall be prequalified as described in AWS D1.1, or shall be qualified by tests as prescribed in AWS D1.1. Properly documented evidence of compliance with all requirements of these specifications for previous qualification tests shall establish a welding procedure as prequalified. For welding procedures qualified by tests, the test welding and specimen testing must be witnessed and the test report document signed by the Contracting Officer. Approval of any welding procedure will not relieve the Contractor of the responsibility for producing a finished structure meeting all requirements of these specifications. The Contractor will be directed or authorized to make any changes in previously approved welding procedures that are deemed necessary or desirable by the Contractor Officer. The Contractor shall submit a complete schedule of welding procedures for each steel structure to be welded. The schedule shall conform to the requirements specified in the provisions AWS D1.1 The schedule shall provide detailed procedure specifications and tables or diagrams showing the procedures to be used for each required joint. Welding procedures must include filler metal, preheat, interpass temperature and stress-relief heat treatment requirements. Each welding procedure shall be clearly identified as being prequalified or required to be qualified by tests. Welding procedures must show types and locations of welds designated or in the specifications to receive nondestructive examination.

b. Welding Process - Welding of structural steel shall be by an electric arc welding process using a method which excludes the atmosphere from the molten metal and shall conform to the applicable provisions of AWS D1.1. Welding shall be such as to minimize residual stresses, distortion and shrinkage.

c. Welding Technique

(1) Filler Metal - The electrode, electrode-flux combination and grade of weld metal shall conform to the appropriate AWS specification for the base metal and welding process being used or shall be as shown where a specific choice of AWS specification allowables is required. The AWS designation of the electrodes to be used shall be included in the schedule of welding procedures. Only low hydrogen electrodes shall be used for manual shielded metal-arc welding regardless of the thickness of the steel. A controlled temperature storage oven shall be used at the job site as prescribed by AWS D1.1 to maintain low moisture of low hydrogen electrodes.

(2) Preheat and Interpass Temperature - Preheating shall be performed as required by AWS D1.1, or as otherwise specified except that the temperature of the base metal shall be at least70 degrees F. The weldments to be preheated shall be slowly and uniformly heated by approved means to the prescribed temperature, held at that temperature until the welding is completed and then permitted to cool slowly in still air.

(3) Stress-Relief Heat Treatment - Where stress relief heat treatment is specified or shown, it shall be in accordance with the requirements of AWS D1.1, unless otherwise authorized or directed.

d. Workmanship - Workmanship for welding shall be in accordance with AWS D1.1, and other applicable requirements of these specifications.

(1) Preparation of Base Metal - Prior to welding the Contractor shall inspect surfaces to be welded to assure compliance with AWS D1.1.

(2) Temporary Welds - Temporary welds required for fabrication and erection shall be made under the controlled conditions prescribed for permanent work. Temporary welds shall be made using low-hydrogen welding electrodes and by welders qualified for permanent work as specified in these specifications. Preheating for temporary welds shall be as required by AWS D1.1 for permanent welds except that the minimum temperature shall be 120 degrees F in any case. In making temporary welds arcs shall not be struck in other than weld locations. Each temporary weld shall be removed and ground flush with adjacent surfaces after serving its purpose.

(3) Tack Welds - Tacks welds that are to be incorporated into the permanent work shall be subject to the same quality requirements as the permanent welds and shall be cleaned and thoroughly fused with permanent welds. Preheating shall be performed as specified above for temporary welds. Multiple-pass tack welds shall have cascaded ends. Defective tack welds shall be removed before permanent welding.

2.2.2.2 Welding of Steel Castings

Unsound material shall be removed from the surfaces of steel castings to be incorporated into welded connections by chipping, machining, air-arc gouging or grinding. Major connections designed for transfer of stresses shall not be welded if the temperature of the casting is lower than100 degrees F. Castings containing over 0.35 percent carbon or over 0.75 percent manganese shall be preheated to a temperature not to exceed450 degrees F and welding shall be accomplished while the castings are maintained at a temperature above350 degrees F. Welding will not be permitted on castings containing carbon in excess of 0.45 percent except on written authorization. Castings requiring welding repairs after the first annealing and castings involving welding fabrication shall be stress-relieved annealed prior to receiving final machining unless otherwise permitted.

2.2.2.3 Welding of Aluminum

Welding of aluminum shall conform to AWS D1.2. The welding process and welding operators shall be prequalified as required by AWS D1.2 in accordance with the methods described in ASME BPV IX, Section IX. A certified report giving the results of the qualifying tests shall be furnished for approval. A complete schedule of the welding process for each aluminum fabrication to be welded shall be furnished for approval.

2.2.2.4 Welding of Steel Studs

The procedures for welding steel studs to structural steel and sheet pile, including mechanical, workmanship, technique, stud application qualification, production quality control and fabrication and verification inspection procedures shall conform to the requirements of AWS D1.1, except as otherwise specified.

a. Application Qualification for Steel Studs - As a condition of

approval of the stud application process, the Contractor shall furnish certified test reports and certification that the studs conform to the requirements of AWS D1.1, certified results of the stud manufacturer's stud base qualification test, and certified results of the stud application qualification test as required by AWS D1.1, except as otherwise specified.

b. Production Quality Control - Quality control for production welding of studs shall conform to the requirements of AWS D1.1, except as otherwise specified. Studs on which pre-production testing is to be performed shall be welded in the same general position as required on production studs (flat, vertical, overhead or sloping). If the reduction of the length of studs becomes less than normal as they are welded, welding shall be stopped immediately and not resumed until the cause has been corrected.

2.2.2.5 Welding of Fracture Critical Members (FCM)

Welding procedures for FCM shall be qualified in accordance with AASHTO Guide Specifications for Fracture Critical Non-Redundant Bridge Members.

2.2.3 Bolted Connections

2.2.3.1 Bolted Structural Steel Connections

Bolts, nuts and washers shall be of the type specified or indicated. All nuts shall be equipped with washers except for high strength bolts. Beveled washers shall be used where bearing faces have a slope of more than 1:20 with respect to a plane normal to the bolt axis. Where the use of high strength bolts is specified or indicated the materials, workmanship and installation shall conform to the applicable provisions of ASTM A 325M ASTM A 325 or ASTM A 490. Slip-critical connections are required where noted on the contract drawings.

a. Bolt Holes - Bolt holes shall be accurately located, smooth, perpendicular to the member and cylindrical.

(1) Holes for regular bolts shall be drilled or subdrilled and reamed in the shop and shall not be more than 1/16 inch larger than the diameter of the bolt.

(2) Holes for fitted bolts shall be match-reamed or drilled in the shop. Burrs resulting from reaming shall be removed. The threads of bolts shall be entirely outside of the holes. The body diameter of bolts shall have tolerances as recommended by ASME B4.1 for the class of fit specified. Fitted bolts shall be fitted in reamed holes by selective assembly to provide an LN-2 fit.

(3) Holes for high strength bolts shall have diameters of not more than1/16 inch larger than bolt diameters. If the thickness of the material is not greater than the diameter of the bolts the holes may be punched. If the thickness of the material is greater than the diameter of the bolts the holes may be drilled full size or subpunched or subdrilled at least1/8 inch smaller than the diameter of the bolts and then reamed to full size. Poor matching of holes will be cause for rejection. Drifting occurring during assembly shall not distort the metal or enlarge the holes. Reaming to a larger diameter of the next standard size bolt will be allowed for slight mismatching.

2.2.3.2 Bolted Aluminum Connections

Punching, drilling, reaming and bolting for bolted aluminum connections shall conform to the requirements of the Aluminum Design Manual.

2.2.4 Machine Work

Tolerances, allowances and gauges for metal fits between plain, non-threaded, cylindrical parts shall conform to ASME B4.1 for the class of fit shown or required unless otherwise shown on approved detail drawings. Where fits are not shown they shall be suitable as approved. Tolerances for machine-finished surfaces designated by non-decimal dimensions shall be within 1/64 inch. Sufficient machining stock shall be allowed on placing pads to ensure true surfaces of solid material. Finished contact or bearing surfaces shall be true and exact to secure full contact. Journal surfaces shall be polished and all surfaces shall be finished with sufficient smoothness and accuracy to ensure proper operation when assembled. Parts entering any machine shall be accurately machined and all like parts shall be interchangeable except that parts assembled together for drilling or reaming of holes or machining will not be required to be interchangeable with like parts. All drilled holes bolts shall be accurately located.

2.2.4.1 Finished Surfaces

Surface finishes indicated or specified shall be in accordance with ASME B46.1. Values of required roughness heights are arithmetical average deviations expressed inmicroinches. These values are maximum. Lesser degrees will be satisfactory unless otherwise indicated. Compliance with surface requirements shall be determined by sense of feel and visual inspection of the work compared to Roughness Comparison Specimens in accordance with the provisions of ASME B46.1. Values of roughness width and waviness height shall be consistent with the general type of finish specified by roughness height. Where the finish is not indicated or specified it shall be that which is most suitable for the particular surface, provide the class of fit required and be indicated on the detail drawings by a symbol which conforms to ASME B46.1 when machine finishing is provided. Flaws such as scratches, ridges, holes, peaks, cracks or checks which will make the part unsuitable for the intended use will be cause for rejection.

2.2.4.2 Unfinished Surfaces

All work shall be laid out to secure proper matching of adjoining unfinished surfaces unless otherwise directed. Where there is a large discrepancy between adjoining unfinished surfaces they shall be chipped and ground smooth or machined to secure proper alignment. Unfinished surfaces shall be true to the lines and dimensions shown and shall be chipped or ground free of all projections and rough spots. Depressions or holes not affecting the strength or usefulness of the parts shall be filled in an approved manner.

2.2.4.3 Pin Holes

Pin holes shall be bored true to gauges, smooth, straight and at right angles to the axis of the member. The boring shall be done after the member is securely fastened in position.

2.2.4.4 Gears

Gears shall have machine cut teeth of a form conforming to applicable design requirements of AGMA 2005-B and AGMA 6001-C unless otherwise specified or shown.

2.2.4.5 Shafting

All shafting shall be turned or ground hot-rolled or cold-rolled steel as required unless otherwise specified or authorized. Fillets shall be provided where changes in section occur. Cold-finished shafting may be used where keyseating is the only machine work required.

2.2.4.6 Bearings

Bearings may be lined with babbit or bronze unless otherwise specified or shown. Where the bearing pressure is in excess of 200 psi, bearings shall be lined with bronze. Pressures on lined bearings shall not exceed 250 psi of projected area unless otherwise required or authorized. Anti-friction bearings of approved types and of sizes not less than those recommended by the bearing manufacturer for the duty intended will be permitted subject to approval. All bearings shall be properly aligned and provided with a suitable means of lubrication. Anti-friction bearings shall be so installed as to provide for retention of the lubricant and to exclude dirt and grit.

2.2.5 Miscellaneous Provisions

2.2.5.1 Metallic Coatings

a. Zinc Coatings - Zinc coatings shall be applied in a manner and of a thickness and quality conforming to ASTM A 123. Where zinc coatings are destroyed by cutting, welding or other causes the affected areas shall be regalvanized. Coatings 2 ounces or heavier shall be regalvanized with a suitable low-melting zinc base alloy similar to the recommendations of the American Hot-Dip Galvanizers Association to the thickness and quality specified for the original zinc coating. Coatings less than 2 ounces shall be repaired in accordance with ASTM A 780.

b. Cadmium Coatings - Cadmium coatings shall be of a quality and thickness conforming to the requirements of ASTM B 766 and inspection shall conform to the requirements of ASTM E 165, Type I.

c. Chromium Coatings - Chromium coatings for engineering use shall be applied in conformity with ASTM B 177.

2.2.5.2 Cleaning of Corrosion-Resisting Steel

Oil, paint and other foreign substances shall be removed from corrosion-resisting steel surfaces after fabrication. Cleaning shall be done by vapor degreasing or by the use of cleaners of the alkaline, emulsion or solvent type. After the surfaces have been cleaned they shall be given a final rinsing with clean water followed by a 24 hour period during which the surfaces are intermittently wet with clean water and then allowed to dry for the purpose of inspecting the clean surfaces. The surfaces shall be visually inspected for evidence of paint, oil, grease, welding slag, heat treatment scale, iron rust or other forms of contamination. If evidence of foreign substance exist the surface shall be

cleaned in accordance with the applicable provisions of ASTM A 380. The proposed method of treatment shall be furnished for approval. After treatment the surfaces shall be visually reinspected. Brushes used to remove foreign substances shall have only stainless steel or nonmetallic bristles. Any contamination occurring subsequent to the initial cleaning shall be removed by one or more of the methods indicated above.

2.2.5.3 Lubrication

The arrangement and details for lubrication shall be as shown. Before erection or assembly all bearing surfaces shall be thoroughly cleaned and lubricated with an approved lubricant.

2.2.6 Shop Assembly

Each machinery and structural unit furnished shall be assembled in the shop to determine the correctness of the fabrication and matching of the component parts unless otherwise specified. Tolerances shall not exceed those shown. Each unit assembled shall be closely checked to ensure that all necessary clearances have been provided and that binding does not occur in any moving part. Assembly in the shop shall be in the same position as final installation in the field unless otherwise specified. Assembly and disassembly work shall be performed in the presence of the Contracting Officer unless waived in writing. Errors or defects disclosed shall be immediately remedied by the Contractor without cost to the Government. Before disassembly for shipment each piece of a machinery or structural unit shall be match-marked to facilitate erection in the field. The location of match-marks shall be indicated by circling with a ring of white paint after the shop coat of paint has been applied or as otherwise directed.

2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

The Contractor shall have required material tests and analyses performed and certified by an approved laboratory to demonstrate that materials are in conformity with the specifications. These tests and analyses shall be performed and certified at the Contractor's expense. Tests, inspections, and verifications shall conform to the requirements of the particular sections of these specifications for the respective items of work unless otherwise specified or authorized. Tests shall be conducted in the presence of the Contracting Officer if so required. The Contractor shall furnish specimens and samples for additional independent tests and analyses upon request by the Contracting Officer. Specimens and samples shall be properly labeled and prepared for shipment.

2.3.1 Nondestructive Testing

When doubt exists as to the soundness of any material part such part may be subjected to any form of nondestructive testing determined by the Contracting Officer. This may include ultrasonic, magnaflux, dye penetrant, x-ray, gamma ray or any other test that will thoroughly investigate the part in question. The cost of such investigation will be borne by the Government. Any defects will be cause for rejection and rejected parts shall be replaced and retested at the Contractor's expense.

2.3.2 Tests of Machinery and Structural Units

The details for tests of machinery and structural units shall conform to the requirements of the particular sections of these specifications

covering these items. Each complete machinery and structural unit shall be assembled and tested in the shop in the presence of the Contracting Officer unless otherwise directed. Waiving of tests will not relieve the Contractor of responsibility for any fault in operation, workmanship or material that occurs before the completion of the contract or guarantee. After being installed at the site each complete machinery or structural unit shall be operated through a sufficient number of complete cycles to demonstrate to the satisfaction of the Contracting Officer that it meets the specified operational requirements in all respects.

2.3.3 Inspection of Structural Steel Welding

The Contractor shall maintain an approved inspection system and perform required inspections in accordance with Contract Clause CONTRACTOR INSPECTION SYSTEM. Welding shall be subject to inspection to determine conformance with the requirements of AWS D1.1, the approved welding procedures and provisions stated in other sections of these specifications. Nondestructive examination of designated welds will be required. Supplemental examination of any joint or coupon cut from any location in any joint may be required.

2.3.3.1 Visual Examination

All visual examination of completed welds shall be cleaned and carefully examined for insufficient throat or leg sizes, cracks, undercutting, overlap, excessive convexity or reinforcement and other surface defects to ensure compliance with the requirements of AWS D1.1 or AWS D1.2, as appropriate. Defects shall be corrected as provided in AWS D1.1 or AWS D1.2, and as required the COR.

2.3.3.2 Nondestructive Examination

The nondestructive examination of shop and field welds shall be performed as designated or described in the sections of these specifications covering the particular items of work.

a. Testing Agency - The nondestructive examination of welds and the evaluation of examination tests as to the acceptability of the welds shall be performed by a testing agency adequately equipped and competent to perform such services or by the Contractor using suitable equipment and qualified personnel. In either case written approval of the examination procedures is required and the examination tests shall be made in the presence of the Contracting Officer. The evaluation of examination tests shall be subject to the approval and all records shall become the property of the Government.

b. Examination Procedures - Examination procedures shall conform to the following requirements.

(1) Ultrasonic Testing - Making, evaluating and reporting ultrasonic testing of welds shall conform to the requirements of AWS D1.1 or AWS D1.2, as appropriate. The ultrasonic equipment shall be capable of making a permanent record of the test indications. A record shall be made of each weld tested.

(2) Radiographic Testing - Making, evaluating and reporting radiographic testing of welds shall conform to the requirements of AWS D1.1 or AWS D1.2.

(3) Magnetic Particle Inspection - Magnetic particle inspection of welds shall conform to the applicable provisions of ASTM E 709.

(4) Dye Penetrant Inspection - Dye penetrant inspection of welds shall conform to the applicable provisions of ASTM E 165.

c. Acceptability of Welds - Welds shall be unacceptable if shown to have defects prohibited by AWS D1.1 or AWS D1.2, or possess any degree of incomplete fusion, inadequate penetration or undercutting.

d. Welds to be subject to nondestructive examination shall be determined by the COR.

2.3.3.3 Testing Fracture Critical Members (FCM)

Weld testing, inspection, and personnel qualifications and certification of FCM shall be in accordance with AASHTO Guide Specifications for Fracture Critical Non-Redundant Bridge Members. Copies of the weld inspector's certification and qualifications for all assistant inspectors shall be submitted. All members designated as FCM shall have their joints tested. All complete penetration butt welds shall have radiographic testing; those welds found to be inaccessible to a radiation source or film, or otherwise situated where radiographic examination is not feasible may be examined, with written approval, by dye penetrant, magnetic particle tests, or ultra sonic tests. All other FCM welds shall have ultrasonic testing.

2.3.3.4 Test Coupons

The Government reserves the right to require the Contractor to remove coupons from completed work when doubt as to soundness cannot be resolved by nondestructive examination. Should tests of any two coupons cut from the work of any welder show strengths less than that specified for the base metal it will be considered evidence of negligence or incompetence and such welder shall be removed from the work. When coupons are removed from any part of a structure the members cut shall be repaired in a neat manner with joints of the proper type to develop the full strength of the members. Repaired joints shall be peened as approved or directed to relieve residual stress. The expense for removing and testing coupons, repairing cut members and the nondestructive examination of repairs shall be borne by the Government or the Contractor in accordance with the Contract Clauses INSPECTION AND ACCEPTANCE.

2.3.3.5 Supplemental Examination

When the soundness of any weld is suspected of being deficient due to faulty welding or stresses that might occur during shipment or erection the Government reserves the right to perform nondestructive supplemental examinations before final acceptance. The cost of such inspection will be borne by the Government.

2.3.4 Welding Repairs

Defective welds in the structural steel welding repairs shall be repaired in accordance with AWS D1.1. Defective weld metal shall be removed to sound metal by use of air carbon-arc or oxygen gouging. Oxygen gouging shall not be used on ASTM A 514/A 514M steel. The surfaces shall be thoroughly cleaned before welding. Welds that have been repaired shall be retested by the same methods used in the original inspection. Except for

the repair of members cut to remove test coupons and found to have acceptable welds costs of repairs and retesting shall be borne by the Contractor. Defective welds in aluminum shall be repaired in accordance with AWS D1.2

2.3.5 Inspection and Testing of Steel Stud Welding

Fabrication and verification inspection and testing of steel stud welding shall conform to the requirements of AWS D1.1, except as otherwise specified. The Contracting Officer will serve as the verification inspector. One stud in every 100 and studs that do not show a full 360 degree weld flash, have been repaired by welding or whose reduction in length due to welding is less than normal shall be bent or torque tested as required by AWS D1.1. If any of these studs fail two additional studs shall be bent or torque tested. If either of the two additional studs fail all of the studs represented by the tests shall be rejected. Studs that crack under testing in either the weld, base metal or shank shall be rejected and replaced by the Contractor at no additional cost.

PART 3 EXECUTION

3.1 INSTALLATION

All parts to be installed shall be thoroughly cleaned. Packing compounds, rust, dirt, grit and other foreign matter shall be removed. Holes and grooves for lubrication shall be cleaned. Enclosed chambers or passages shall be examined to make sure that they are free from damaging materials. Where units or items are shipped as assemblies they will be inspected prior to installation. Disassembly, cleaning and lubrication will not be required except where necessary to place the assembly in a clean and properly lubricated condition. Pipe wrenches, cold chisels or other tools likely to cause damage to the surfaces of rods, nuts or other parts shall not be used for assembling and tightening parts. Bolts and screws shall be tightened firmly and uniformly but care shall be taken not to overstress the threads. When a half nut is used for locking a full nut the half nut shall be placed first and followed by the full nut. Threads of all bolts except high strength bolts, nuts and screws shall be lubricated with an approved lubricant before assembly. Threads of corrosion-resisting steel bolts and nuts shall be coated with an approved antigalling compound. Driving and drifting bolts or keys will not be permitted.

3.1.1 Alignment and Setting

Each machinery or structural unit shall be accurately aligned by the use of steel shims or other approved methods so that no binding in any moving parts or distortion of any member occurs before it is fastened in place. The alignment of all parts with respect to each other shall be true within the respective tolerances required. Machines shall be set true to the elevations shown.

3.1.2 Blocking and Wedges

All blocking and wedges used during installation for the support of parts to be grouted in foundations shall be removed before final grouting unless otherwise directed. Blocking and wedges left in the foundations with approval shall be of steel or iron.

3.1.3 Foundations and Grouting

Concreting of subbases and frames and the final grouting under parts of machines shall be in accordance with the procedures as specified in Section 03301, CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS.

3.2 PROTECTION OF FINISHED WORK

3.2.1 Machined Surfaces

Machined surfaces shall be thoroughly cleaned of foreign matter. All finished surfaces shall be protected by suitable means. Unassembled pins and bolts shall be oiled and wrapped with moisture resistant paper or protected by other approved means. Finished surfaces of ferrous metals to be in bolted contact shall be washed with an approved rust inhibitor and coated with an approved rust resisting compound for temporary protection during fabrication, shipping and storage periods. Finished surfaces of metals which shall be exposed after installation except corrosion resisting steel or nonferrous metals shall be painted as specified in Section 09965 PAINTING: HYDRAULIC STRUCTURES.

3.2.2 Lubrication After Assembly

After assembly all lubricating systems shall be filled with the lubricant specified and additional lubricant shall be applied at intervals as required to maintain the equipment in satisfactory condition until acceptance of the work.

3.2.3 Aluminum

Aluminum that shall be in contact with grout or concrete shall be protected from galvanic or corrosive action by being given a coat of zinc-chromate primer and a coat of aluminum paint. Aluminum in contact with structural steel shall be protected against galvanic or corrosive action by being given a coat of zinc-chromate primer and a coat of aluminum paint. The zinc-chromate primer shall conform to SAE AMS 3110. The aluminum paint shall consist of a aluminum paste conforming to ASTM D 962, spar varnish conforming to SAE AMS 3132 and thinner compatible with the varnish. The aluminum paint shall be field mixed in proportion of2 pounds of paste, not more thanone gallon of spar varnish and not more thanone pint of thinner.

3.3 TESTS

3.3.1 Workmanship

Workmanship shall be of the highest grade and in accordance with the best modern practices to conform with the specifications for the item of work being furnished.

3.3.2 Production Welding

Production welding shall conform to the requirements of AWS D1.1 or AWS D1.2 as applicable. Studs on which pre-production testing is to be performed shall be welded in the same general position as required on production items (flat, vertical, overhead or sloping). Test and production stud welding will be subjected to visual examination or inspection. If the reduction of the length of studs becomes less than normal as they are welded, welding shall be stopped immediately and not resumed until the cause has been corrected.

-- End of Section --

SECTION 05120

STRUCTURAL STEEL
09/97

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 basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC FCD	(1995a) Quality Certification Program Description
AISC ASD Mnl	(1989) Manual of Steel Construction Allowable Stress Design
AISC ASD/LRFD Vol II	(1992) Manual of Steel Construction Vol II: Connections
AISC Design Guide #10	(1989) Erection Bracing of Low-Rise Structural Steel Frames
AISC LRFD Vol I	(1995) Manual of Steel Construction Load & Resistance Factor Design, Vol I: Structural Members, Specifications & Codes
AISC LRFD Vol II	(1995) Manual of Steel Construction Load & Resistance Factor Design, Vol II: Structural Members, Specifications & Codes
AISC Pub No. S303	(1992) Code of Standard Practice for Steel Buildings and Bridges

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 6/A 6M	(1997) General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A 36/A 36M	(1996) Carbon Structural Steel
ASTM A 53	(1997) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 242/A 242M	(1993a) High-Strength Low-Alloy Structural Steel

ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 325	(1997) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 325M	(1993) High-Strength Bolts for Structural Steel Joints (Metric)
ASTM A 490	(1997) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
ASTM A 490M	(1993) High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A 500	(1996) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(1996) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 502	(1993) Steel Structural Rivets
ASTM A 514/A 514M	(1994a) High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM A 529/A 529M	(1996) High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A 563	(1996) Carbon and Alloy Steel Nuts
ASTM A 563M	(1996) Carbon and Alloy Steel Nuts (Metric)
ASTM A 572/A 572M	(1997) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 588/A 588M	(1997) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 618	(1996) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A 709/A 709M	(19997a) Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched-and-Tempered Alloy Structural Steel Plates for Bridges
ASTM A 852/A 852M	(1997) Quenched and Tempered Low-Alloy

	Structural Steel Plate with 70 ksi (485 MPa) Minimum Yield Strength to 4 in. (100 mm) Thick
ASTM F 436	(1993) Hardened Steel Washers
ASTM F 436M	(1993) Hardened Steel Washers (Metric)
ASTM F 844	(1990) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F 959	(1996) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.21.1	(1994) Lock Washers (Inch Series)
ASME B46.1	(1995) Surface Texture (Surface Roughness, Waviness, and Lay)

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1993) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1	(1996) Structural Welding Code - Steel

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)

1.2 GENERAL REQUIREMENTS

Structural steel fabrication and erection shall be performed by an organization experienced in structural steel work of equivalent magnitude. The Contractor shall be responsible for correctness of detailing, fabrication, and for the correct fitting of structural members. Connections, for any part of the structure not shown on the contract drawings, shall be considered simple shear connections and shall be designed and detailed in accordance with pertinent provisions of AISC ASD Mnl and AISC LRFD Vol II. Substitution of sections or modification of connection details will not be accepted unless approved by the Contracting Officer. AISC ASD Mnl and AISC ASD/LRFD Vol II shall govern the work. Welding shall be in accordance with AWS D1.1. High-strength bolting shall be in accordance with AISC ASD Manual. Section 05055 provides addtional requirements.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation;

submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Structural Steel System; GA-RE. Structural Connections; GA.

Shop and erection details including members (with their connections) not shown on the contract drawings. Welds shall be indicated by standard welding symbols in accordance with AWS A2.4.

SD-08 Statements

Erection; GA-RE.

Prior to erection, erection plan of the structural steel framing describing all necessary temporary supports, including the sequence of installation and removal.

SD-13 Certificates

Mill Test Reports; GA-RE.

Certified copies of mill test reports for structural steel, structural bolts, nuts, washers and other related structural steel items, including attesting that the structural steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified, prior to the installation.

Welder Qualifications; GA-RE.

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.1.

Fabrication; GA-RE.

A copy of the AISC certificate indicating that the fabrication plant meets the specified structural steelwork category.

SD-14 Samples

High Strength Bolts and Nuts; GA-RE. Carbon Steel Bolts and Nuts; GA-RE. Nuts Dimensional Style; GA-RE. Washers; GA-RE.

Random samples of bolts, nuts, and washers as delivered to the job site if requested, taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

1.4 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

2.1.1 Carbon Grade Steel (plates, bars and angles)

Carbon grade steel shall conform to ASTM A 36/A 36M.

2.1.2 High-Strength Low-Alloy Steel (All other steel except plates, bars and angles)

High-strength low-alloy steel shall conform to ASTM A 572/A 572M, Grade 50.

2.1.3 Corrosion-Resistant High-Strength Low-Alloy Steel

Corrosion-resistant steel shall conform to ASTM A 242/A 242M.

2.1.4 Quenched and Tempered Alloy Steel

Tempered alloy steel shall conform to ASTM A 514/A 514M.

2.1.5 Carbon and High-Strength Low-Alloy Steel

Carbon and high-strength low-alloy steel shall conform to ASTM A 709/A 709M.

2.1.6 Quenched and Tempered Low-Alloy Steel

Quenched and tempered low-alloy steel shall conform to ASTM A 852/A 852M, 70 ksi.

2.1.7 Structural Shapes

Structural shapes in accordance with ASTM A 6/A 6M shall be used.

2.2 STRUCTURAL TUBING

Structural tubing shall conform to ASTM A 500, Grade B .

2.3 STEEL PIPE

Steel pipe shall conform to ASTM A 53, Type E Type S or Grade B as shown on the drawings.

2.4 HIGH STRENGTH BOLTS AND NUTS

High strength bolts shall conform to ASTM A 325, Type 1 with carbon steel nuts conforming to ASTM A 563, Grade C .

2.5 CARBON STEEL BOLTS AND NUTS

Carbon steel bolts shall conform to ASTM A 307, Grade A with carbon steel nuts conforming to ASTM A 563, Grade A.

2.6 NUTS DIMENSIONAL STYLE

Carbon steel nuts shall be Heavy Hex style when used with ASTM A 307 bolts or Heavy Hex style when used with ASTM A 325 or ASTM A 490 bolts.

2.7 WASHERS

Plain washers shall conform to ASTM F 844. Other types, when required, shall conform to ASME B18.21.1 .

2.8 PAINT

Paint shall conform to Section 09965

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC ASD Mnl. Fabrication and assembly shall be done in the shop to the greatest extent possible. The fabricating plant shall be certified under the AISC FCD for Category Supplement structural steelwork. Compression joints depending on contact bearing shall have a surface roughness not in excess of 500 micro inches as determined by ASME B46.1, and ends shall be square within the tolerances for milled ends specified in ASTM A 6/A 6M. Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type (slip-critical) high-strength bolted connections shall be prepared for painting in accordance with endorsement "P" of AISC FCD and primed with the specified paint.

3.2 ERECTION

a: Erection of structural steel, except as indicated in item b. below, shall be in accordance with the applicable provisions of AISC LRFD Vol I . Erection plan shall be reviewed, stamped and sealed by a structural engineer licensed by the state in which the project is located.

b. For low-rise structural steel buildings (60 feet tall or less and a maximum of 2 stories), the erection plan shall conform to AISC Pub No. S303 and the structure shall be erected in accordance with AISC Design Guide #10.

3.2.1 Structural Connections

Anchor bolts and other connections between the structural steel and foundations shall be provided and shall be properly located and built into connecting work. Field welded structural connections shall be completed before load is applied.

3.2.2 Base Plates and Bearing Plates

Column base plates for columns and bearing plates for beams, girders, and

similar members shall be provided. Base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed and properly positioned, but prior to placing superimposed loads. Separate setting plates under column base plates will not be permitted. The area under the plate shall be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.2.3 Field Priming

After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

-- End of Section --

SECTION 05502

MISCELLANEOUS METALWORK

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of providing all plant, equipment, materials and labor for fabricating, furnishing, erecting, and installing all metalwork, standard articles, and shop-fabricated items. Miscellaneous metalwork specifically covers the furnishing, fabrication, and installation of the stoplog closure gap structure and associated items, including the lifting beam, and the gate well structures including associated items. Miscellaneous metalwork, standard articles and shop-fabricated items include all materials not covered elsewhere in these Specifications for payment items, but are indicated or shown on the contract drawings which are incidental or listed herein, along with all sundry items not specifically mentioned, including handrails; grab bars; ladder rungs; landing platforms; ladders; gratings; grate covers; safety chains; padlocks; cable; shackles and turnbuckles; plates, angles, wide flange posts, lifting beam; drain pipe and miscellaneous items for stoplog gap and stoplog storage; angle posts; embedded plates and angles for miscellaneous items such as blockouts, sills, recesses, pedestals and tie-downs; rubber J-seals; neoprene strip, eyebolts; and studs.

1.2 RELATED WORK SPECIFIED ELSEWHERE

1.2.1 Structural Metals

Fabrication requirements and workmanship provisions for items specified in this section shall conform with the requirements of Section: 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

1.2.2 Painting

Section 09965 PAINTING:HYDRAULIC STRUCTURES.

1.2.3 Concrete

Section 03301 CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS.

1.3 REFERENCE PUBLICATIONS

The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this Specification to the extent indicated by the references thereto or as required:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.2.1	(1981) Square and Hex Bolts and Screws, Including Hex Cap Screws, and Lag Screws

ANSI B18.2.2	(1989) Square and Hex Nuts
ANSI B18.2.3	(1989) Socket Cap, Shoulder and Set Screws
ANSI B18.6.2	(R1983) Square Head Set Screws, and Slotted Headless Set Screws
ANSI B18.6.3	(R1983) Slotted and Recessed Head Machine Screws and Machine Screw Nuts
ANSI B18.21.1	(R1983) Lock Washers
ANSI B18.22.1	(R1983) Plain Washers
ANSI/NAAMM MBG 531	Gratings, Metal, Bar Type (Floor, Except for Naval Vessels

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)Org

ASME B46.1	(1955) Surface Texture (Surface Roughness, Waviness and Lay

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A1	(1984) Carbon Steel Tee Rails
ASTM A27	(1991) Steel Castings, Carbon, for General Application
ASTM A36	(1991) Structural Steel
ASTM A53	(1990b) Pipe, Steel, Black adn Hot-Dipped, Zinc-Coated Welded and SeamlessRef Title
ASTM A108	(1990a) Steel Bars, Carbon, Cold-Finished, Standard Quality
ASTM A123	(1989a) Zinc (Hot-Galvanized) Coatings on Iron and Steel Products
ASTM A153	(R1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A167	(1991) Stainless and Heat-Resisting Chromium-Nickel Stell Plate, Sheet and Strip
ASTM A193	(1991a) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

ASTM A194	(1991) Carbon and Alloy-Steel Nuts for Bolts for High-Temperature Service
ASTM A276	Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A307	(1991) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A325	(1991c) Structural Bolts, Steel, Heat-Treated, 12/1-5 ksi Minimum Tensile Strength
ASTM A570	(1991) Steel Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM A603	(1988) Zinc-Coated Steel Structural Wire Rope
ASTM A668/A668M	(1996) Steel Forgings, Carbon and Alloy, for General Industrial Use
ASTM A780	(1990) Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM B6	(1987) Zinc (Slab Zinc)
ASTM B209	(1992a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B211	(1992a) Aluminum and Aluminum-Alloy Bar, Rod, and Wire
ASTM B241	(1992a) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B255	(1983a) Sintered Bronze Structural Parts
ASTM B308	(1992a) Aluminum-Alloy 6061-T6 Standard Structural Shapes

FEDERAL SPECIFICATION (FED. SPEC.)

FF-S-325	Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
QQ-B-637	Brass, Naval: Rod, Wire, Shapes, Forgings, and Flat Products with Finished Edges (Bar, Flat Wire and Strip)
QQ-L-201	Lead Sheet

RR-C-271	Chains and Attachments, Welded and Weldless

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

1992	Standard Specifications for Highway Bridges

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1922	(Rev A) Shield, Expansion (Caulking Anchors, Single Lead)
CID A-A-1923	(Rev A) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)
CID A-A-1924	(Rev A; Notice 1) Shield, Expansion (Shelf Drilling Tubular Expansion Shell Bolt Anchors)
CID A-A-1925	(Rev A; Notice 1) Shield, Expansion (Nail Anchors)
CID A-A-55614	(Rev A) Shield, Expansion (Non-Drilling Expansion Anchors)
CID A-A-55615	(Rev A) Shield, Expansion (Wood Screw and Lag Bolt Self-Threading Anchors)
CID A-A-60005	(Rev E; Notice 1) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

1.4 QUALITY CONTROL

1.4.1 General

The Contractor shall establish and maintain quality control for the work specified in this section to assure compliance with the contract requirements and shall maintain detailed records of his quality control for construction opera-tions, including, but not limited to the following:

(a)Material;
(b)Fabrication and workmanship;
(c)Welding; and
(d)Installation.

1.4.2 Certification

The Contractor shall certify that all materials, either specifically

manufactured for this work or manufactured as a stock item, conform to the requirements of these Specifications. Such certification will not relieve the Contractor of responsibility for any fault in operation, workmanship, or material that may develop before the completion of his work or guarantee. Tests shall be made as indicated in the respective section of the Specifications or on the contract drawings and in the presence of the Contracting Officer's Representative (COR). The Contractor shall furnish the COR certified results in triplicate of any required tests or analyses.

1.4.3 Workmanship

1.4.3.1 General

Workmanship shall be of the highest grade in accordance with the best modern practices to conform to the specifications for the item of work being furnished.

1.4.3.2 Commercial Equipment

Commercial equipment furnished under this contract, but not designed especially for this particular project, shall be the standard product of a manufacturer regularly engaged in the manufacture of equipment of this type, of current manufacture, new and unused, built on the multiple or repetitive system, suitable for the intended use. The provisions of this section shall not apply to the manufacture of the items themselves, except as specifically directed by the COR.

1.4.4 Reporting

Three copies of these records and tests, as well as records of corrective action taken, shall be furnished to the COR daily when work under this Section is being performed.

1.5 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Lists of Materials, para 1.5; GA-RE.

The Contractor shall furnish three copies of all purchase and mill orders, shop orders and work orders. The Contractor shall furnish a list designating the material to be used for each item at the time of submittal of shop drawings. Where mill tests are required, purchase orders shall contain the test site address and the name of the testing agency. The Contractor shall also furnish a shipping bill or memorandum of each shipment of finished pieces or members to the project site giving the designation mark and weight of each piece, the number of pieces, the total weight and the car initial and number.

SD-04 Drawings

Shop Drawings, para 1.5; GA-EC.

Drawings shall include catalog cuts, templates, fabrication, erection and assembly details, and type, grade and class of materials as appropriate. Elements of fabricated items inadvertently omitted on contract drawings shall be detailed by the fabricator and indicated on the shop drawings.

Recess Frames; GA-EC.

Anchorage drawings.

SD-08 Statements

Manufacturer Design Calculations; GA-EC.

For railings and landing platforms, manufacturer design calculations, showing that the installed railings and the landing platform are capable of withstanding loads specified, shall be submitted and approved prior to installation

SD-13 Certificates

Certification, para 1.5; GA-RE.

Certification of material tests and analyses, examinations, welding procedures and welding operator qualifications shall be submitted in triplicate for approval. Test reports for material tests and analyses shall be identified with specific lots and items prior to installation.

1.6 WELDING PROCEDURES

Welding shall be in accordance with Section: 05055.

PART 2 PRODUCTS

2.1 MATERIALS

Materials and standard articles shall conform to the respective specifications and any specific requirements. Sizes shall be as specified or shown on drawings. Where material requirements are not specified, materials furnished shall be suitable for the intended use and shall be approved by the COR.

2.1.1 Structural Steel

Shall be inaccordance with Section 05120 Structural Steel.

2.1.1.1 Stainless Steel Shapes

ASTM A276, Type 304.

2.1.1.2 Stainless Steel Plate, Sheet and Strip

ASTM A167, Type 304.

2.1.2 Steel Pipe

ASTM A53, Type E or S, seamless black or galvanized, nominal size and weight class or outside diameter and nominal wall thickness, all as shown on the drawings.

2.1.3 Lead Sheet

Fed. Spec. QQ-L-201, grade as indicated.

2.1.4 Zinc

ASTM B6, grade as indicated.

2.1.5 Bolting Material

Bolts, nuts, and washers shall be of the material, grade, type, class, style, and finish indicated or best suited for intended use.

2.1.5.1 High-Strength Bolts, Nuts, and Washers

ASTM A325.

2.1.5.2 Bolts, Nuts, and Washers (Other than High-Strength)

2.1.5.2.# Bolts and Nuts

ASTM A307, grade A.

2.1.5.2.# Bolts

ANSI B18.2.1.

2.1.5.2.# Nuts

ANSI B18.2.2.

2.1.5.2.# Washers

a. Plain Washers: ANSI B18.22.1, Type B
b. Lock Washer: ANSI B18.21.1.

2.1.5.2.# Corrosion-Resisting Bolts and Studs

ASTM A193, Type 304; Corrosion-resisting nuts: ASTM A194, Type 304.

2.1.5.2.# Welded Studs

ASTM A108.

2.1.5.3 Screws

Screws shall be of the material, grade, type, style, and finish indicated or best suited for use intended.

2.1.5.3.# Cap Screws

ANSI B18.2.1, ANSI B18.3, or ANSI B18.6.2, as required.

2.1.5.3.# Machine Screws

ANSI B18.6.3.

2.1.5.3.# Set Screws

ANSI B18.6.2.

2.1.5.3.# Bronze Fasteners

Bronze fasteners where shown on the contract drawings shall conform to the requirements of ASTM B98, Alloy 655 (Hard).

2.1.5.3.# Brass Fasteners

Brass fasteners shall meet the requirements of either ASTM B16 or B21.

2.1.5.3.# Stainless Steel Screws

Stainless steel screws, bolts, and studs shall meet the requirements of ASTM A193, Type 304.

2.1.6 Expansion Anchors

Anchors shall be stainless steel Maxi-Bolt from Drillco National Group, Long Island City, New York, or an approved equal.

2.1.7 Chains and Attachments

Fed. Spec. RR-C-271.

2.1.8 Floor Gratings (Fabricated)

ANSI/NAAMM MBG 531

2.1.8.1 Description of grating: w - 19 - 4 (1-1/4 x 3/16)

2.1.8.2 Anchorage:

As shown on the plans or as recommended by the manufacturer and approved by the COR.

2.1.8.3 Finish:

Steel zinc-coated in accordance with ASTM A123 after fabrication, and steel hardware and fasteners completely zinc-coated in accordance with ASTM A153/A153M.

2.1.9 Landing Platforms, Fixed Ladders, Ladder Rungs and Grab Bars

Material for landing platforms, fixed ladders, ladder rungs and grab bars shall meet the requirements of ASTM A36. All ladder rungs shall have a minimum diameter of one inch and Galvanized.

2.1.10 Galvanizing

If specified, galvanizing shall conform to the requirements of either ASTM A123 or ASTM A153, whichever is applicable.

2.1.11 Bituminous Fill

Bituminous concrete fill for rail recesses where shown on the Contract Drawings shall meet requirements of Section: ASPHALTIC CONCRETE INTERMEDIATE LEVELING AND SURFACE COURSES. Material shall be placed and hand-tamped to dimensions and at locations indicated. Where material will contact the face of rail, a tack coat shall be applied to the face of the rail in accordance with Section: BITUMINOUS TACK COAT.

2.1.12 Cable

Cables for stoplog storage shall be 1/4-inch diameter strand meeting the requirements of ASTM A586 for zinc-coated steel structural strand, with a Class A coating inner wire and Class C coating outer wires.

2.1.13 Hinges

Hinges shall be wrought steel, sized as shown on the drawings. The hinges shall be furnished blank for welding and shall have corrosion-resistant pins.

2.1.14 Padlocks and Hasps

Padlocks shall be furnished with heavy-duty corrosion-resistant case and shall be keyed alike. The Contractor shall furnish two keys to fit all locks furnished. Hasps shall be wrought steel, sized where required to accommodate padlocks

2.1.15 Ratchet Load Binder

The ratchet load binder shall be a one-piece unit furnished with steel hooks which can be attached to a 1/2-inch chain. The binder shall be ratchet operated capable of a minimum 8-inch take-up.

2.1.16 Shackles and Turnbuckles

Shackles and turnbuckles shall be forged steel in accordance with ASTM A668. Turnbuckles shall be end threaded right- and left-hand and shall be of the size as shown on the contract drawings. Shackle for the lifting

beam shall be a D-Shackle, one inch diameter, suitable to accomodate the lifing hook

2.1.17 Elastomeric Bearing Pads

Elastomeric bearing pads shall conform to the requirements of AASHTO, Division II, Section 18.

2.2 FABRICATION

2.2.1 General

Except as otherwise specified, all fabrication, welding, machine work. assembly, erection and testing shall be in accordance with Section: 05055. All metal not otherwise shown on the contract drawing, specified herein or otherwise approved by the Contracting Officer's Representative, shall be structural steel. Shop drawings for all items covered by this Section shall be submitted for approval in accordance with specification Section, SUBMITTAL PROCEDURES.

2.2.2 Handrails

Handrails shall be of the type specified and shown on the drawings and shall be furnished and installed complete with all fittings, brackets, fasteners, sleeves, anchors, and other appurtenances as shown and as required for proper installation.

2.2.2.1 Materials

Steel railings shall be as specified in paragraph , titled "Steel Pipe". Other appurtenances shall be of the same material as the rails and posts or approved compatible materials. Railings shall be galvanized after fabrication.

2.2.2.2 Fabrication

Rigid joints in railings shall be welded and shall be flush-finished. Welded joints shall be reinforced with tight-fitting interior sleeves and shall be assembled by welding rails and posts to flush-type fittings, or by mitering and welding joining rails and posts. Slip-on fittings shall be tight-fitting. Fasteners for slip-on fittings shall be the self-locking, concealed type. Expansion joints in railings shall be an inner-sleeved slip-joint, with one end of the sleeve secured to one rail and the ends of the adjoining rails separated a minimum of 1-inch in the installed position. Expansion joints shall be located in rails near the intersection of rails and posts. Bends in railings shall be made in a manner that railings are not crushed and shall maintain their original cross-sectional shape. Welds shall be ground smooth. Railings shall be free of burrs, sharp corners, and sharp edges. Handrails shall be designed to meet EM 385-1-1, US Army Corps of Engineers, Safety and Health Requirements Manual and OSHA requirements. The design shall include a design working load of 200 pounds applied in any direction at any point on the top rail without exceeding the specified minimum yield stress at any point in any cross-section of the rail system. Design of the rail anchorage shall

include the 200-pound load applied to the rail. Design calculations must be submitted and approved prior to installation.

2.2.2.3 Installation

Railings shall be installed as specified and shown on the drawings. Railing posts anchored to concrete surfaces perpendicular to the posts shall be set in pipe sleeve inserts with a steel plate welded to the bottom of the sleeve, and anchored in the concrete. The space between posts and sleeves shall be filled with non-shrink grout in accordance with Section 03301: CAST-IN-PLACE CONCRETE, and covered with standard collar fittings secured to the posts. A 1/4-inch drain hole shall be drilled near the bottom of each post.

2.2.3 Gratings (Fabricated)

Grating shall be of the material and size shown on the drawings, and shall be fabricated in sectional panels of the width and length shown on the drawings or as appropriate, to accurately fit within the supporting recess frames. Openings through panels shall be provided as shown on the drawings or as required. Hinged panels shall be provided with hinges of the type shown on the drawings or suitable for the application. Steel gratings shall be galvanized after fabrication. Edges of gratings and openings through gratings which require the cutting of more than one bearing bar shall be banded. Fasteners shall be of the type recommended by the manufacturer and approved by the COR.

2.2.4 Recess Frames

Recess frames shall be fabricated of structural shapes. The anchorage design drawings and details shall be submitted by the Contractor for approval by the COR. Welded joints in frames shall be ground smooth. Steel frames shall be galvanized after fabrication. Frames shall be anchored to supports in the manner shown on the drawings and shall not be continuous across contraction or expansion joints.

2.2.5 Ladder Rungs and Grab Bars

Rungs and grab bars shall be fabricated from steel bars (round) in accordance with the requirements of EM 385-1-1 including Appendix J or as shown on the drawings and shall be galvanized after fabrication.

2.2.5.1 Ladders

Ladders shall be fixed-rail metal ladders conforming to the requirements of EM 385-1-1 and to details shown. Ladders shall be fabricated of structural steel as shown and shall be galvanized after fabrication. Fabrication of ladders shall consist of solid-section rod rungs fitted into holes in bar side rails and welded. Splices in side rails shall be made using full penetration welds and shall provide a flush and smooth transition between connecting ends. All welds shall be ground smooth Ladder rails shall be welded to bent-bar supporting brackets anchored to supporting structure as shown.

2.2.6 Embedded Items

Armor angles, armor plates, frames and miscellaneous steel embedded items shall be fabricated and erected true to line and grade. Edges of exposed faces may have a vertical or horizontal distortion from a straight line not greater than 0.025 inch per foot of length provided that the distortion for any single piece shall not exceed 1/4-inch. Length deviation of assemblies shall not be cumulative error so that the unit does not fit or function as shown on the contract drawings. Plates shall be flat, not varying from a true surface by more than 1/8-inch at any point. Unless specified to be galvanized or stainless steel, all surfaces shall be given a primer coat of the required paint prior to installation. Exposed surfaces shall then be field painted with required finish coats. Stoplog sill and seal plates shall meet the dimensional tolerances of paragraph titled " Construction Tolerances, Section: 03301.

2.2.7 Finish Surfaces

Finishes shall in general conform to the requirements of the paragraph titled "Machine Work" of Section: 05055, and as further specified herein.

Contact surfaces of steel plates or bars used for clamping the rubber J-seals in proper position shall be surface finished to a roughness value of 125 micro-inches in accordance with the provision of ASME B46.1.

2.2.8 Painting

Painting shall be in accordance with Section 09965 PAINTING:HYDRAULIC STRUCTURES.

2.2.9 Landing Platforms

Landing platforms and appurtenances shall be designed to meet EM 385-1-1, US Army Corps of Engineers, Safety and Health Requirements Manual and OSHA requirements. The landing platforms shall also be designed for the loads specified herein. The platform and platform supports shall be designed for working loads as follows: a uniform vertical load of 100 pounds per square foot and a concentrated vertical load of 300 pounds each applied at the platform level. The uniform load and the concentrated load may be applied independently. The concentrated load shall be applied at locations which provide maximum stress in each individual member of the platform and platform supports. The platform deck shall be composed of steel grating as specified in paragraph 2.1.8 titled "Floor Gratings (Fabricated)". The handrail design shall include a design working load of 200 pounds applied in any direction at any point on the top rail without exceeding the specified minimum yield stress at any point in any cross-section of the rail and platform system. Design of the rail anchorage and the platform support shall include the 200-pound load applied to the rail. The handrail load shall be applied concurrent with the platform loads. Maximum deflection of the platform shall not exceed 1/4-inch. Anchorage to the wall shall be designed using expansion anchors as specified in paragraph 2.1.6 titled "Expansion Anchors". The platform frame and handrail may be welded and/or a bolted unit; however, the unit must be capable of removal through the entrance hatch either as a unit or as an assemblage. Design

calculations must be submitted and approved prior to installation.

PART 3 EXECUTION

3.1 ERECTION

3.1.1 General

Installation and erection of all parts of this work shall be in accordance with the approved shop drawings, erection diagrams or working drawings. All parts to be installed shall be thoroughly cleaned. Packing compounds, rust, dirt, grit, and other foreign matter shall be removed. Holes and grooves for lubrication shall be cleaned. Enclosed chambers or passages shall be examined to make sure that they are free from damaging materials. Where units or items are shipped as assemblies they will be inspected by the COR prior to installation. Disassembly, cleaning, and lubrication will not be required except where there is indication that such work is necessary to place the assembly in a clean and properly lubricated condition. Pipe wrenches, cold chisels, or other tools likely to cause damage to the surfaces of rods, nuts, or parts shall not be used for the work of assembling and tightening parts. Bolts and screws shall be tightened firmly and uniformly, but care shall be taken not to overstress the threads. When a half nut is used for the purpose of locking a full nut, the half nut shall be placed first and followed by the full nut. Threads of all bolts, except high strength bolts, nuts, and screws shall be lubricated by graphite and oil before assembly. Threads of corrosion-resisting steel bolts and nuts shall be coated with a suitable anti-galling compound. Driving and drifting bolts or keys will not be permitted.

3.1.2 Alignment and Setting

Each structural unit shall be accurately aligned by the use of steel shims or other approved methods so that no binding in any moving parts or distortion of any member occurs before it is finally fastened in place. The alignment of all parts with respect to each other shall be true within the respective tolerance required.

3.1.3 Blocking and Wedges

All blocking, wedges, or shims used for the support, during installation, of parts to be grouted in shall be removed before final grouting, unless otherwise directed by the COR. Blocking, wedges or shims left in the foundation with the approval of the COR shall be of steel or iron.

3.1.4 Foundations and Grouting

Concreting of sub-bases and frames and the final grouting under base plates shall be in accordance with the procedures as specified in Section: CAST-IN-PLACE CONCRETE. Grouting under base plates, structural units, or castings to build them up to proper grade or alignment will not be permitted, without blocking or the use of wedges or shims.

3.1.5 Corner Protection and Armor Angles and Plates

Steel wall armor and protection angles and plates required at the gate post concrete for the rolling gate closures, for the stoplog gap guides, and stoplog post guides shall be set in the forms true to line and grade. All wall armor shall be given a primer coat of the required paint on all surfaces prior to installation in the forms.

3.2 PAINTING

Corrosion-resisting surfaces, rubber seals, bearing surfaces, machined surfaces and surfaces specified to be galvanized shall not be painted. The surfaces of the rolling gates, including brackets, wheels (except tread), and miscellaneous appurtenances shall be painted as specified in Section 09965 PAINTING:HYDRAULIC STRUCTURES.

3.3 TRIAL OPERATION AND TEST

The intermediate posts and stoplogs will be placed. The lifting beam will be used whenever stoplogs are lifted. The placement shall be performed at least two times to demonstrate, to the satisfaction of the COR, compliance with the specification requirements and acceptable operation. In the closed position, the COR will visually inspect the position of the seals for unacceptable fit. There shall be no gaps between the seal and the sealing surface.

SECTION 05615

STOPLOGS
04/93

PART 1 GENERAL

The work covered by this section consists of furnishing all equipment, materials and labor for fabricating and installing the aluminum stoplogs at the locations shown on the contract drawings. This also includes the canvas covering of the stoplog when in storage.

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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1994) Carbon Structural Steel
ASTM A 153/A 153M	(1995) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 193/A 193M	(1998) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 242/A 242M	(1993a) High-Strength Low-Alloy Structural Steel
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength
ASTM A 320/A 320M	(1994a) Alloy Steel Bolting Materials for Low-Temperature Service
ASTM A 325	(1994) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 325M	(1993) High-Strength Bolts for Structural Steel Joints (Metric)
ASTM A 490	(1993) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
ASTM A 490M	(1993) High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A 529/A 529M	(1994) High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A 572/A 572M	(1994c) High-Strength Low-Alloy Columbium-Vanadium Structural Steel

ASTM A 588/A 588M	(1994) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM B 221	(1995a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM B 308/B 308M	(1995a) Aluminum-Alloy 6061-T6 Standard Structural Shapes
ASTM D 395	(1989; R 1994) Rubber Property - Compression Set
ASTM D 412	(1992) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 413	(1982; R 1993) Rubber Property - Adhesion to Flexible Substrate
ASTM D 471	(1995) Rubber Property - Effect of Liquids
ASTM D 572	(1988; R 1994) Rubber - Deterioration by Heat and Oxygen
ASTM D 2240	(1995) Rubber Property - Durometer Hardness

AMERICAN WELDING SOCIETY (AWS)

AWS D1.2	(1997) Structural Welding Code - Aluminum
AWS D1.2A	(1983) Commentary on Structural Welding Code - Aluminum

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.21.1	(1994) Lock Washers (Inch Series)
ASME B46.1	(1995) Surface Texture (Surface Roughness, Waviness, and Lay)

1.2 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Sequencing and Scheduling; GA-RE.

Sequencing and scheduling plan shall be submitted and approved before the work is commenced.

SD-04 Drawings

Detail Drawings; GA-RE.

Detail drawings shall be submitted as specified in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

SD-07 Schedules

Materials; FIO.

Materials orders, materials lists and materials shipping bills shall be submitted as specified in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

SD-08 Statements

Welding; GA-RE.

Schedules of welding procedures for aluminum and welding processes for aluminum shall be submitted as specified in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

SD-09 Reports

Tests, Inspections, and Verifications; FIO.

Certified test reports for material tests shall be submitted with all materials delivered to the site.

SD-18 Records

Materials Disposition Records; FIO.

A system of identification which shows the disposition of specific lots of approved materials and fabricated items in the work shall be established and submitted before completion of the contract.

1.3 QUALIFICATION OF WELDERS AND WELDING OPERATORS

Qualification of welders and welding operators shall conform to the requirements of Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

1.4 DELIVERY, STORAGE AND HANDLING

Delivery, handling and storage of materials and fabricated items shall conform to the requirements specified herein and in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

1.4.1 Rubber Seals

Rubber seals shall be stored in a place which permits free circulation of air, maintains a temperature of 70 degrees F or less, and prevents the rubber from being exposed to the direct rays of the sun. Rubber seals shall be kept free of oils, grease, and other materials which would deteriorate the rubber. Rubber seals shall not be distorted during handling.

1.5 SEQUENCING AND SCHEDULING

Develop a sequencing and scheduling plan which illustrates that work affecting railroads and roadways has been coordinated with the approprate group as listed under the Section Special Scheduling. The plan shall include schedules, lists of labor or materials to be provided to the affected company and agency, and any other aspects of the work that may impact on the operations of these entities. The plan shall clearly demonstrate how all railroad tracks, public or private roads, streets, or highways will be kept open to traffic at all times during the construction period, except as otherwise specified or directed. Refer to all sections for other requirements such as warning signs, flagmen, permits, and debris removal for work to be done.

1.6 Deleted

PART 2 PRODUCTS

2.1 MATERIALS

Materials orders, materials lists and materials shipping bills shall conform to the requirements of Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

2.1.1 Metals

Structural steel , structural aluminum, and other metal materials sections and standard articles shall be as shown and as specified herein and in Section 05502 METALS: MISCELLANEOUS METALWORK.

2.1.1.1 Structural Aluminum

Structural aluminum shall conform to ASTM B 308/B 308M (1995a) Aluminum-Alloy 6061-T6 Standard Structural ShapesAlloy 6061, Temper T6. Also ASTM B 221(1995a) for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

2.1.2 Stoplog Storage

Stoplog storage shall include cable, chain, eyebolts, plates, studs, a neoprene strip and a padlock, as specified in Section: 05055 MISCELLANEOUS METAL WORK.

The covering over the stoplog stack in storage position may be a commercially manufactured waterproof treated canvas material with reinforced eyelets spaced along the edges for tie-down purposes. The canvas covering shall be sized to cover the stoplog stack. A sample canvas covering shall be submitted to the COR for approval.

2.1.3 Rubber Seals

Rubber seals shall be of the molded type only, shall be compounded of natural rubber, synthetic polyisoprene or a blend of both and shall contain reinforcing carbon black, zinc oxide, accelerators, antioxidants, vulcanizing agents and plasticizers. Physical characteristics of the seals shall meet the following requirements:

Physical Test	Test Value	Test Method Specification
Tensile Strength	2500 psi (min.)	ASTM D412
Elongation at Break	450% (min.)	ASTM D412
300% Modulus	900 psi (min.)	ASTM D412
Durometer Hardness (Shore Type A)	60 to 70	ASTM D2240
Water Absorption	5% by weight (max.)	ASTM D471
Compression Set	30% (max.)	ASTM D395
Tensile Strength (After aging 48 hrs)	80% of tensile strength (min)	ASTM D572

The "Water Absorption" test shall be performed with distilled water. The washed specimen shall be blotted dry with filter paper or other absorbent material and suspended by means of small glass rods in the oven at a temperature of 70 degrees + 2 degrees C for 22 hours + 1/4 hour. The specimen shall be removed, allowed to cool to room temperature in air and weighed. The weight shall be recorded to the nearest 1 mg as W1 (W1 is defined in ASTM D471). The immersion temperature shall be 70 degrees + 1 degree C and the duration of immersion shall be 166 hours.

2.2 MANUFACTURED UNITS

Commercial equipment furnished under this contract, but not designed especially for this particular project, shall be the standard product of a manufacturer regularly engaged in the manufacture of equipment of this type, of current manufacture, new and unused, built on the multiple or repetitive system, suitable for the intended use, and the provisions of this section shall not apply to the manufacture of the items themselves, except as specifically directed by the Contracting Officer's Representative.

2.2.1 Screws, Bolts, Nuts and Washers

Stainless Steel screws, bolts,nuts and washers shall meet the requirements of ASTM A 193/A 193M, Type 304. Bolts 1/2 inch and larger shall have hexagon heads. The finished shank of bolts shall be long enough to provide full bearing. Washers for use with bolts shall conform to the requirements specified in the applicable specification for bolts.

2.3 FABRICATION

2.3.1 Detail Drawings

Detail drawings of stoplogs and appurtenant shop fabricated items, including fabrication drawings, shop assembly drawings, delivery drawings, and field installation drawings, shall conform to the requirements specified and in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

2.3.1.1 Fabrication Drawings

Fabrication drawings shall show complete details of materials, tolerances, connections, and proposed welding sequences which clearly differentiate shop welds and field welds.

2.3.1.2 Shop Assembly Drawings

Shop assembly drawings shall provide details for connecting the adjoining fabricated components in the shop to assure satisfactory field installation.

2.3.1.3 Delivery Drawings

Delivery drawings shall provide descriptions of methods of delivering components to the site, including details for supporting fabricated components during shipping to prevent distortion or other damages.

2.3.1.4 Field Installation Drawings

Field installation drawings shall provide a detailed description of the field installation procedures. The description shall include the location and method of support of installation and handling equipment; provisions to be taken to protect concrete and other work during installation; method of maintaining components in correct alignment; and methods for installing appurtenant items.

2.3.2 Structural Fabrication

Structural fabrication shall conform to the requirements specified and in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

2.3.3 Finishes

Contact surfaces of aluminum plates or bars for clamping the rubber J-seals shall be surface finished to a roughness value of 125 micro-inches using ASME B46.1 standards.

2.3.4 Welding

Welding shall conform to the requirements specified in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS. Field welding is not permitted. All welds shall be continuous.

2.3.5 Bolted Connections

Bolted connections shall conform to the requirements specified in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

2.3.6 Machine Work

Machine work shall conform to the requirements specified in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS AND SECTION 05120.

2.3.7 Miscellaneous Provisions

Miscellaneous provisions for fabrication shall conform to the requirements specified and in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS. Zinc coating of hardware items shall conform to ASTM A 153/A 153M. All component parts shall be protected from galvanic corrosion due to contact between dissimilar materials.

2.3.8 Fabrications

2.3.8.1 Stoplogs

Stoplogs shall be fabricated using materials of the size and thickness indicated on the contract drawings, or if not indicated, as required to

limit the maximum bending stress to 7000 psi. Stoplog components shall be fabricated using the extrusion process with individual components welded to form completed units per AWS D1.2.

Stoplog units shall be fabricated true and straight and shall not be more than 1/16-inch out of straightness per 10-foot length of the unit. In addition, stoplog units shall be within a maximum tolerance of 1/16-inch for camber and sweep, and within a maximum tolerance of 1/16-inch for twist per 10-foot length of the unit.

Contact surfaces between the stoplogs and the edge grooves, and between the adjacent stoplogs themselves, shall be smooth mill finish. The channel frame shall be mitered, and shop welds shall be ground smooth.

2.3.8.2 Stoplog Guides

Stoplog guides shall be fabricated of structural steel conforming to ASTM A 36/A 36M .

2.3.8.3 Miscellaneous Embedded Metals

Corner protection angles, frames, base plates, and other embedded metal items required for complete installation shall conform to the details shown.

2.3.9 Seal Assemblies

Seal assemblies shall consist of rubber seals, stainless steel retainer and spacer bars, and fasteners. Rubber seals shall be continuous over the full length. Seals shall be accurately fitted and drilled for proper installation. Bolt holes shall be drilled in the rubber seals by using prepared templates or the retainer bars as templates. Splices in seals shall be fully molded, develop a minimum tensile strength of 50 percent of the unspliced seal, and occur only at locations shown. All vulcanizing of splices shall be done in the shop. The vulcanized splices between molded corners and straight lengths shall be located as close to the corners as practicable. Splices shall be on a 45 degree bevel related to the "thickness" of the seal. The surfaces of finished splices shall be smooth and free of irregularities. Finishes shall conform to the requirements of the paragraph titled "Machine Work" in Section 05055. The contact surfaces of the aluminum plates or bars used for clamping the rubber J-seals in proper position shall be surface finished to a roughness value of 125 micro-inches in accordance with the provisions of ANSI B46.1.

2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

Tests, inspections, and verifications for materials shall conform to the requirements specified in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall conform to the requirements specified and in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

3.2 PROTECTION OF FINISHED WORK

Protection of finished work shall conform to the requirements specified in

Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

3.3 ACCEPTANCE TRIAL OPERATION

After completion of installation, the Contracting Officer will examine the stoplog installation for final acceptance. The individual components of the stoplog installation will be examined first to determine whether or not the workmanship conforms to the specification requirements. The Contractor will be required to place the stoplogs in the guides a sufficient number of times, a minimum of two times to demonstrate that the stoplogs fit properly and seat uniformly. Required repairs or replacements to correct defects, shall be made at no cost to the Government. The trial operation shall be repeated after defects are corrected.

-- End of Section --

SECTION 05650

RAILROADS
12/99

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 basic designation only.

AMERICAN RAILWAY ENGINEEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA Manual	(1999) Manual for Railway Engineering (4 Vol.)
AREMA Track Plans	(1999) Portfolio of Track Work Plans

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ASNT CP-189	(1995) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 325	(1997) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 325M	(1997) High-Strength Bolts for Structural Steel Joints (Metric)
ASTM A 490	(1997) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
ASTM A 490M	(1993) High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 127	(1988; R 1993el) Specific Gravity and

	Absorption of Coarse Aggregate
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 142	(1978; R 1997) Clay Lumps and Friable Particles in Aggregates
ASTM C 535	(1996el) Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 702	(1998) Reducing Samples of Aggregate to Testing Size
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 217	(1997) Cone Penetration of Lubricating Grease (IP50/88)
ASTM D 402	(1997) Distillation of Cut-Back Asphaltic (Bituminous) Products
ASTM D 445	(1997) Kinematic Viscosity of Transparent and Opaque Liquids (the Calculation of Dynamic Viscosity)
ASTM D 566	(1997) Dropping Point of Lubricating Grease
ASTM D 1241	(1968; R 1994el) Materials for Soil-Aggregate Subbase, Base, and Surface Courses
ASTM D 1310	(1986; R 1997el) Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus
ASTM D 1556	(1990; R 1996el) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 1683	(1990a) Failure in Sewn Seams of Woven Fabrics
ASTM D 2171	(1994) Viscosity of Asphalts by Vacuum Capillary Viscometer

ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3740	(1999b) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D 3776	(1996) Mass Per Unit Area (Weight) of Woven Fabric
ASTM D 4354	(1996) Sampling of Geosynthetics for Testing
ASTM D 4355	(1992) Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491	(1999) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(1991; R 1996) Trapezoid Tearing Strength of Geotextiles
ASTM D 4595	(1986; R 1994) Tensile Properties of Geotextiles by the Wide-Width Strip Method
ASTM D 4632	(1991; R 1996) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4716	(1995) Determining the (In plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
ASTM D 4751	(1999) Determining Apparent Opening Size of a Geotextile
ASTM D 4759	(1988; R 1996) Determining the Specification Conformance of Geosynthetics
ASTM D 4791	(1999) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D 4833	(1988; R 1996el) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes
ASTM F 405	(1997) Corrugated Polyethylene (PE) Tubing and Fittings
ASTM F 512	(1995) Smooth-Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1998) Structural Welding Code - Steel

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C2	(1995) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes
AWPA C6	(1997) Cross Ties and Switch Ties Preservative Treatment by Pressure Processes
AWPA M2	(1997) Standard for Inspection of Treated Timber Products
AWPA M6	(1997) Brands Used on Forest Products
AWPA P2	(1995) Standard for Creosote Solutions

FEDERAL HIGHWAY ADMINISTRATION (FHWA)

FHWA SA-89-006	(1988) Manual on Uniform Traffic Control Devices for Streets and Highways

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 Data

Wood TiesGA-RE

Name of the tie manufacturer, Rail Tie Association membership, the wood species proposed, the quantities of ties for each specie proposed, and product data for the ties to be furnished, including the type of seasoning to be utilized, prior to ordering the ties

New Jointed Rail; GA-RE. Relay Rail; GA-RE.

Joint Bars; GA-RE. Compromise Joint Bars; GA-RE.

Manufacturer's data on new rail including: rail weight, rail section, drilling, rail length, date rolled, and the name of the mill where the rail was rolled. For relay rail the required information shall include weight, section, lengths, and the name of the supplier. The maximum allowable vertical wear on the rail head and the maximum allowable horizontal wear on the side of the rail shall be provided. The design of the joint bars and compromise joint bars proposed to be furnished with each rail section shall also be provided.

Miscellaneous Track MaterialsGA-RE

Manufacturer's data for all track materials to be furnished.

Components or Products; GA-RE.

Performance data for components or products proposed as an equivalent to those specified. The Contracting Officer's written approval is required for any such equivalent type component or product proposed to be used.

SD-04 Drawings

Standard details and layout of track.

SD-07 Schedules

Materials and Equipment; GA-RE.

A complete schedule of the materials proposed for installation within 60 days of receipt of notice to proceed, and before installation of the materials; the schedule shall include a list of equipment proposed for the work.

SD-08 Statements

Thermite Welding Procedures; GA-RE.

A detailed statement covering the step-by-step procedures to be employed in making the welds, including a complete description of each of the following items, as applicable, and any other essential characteristics included in the welding procedures:

a. The manufacturer's trade name for the welding process.

b. The method used for cutting and cleaning the rail ends. Flame cutting of rail ends will not be allowed.

c. The minimum and maximum spacing between rail ends.

d. The method used for maintaining the rails in alignment during

welding.

e. The method used for preheating, including time and temperature.

f. The tapping procedure, including the minimum time required to cool the weld under the mold insulation.

g. The method used, including a description of special tools and equipment, for removing the upset metal and finishing the weld to the final contour.

h. Quality control procedures to be followed.

i. The contractual agreements with any subcontractor employed by the Contractor in doing the work.

Electric Arc Welding

A detailed specification covering the step-by-step procedures to be employed in making the electric arc welds. A complete description of each of the following items as applicable and any other essential characteristics shall be included in the procedure specifications.

a. Type, size, and capacity of electric welding machine (250 amp minimum), grinder and other equipment. Also, type and size of material (welding rod or wire).

b. The method to be used to remove defective and excess metal prior to welding (arcair or grinding).

c. The method to be used to prevent warping.

d. The method used for preheating, including time and temperature.

e. The method of applying metal buildup and slag removal.

f. The method of securing original contour of items welded.

g. Quality control procedures to be followed.

h. Welding materials (rod or wire), name and manufacturer of materials (low carbon steel) for welding rail, rail frogs, guard rails, switch point protectors, and switch points without manganese inserts and materials (manganese alloy) for welding manganese frogs, RBM frogs, manganese switch point inserts and manganese railroad crossing inserts or castings.

SD-09 Reports

Sampling and Testing; GA-RE.

One certified copy of Test Reports for each test performed on the ballast and subballast within 2 working days of the test completion.

Wood Ties; GA-RE.

Certified test and inspection reports for crossties and switch ties subsequent to treatment, a minimum of seven calendar days prior to any ties being installed in track. Test and inspection reports shall contain the information required by Part 7 of AWPA M2.

Geotextiles; GA-RE.

Independent testing laboratory's certified test reports for geotextiles, including necessary analysis and interpretation. These reports shall provide results of the laboratory testing performed on samples of the geotextile material delivered to the jobsite. Test reports shall be submitted at least 5 working days prior to the installation of the geotextile.

Ultrasonic Test; GA-RE.

Results of the ultrasonic rail testing. Results shall list defects and rail stationing.

SD-13 Certificates

Wood Ties; GA-RE.

Certificates of compliance prior to any ties being installed in track.

Ballast; GA-RE. Subballast; GA-RE.

Certificates of Compliance for the ballast and subballast materials to be installed in this project.

Materials and Equipment; GA-RE.

Manufacturer's certificates of conformance for the following materials:

a. Rail.
b. Tie plates.
c. Track bolts, nuts, and spring washers.
d. Joint bars.
e. Rail anchors.
f. Track spikes.
h. Rail welding process.

SD-14 Samples

Geotextile; GA-RE.

Geotextile samples for testing. Samples shall be submitted a minimum of 30 days prior to the beginning of installation of the geotextiles. One sample shall be provided for each 20 units (rolls, panels, etc.) of geotextile to be used in the contract. All samples shall be from the same production lot as will be supplied for the contract. Samples shall be identified by the

manufacturer's name, brand name, lot designation, and project name. The minimum size of sample submitted for testing shall be the full width of the geotextile by 5 ft.

Ballast and Subballast Samples; GA-RE.

Samples of the ballast and subballast material for testing. Samples shall be submitted a minimum of 30 days prior to the installation of the material. Samples shall be obtained from the quarry, supplier, or other source that will be used to provide the ballast and subballast materials for this project using the methods described in ASTM D 75. One representative sample of not less than 200 lbs of ballast material shall be submitted for each 10,000 ton of ballast to be installed. One representative sample of not less than 200 lbs of subballast material shall be submitted for each 10,000 ton of subballast to be installed.

SD-18 Records

Record of Field Weld; GA-RE.

A welding record of each field weld on the form attached at the end of this section. The original copies of the form bearing the signatures and initials of personnel involved shall be submitted as part of the Project Record Documents.

Table VII; GA-RE.

A record of the items repaired or rebuilt by the electric arc welding method and grinding as shown on Table VII at the end of this section.

Waybills and Delivery Tickets; GA-RE.

Copies of waybills and delivery tickets for ballast and subballast during the progress of work. Certified waybills and delivery tickets for all ballast and subballast actually used.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Materials and Samples

The Contracting Officer will notify the Contractor of the materials approved or disapproved. Disapproved materials that have already been delivered to the project site, shall be promptly segregated from the approved materials and removed from the premises. If materials are disapproved, acceptable replacement materials shall be provided at no additional cost to the Government. Initial approval by the Contracting Officer will not prevent the removal and replacement of materials that are materially defective or materials not meeting this specification that are discovered during construction and/or routine quality control/quality assurance operations.

1.3.2 Geotextiles

Geotextiles shall be shipped and stored in their original ultraviolet

resistant cover until the day of installation. Geotextiles shall be protected from vandalism, temperatures greater than 140 degrees F, dirt, dust, mud, debris, moisture, sunlight, and ultraviolet rays. Geotextiles delivered to the project site shall be clearly labeled on the material cover to show the manufacturer's name, brand name, fabric type, location and date manufactured, lot identification, width, and length.

1.4 QUALIFICATIONS

1.4.1 Track Construction

Track construction shall be performed under the direction of qualified and competent supervisory personnel experienced in railroad construction.

1.4.2 Welding

Welding shall be performed under the direct supervision of an experienced welding supervisor or foreman.

1.5 PROJECT/SITE CONDITIONS

1.5.1 Temporary Work

During construction, suitable roads and crossings with all necessary lights, signs, drainage, and other appurtenances required for safe public and local travel shall be provided. Suitable temporary fences shall be erected and maintained where required to prevent trespass upon work or damage to adjoining property. Drainage shall be maintained, and the accumulation of water that might affect the stability of the roadbed will not be permitted.

1.5.2 Welding

Welding shall not be performed in rain, snow, or other inclement weather without adequately protecting the weld from the elements.

1.5.3 License Agreement

The work under this contract is being accomplished under a license agreement between the RAIL CORPORATION (hereinafter referred to as the Railroad Company) and the UNITED STATES OF AMERICA executed on this construction contract.

1.5.3.1 Provisions and Requirements

The following provisions and requirements are made a part of this contract in order for the UNITED STATES OF AMERICA to perform its obligations under the License agreement:

a. The Contractor shall perform the work in conformance with the standards of care and practice appropriate to the nature of the work.

b. The Contractor shall allow the Railroad Company to view and

inspect the work at any time.

c. The Contractor shall not enter the Railroad Company's premises until specifically authorized by the Contracting Officer. The Contractor shall notify the Contracting Officer at least 7 days prior to the planned date for entering the premises of the Railroad Company.

d. The Contractor shall take any safety precautions that the Railroad Company deems necessary. No equipment, unless being utilized to perform work on the railroad track, shall be located within 12 ft of the centerline of the nearest railroad track. Such equipment allowed within 12 ft of the centerline of the nearest railroad track shall be attended at all times.

e. The Contractor shall furnish evidence of Workmen's Compensation coverage for both itself and for all subcontractors.

f. The Contractor shall maintain at all times during any construction, maintenance, or removal work, the following insurance coverages:

(1) Contractor's Public Liability and Property Damage Liability Insurance, including automobile coverage, with a combined single limit of $2,000,000 per occurrence;

(2) For each subcontractor, Contractor's Protective Public Liability and Property Damage Liability Insurance, including automobile coverage, with a combined single limit of $2,000,000 per occurrence;

(3) Railroad Protective Public Liability and Property Damage Liability Insurance with a combined single limit of $2,000,000 per occurrence.

1.5.3.2 Insurance Policy Requirements

The Railroad Protective Liability policy shall name the Burlington Northern Rail Corporation, and UNITED STATES OF AMERICA as the named insureds and shall include an endorsement in the form appearing in the Standard Provisions of the contract documents. The Contractor shall furnish to the Railroad Company, the Railroad Protective Liability policy and the certificates evidencing the other insurance coverage required in this section. Each policy and/or certificate shall provide that cancellation of the insurance cannot be accomplished unless at least ten (10) days notice is given to the Railroad Company.

PART 2 PRODUCTS

2.1 BALLAST

Prepared ballast shall be crushed stone, Size No. 4A, conforming to Chapter 1, Part 2, of AREMA Manual for quality, soundness and gradation. The ballast shall be 24 inchs thick. In the portion retained on each sieve

specified, the crushed gravel shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the plane. When two fractures are contiguous, the angle between planes of the fractures shall be at least 30 degrees in order to count as two fractured faces. Flat and elongated particle dimension ratio used in ASTM D 4791 shall be 1:3. Ballast materials shall meet the property requirements shown in TABLE I.

TABLE I. MINIMUM PROPERTY REQUIREMENTS - BALLAST

Property	Maximum Value	Minimum Value	Test Method
Percent passing No. 200 Sieve	1.0 percent	--	ASTM C 136 ASTM C 117
Bulk specific gravity			
Rock	--	2.60	ASTM C 127
Blast furnace slag	--	2.30	
Absorption			
Rock	2.0 percent	--	ASTM C 127
Blast furnace slag	5.0 percent	--	
Clay lumps and friable particles	0.5 percent	--	ASTM C 142
Degradation Soundness	35 percent	--	ASTM C 535
Sodium sulfate - 5 cycles	10 percent	--	ASTM C 88
Flat or elongated particles	5 percent	--	ASTM D 4791

2.2 SUBBALLAST

Subballast shall consist of aggregate-soil materials conforming to an ASTM D 1241 Type I, Gradation A mixture. The subballast shall be 24

2.3 GEOTEXTILE

2.3.1 Physical Property Requirements

The geotextile shall be a nonwoven, needle-punched material. The geotextile's fiber shall consist of at least 95 percent by weight polyester, polyamide, polypropylene, or polyethylene. The geotextile shall contain stabilizers and/or inhibitors as necessary to make the filaments resistant to deterioration from ultraviolet light and heat exposure, particularly prior to placement and coverage. The fibers shall be formed into a network which will be dimensionally stable. The edges of the geotextile shall be finished in a way to prevent the outer fibers from

being pulled away from the geotextile. The geotextile shall exceed the applicability property requirements stated in TABLE II.

TABLE II - PROPERTY REQUIREMENTS-GEOTEXTILE

PROPERTY	MINIMUM REQUIREMENTS*	TEST METHOD
Weight**	15 oz/sq yd	ASTM D 3776 Option B
Color	Grey or tinted	--
Grab tensile strength	350 lbs	ASTM D 4632
Puncture strength	185 lbs	ASTM D 4833
Trapezoidal tear strength	150 lbs	ASTM D 4533
Apparent opening size (AOS) (maximum required valve)	Less than 0.22 mm (No. 70 sieve)	ASTM D 4751
Normal permeability (k)	0.1 cm/sec	ASTM D 4491
Permittivity	0.2 per sec	ASTM D 4491
Planar water flow/ transmissivity at i = 1 and normal stress = 3.5 psi	0.006 sq ft/min	ASTM D 4716
Ultraviolet degradation at 150 hours	70 percent strength retained	ASTM D 4355
Seam strength	350 lbs	ASTM D 1683

*These property requirements are Minimum Average Roll Values in the weaker principal direction.

**Geotextile selection shall not be limited by the minimum weight shown. Selection shall be based on the other property requirements listed. Heavier geotextiles have shown greater resistance to abrasion.

2.3.2 Dimensional Requirements

Each roll of geotextile shall be at least 12 ft wide and 200 ft long.

2.3.3 Protective Sand Layer

Sand used in the protective sand layer below the geotextile shall meet the gradation requirements of TABLE III with the gradation determined using the procedures prescribed in ASTM C 136.

TABLE III - GRADATION OF PROTECTIVE SAND LAYER

SIEVE SIZE	PERCENT PASSING SIEVE SIZE BY WEIGHT
1/2 in.	100
No. 4	90 - 100
No. 10	75 - 100
No. 40	40 - 70
No. 200	0 - 5

2.4 OIL FOR CORROSION PROTECTION

Oil for protecting rail and other track materials from corrosion, except joints, shall conform to the following general specification:

Asphalt, 100 penetration minimum 45 percent	ASTM D 402
Flash point, minimum 130 degrees F	ASTM D 1310
Viscosity, kinematic, 140 degrees F 480 to 700 centistokes	ASTM D 2171

2.5 RAIL

2.5.1 New Jointed Rail

New jointed rail shall comply with the following:

a. Rail Lengths: New rail shall be a 136 lbs/yd section or heavier and shall conform to the specifications in Chapter 4, Parts 1 and 2 of AREMA Manual that were in effect at the time of its manufacture. New rail shall be provided in 80 ft lengths.

b. Rail Drilling: New rail shall be provided with the rail ends drilled. Drilling shall be uniform and to the patterns specified.

RAIL	DRILLING
136# (match esixting rail)	(3-1/2, 6, 6 inch)

2.5.2 Welded Rail

New rail shall be, 136lbs, 80 foot section and shall conform to Chapter 4, Part 2 of AREMA Manual.

2.6 TIE PLATES

2.6.1 General

Tie plates shall be of the dimensions and punching pattern (A or B) to fit the rail. New tie plates conforming to Chapter 5, Part 1 of AREMA Manual

shall be used with new rail. Used tie plates in good condition shall not be used with relay rail. The used tie plates shall not be smaller than 7-1/2 by 10 in for use with relay rail having nominal weights less than 100 lbs/yd, or not smaller than 7-1/2 by 11 in double-shoulder for use with relay rail having nominal weights of 100 lbs/yd and greater. Both flat and canted plates will be required to match the existing tie plates that are in track. Canted tie plates shall be used in all new rail and relay out-of-face rail replacements.

2.7 WOOD TIES

Species shall be Ash, Beech, Red and White Oak, Gum, . Switch ties shall be Ash or Oak. Conditioning and seasoning shall conform to the requirements of AWPA C6 for the individual wood species. Ties shall be well seasoned. Prior to preservative treatment, wood ties shall be dried to the oven dry moisture content, or less, as specified in paragraph 3.14 of AWPA C6. The wood may be air dried, vapor dried, or boultonized. Ties which are to be dried by artificial means shall be conditioned and treated as soon as possible after sawing, but no more than 30 days later. The temperature used for boultonizing shall be as high as possible but in no case less than 200 degrees F. Vapor dried ties shall be transferred from drying cylinders to treatment cylinders as quickly as possible to avoid loss of heat from the seasoned ties. Ties shall be pressure treated in accordance with Chapter 3, Part 6 of AREMA Manual by the empty cell process with a 60/40 creosote/coal tar solution (Grade C) in accordance with AWPA P2 to a minimum retention of 8 lbs/cu ft of wood. The Contractor shall record treatment as specified in AWPA M2. Treated ties shall be permanently marked or branded by the producer in accordance with AWPA M6. Ties shall be produced by a member of the Railway Tie Association. All ties, except Southern, Red, and Ponderosa Pine, shall be incised on all four sides in the pattern specified in AREMA Manual, Chapter 3, Part 6, prior to treatment. Splits shall not be longer than 4 in. and not wider than 1/4 in at either end. Splits longer than 4 in but not longer than the width of the face in which the split appears, will be acceptable if specified anti-splitting devices are installed with the splits compressed. Any required adzing and drilling for spikes shall be performed prior to treatment. The Contractor shall notify the Contracting Officer at least 15 days prior to the shipment of any treated ties or timbers from the manufacturer's plant, to provide the Government the opportunity to inspect the materials before shipment. When inspections of onsite materials result in product rejection, the Contractor shall promptly segregate and remove rejected material from the premises. The Government may also charge the Contractor any additional cost of inspection or test when prior rejection makes reinspection or retesting necessary.

2.7.1 Crossties

Wood crossties shall conform to Chapter 3, Part 1 of AREMA Manual.

a. Wood crossties : Wood ties shall be sawed and shall be not less than 12in thick and 12 in wide. The length shall be 9.0 ft.

2.7.2 Tie Plugs

Tie plugs shall fit holes from which spikes are drawn. The plugs shall comply with Chapter 3, Part 1 of AREMA Manual and shall be treated in accordance with Chapter 3, Part 6 of AREMA Manual.

2.8 MISCELLANEOUS TRACK MATERIALS

Miscellaneous track materials shall be as follows:

2.8.1 Spikes

2.8.1.1 Track Spikes

Track spikes shall be new and shall conform to Chapter 5, Part 2 of AREMA Manual. Track spikes size 6 by 5/8 in shall be used with 100 lbs or heavier rail. Track spikes 5-1/2 by 9/16 in shall be used with 90 lb and under rail.

2.8.2 Bolts, Nuts, and Spring Washers

New track bolts, nuts, and spring washers shall be used throughout the project for both new and relay rail.

2.8.2.1 Bolts and Nuts

The various rail, joint bars, and rail drillings require various lengths and diameters of bolt assemblies. The Contractor shall determine the number of bolt assemblies of each size required. All bolt diameters shall be the largest possible for a given rail drilling and joint bar punching. Track bolts and nuts shall conform to Chapter 4, Part 2 of AREMA Manual. Track bolts shall be long enough to leave at least two threads exposed after the nut is tightened.

2.8.2.2 Spring Washers

Spring washers and nuts shall b sized to ensure that the spring washer develops its full reactive force and does not jam into the joint bar hole. Spring washers shall be of the size to fit the bolt and nut used and shall conform to Chapter 4, Part 2 of AREMA Manual, and Section M12 of AREMA Track Plans.

2.8.3 Rail Anchors

Where special tools are required to install or remove anchors, the Contractor shall furnish a minimum of one tool for each 5,000 anchors, or fraction thereof, not to exceed 5 tools per job.

2.8.3.1 New Installation

Rail anchors for new installations shall be new. Sizes shall conform to the various sizes of rail on the project and conform to "Specifications for Rail Anchors" in Chapter 5, Part 7 of AREMA Manual. Anchors may be either drive-on or spring type.

2.8.3.2 Salvaged Rail Anchors

Rail anchors salvaged from the track being removed shall become the property of the Contractor and shall be removed from the site. No used anchors shall be reinstalled unless they have been repinched.

2.9 SALVAGED MATERIALS

2.9.1 Dunnage

Pallets, sills, and other material used for packaging and stacking salvaged track items shall be clean, free of decay or other defect, and sufficiently sturdy for the service intended.

2.9.2 Marking Paint

Marking paint shall be a good quality oil-based spray marking paint or a good quality oil-based paint marker.

2.9.3 Salvaging Rail

The Contractor shall salvage rail as directed; the Government will make available salvaged rail to the Contractor subject to the following:

a. Nondefective and reclaimable rails salvaged from existing tracks may be used to execute spot rail replacement work at other locations of the project, subject to review and approval of the materials by the Contracting Officer.

b. Reclaimable defective rails may be used to construct inner guard rails provided all defects can be cropped off. Detailed inspection shall be made of such rails to ensure that rails which contain critical defects such as transverse defects, head-web separations, vertical split heads, pipe, split webs, etc., are not incorporated in the work. Loose rails located along the right-of-way shall be inspected and used as directed.

2.9.4 Joint Bars

Nondefective joint bars salvaged from existing tracks may be used to execute spot replacement work at other locations of the project, subject to review and approval of the material by the Contracting Officer.

2.9.5 Tie Plates

Tie plates salvaged from existing tracks, which are not either broken, cracked, or severely corroded or worn, may be used to execute the work subject to review and approval of the material by the Contracting Officer.

2.10 RAIL BONDING AND GROUNDING

2.10.1 Rail Bonds

Rail bonds shall be exothermic type ("Cadweld") bonds applied to the field side of the rail head, or 46 in bonds welded to the rail web. The bond

cables shall be flexible bare copper stranded 1/0 AWG cables with preformed ends. Bond cables shall be flexible bare copper stranded cables with preformed ends and shall conform to applicable requirements of AREMA Manual Vol. 3.

2.10.2 Grounding Rods

Grounding rods shall be 3/4 in diameter copper clad steel rods. The minimum length of ground rods shall be 8 ft.

2.10.3 Ground Connection Cables

Connections between the grounding system or ground rods and rails shall be made with a bare flexible copper stranded 2/0 AWG cable.

2.10.4 Electrical Connecting Hardware

Electrical connecting hardware shall be bronze pressure bar type materials having no rotating parts coming in direct contact with conductors.

2.11 WELDING

2.11.1 Rail Welding Kits

Kits for thermite type rail welds shall be approved by the Contracting Officer before use.

2.11.2 Rail

Rail for welding includes Contractor furnished material. The Contractor shall provide welding kits for all rail sections used.

PART 3 EXECUTION

3.1 REMOVAL, SALVAGE, AND DISPOSITION OF MATERIALS

Tracks and segments of track shall not be dismantled until approved to do by the Contracting Officer. The following materials shall be salvaged by the Contractor for later use by the Government. Some of these items will be used in the repair of tracks as indicated.

3.1.1 Methods and Procedures

The Contractor may use any methods to dismantle the track, provided proper measures are taken to ensure the safety of the laborers and the general public, and no damage is caused to track components to be salvaged or other tracks and structures which are indicated to remain. Methods of removal of existing tracks shall not cause damage to adjacent sidewalks or paved roadways. Damage to these facilities caused by the Contractor shall be restored at Contractor's expense.

3.1.2 Transport and Stack Excess and Salvaged Materials

3.1.2.1 Stacking of Rails

Rails shall be stacked on approved sills a minimum of 6 in above the ground. Rails shall be stacked with the heads up and with the ends even. Each layer shall be separated by at least three 2 by 4 in wood strips evenly spaced along the length of the rail. Rail shall be grouped by weight, section, drilling, condition, length, and amount of wear. The weight, section, drilling, and length shall be marked on one of the rails near the mid-height of the stack. These markings shall be painted neatly near one end of the rail.

3.1.2.2 Stacking of Joint Bars, Gauge Rods, and Tie Plates

Joint bars, gauge rods, and tie plates shall be sorted by section, punching and condition and shall be stacked on pallets. Each pallet stack shall be steel banded for forklift handling. The maximum weight on any pallet shall be 1,500 lbs. Compromise joint bars shall be wired together in pairs and stacked on pallets, separate from other bars.

3.1.2.3 Containers

Rail anchors shall be sorted by type and size and placed in kegs, steel drums, or other approved containers. Containers shall be labeled with the rail weight and section.

3.1.2.4 Stacking of Special Trackwork Materials

Special trackwork materials shall be palletized and stacked as directed by the Contracting Officer. The rail weight, rail section, and length shall be marked on each switch point. The weight, section, and frog number shall be marked on the side of each frog casting. Other switch materials salvaged shall be placed in steel drums and labeled as to rail weight, section, length of points, and turnout size.

3.1.3 Material to be Scrapped

All material shall be scrapped and shall become the property of the Contractor.

3.2 PLACEMENT OF BALLAST AND SUBBALLAST

Ballast and Subballast shall be placed to the lines and grades indicated. The average thickness shall be within 0.25 in of the thickness of 24 inchs. Subgrade shall conform to the requirements of Section 02300EARTHWORK. Ballast and Subballast shall not be placed on soft, muddy, or frozen areas. Where the prepared subgrade (roadbed) is soft, muddy, rutted, exhibits severe depressions, or is otherwise damaged, the ballast and subballast shall not be placed until the damaged subgrade has been repaired and the area has been approved by the Contracting Officer.

3.2.1 Subballast

3.2.1.1 Subballast Placement

Subballast shall be placed in two uniform horizontal lifts of not more

than 6 in for the full width of the cross-section to the total depth of 24 inchs. Each subballast layer shall be shaped to a section conforming to the subballast section shown on the drawings and shall be thoroughly compacted.

3.2.1.2 Subballast Compaction

Each subballast lift shall be compacted using approved compaction equipment. The roller weights, vibration frequencies (where applicable), tire pressures (where applicable), and number of passes shall be sufficient to obtain in-place densities across the full width of the subballast and throughout the entire depth of the layer of not less than 95 percent of the ASTM D 1557 laboratory maximum dry density for the subballast material. Prior to placement of subsequent subballast layers the top of the previous layer shall be scarified to a depth of approximately 2 in to insure proper bond of the layers.Density shall be field measured in accordance with ASTM D 1556(base plate, as shown in the drawing shall be used) or ASTM D 2922. The calibration curves shall be checked and adjusted, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM 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. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration, in ASTM D 2922, on each different type of material to be tested at the beginning of a job and at intervals as directed. One field density tests shall be taken for each 1000 square yards of each layer of material placed in each area.

3.2.2 Ballast

3.2.2.1 Ballast Placement

Number 5 AREMA ballast shall be placed in the tracks; 2 in of Number 5 ballast shall be used for 30 feet each side to provide a smooth walking surface for railroad employees. All other areas shall require size AREMA Number 4A ballast.

3.2.2.2 Ballast Distribution

Ballast shall not be distributed until the subballast has been approved by the Contracting Officer. No payment will be made for ballast which is distributed without the Contracting Officer's approval.

a. Ballast distribution shall be to the depth indicated and may be from either trucks or railroad cars.

b. Forming of ruts that would impair proper roadway drainage shall be prevented when distributing ballast from trucks and off track equipment. Any ruts formed greater than 1 in shall be leveled and graded to drain.

c. Ballast shall be unloaded as close as possible to the point of use so that unnecessary handling is prevented. Excess ballast shall be picked up and redistributed at the Contractor's expense. If additional ballast is required for dressing, it shall be added by the Contractor at no increase in unit price.

3.2.2.3 Ballast Below Ties

For new construction, the last 4 inches ballast below the tie, the shoulder ballast and the ballast in the tie cribs shall be placed subsequent to the rail and tie installation. For surfacing existing track, the ballast shall be placed subsequent to rail and tie replacements.

3.3 TRACK CONSTRUCTION

Track construction not covered specifically herein shall be in accordance with AREMA recommendations and recommended practices.

3.3.1 Roadbed Preparation

Clearing and grubbing, grading, excavation, embankment preparation, and subgrade preparation shall be performed in accordance with the specifications. Roadbed surface, grade, and drainage shall be approved prior to any distribution of construction material. Where the subgrade or roadbed is damaged during distribution of materials, ruts and depressions shall be filled and compacted and the roadbed surface reapproved prior to track construction.

3.3.2 Geotextile for Track Construction

Geotextile shall be installed between the subgrade and the ballast. Installation shall be in accordance with subparagraph Geotextile Installation under paragraph Highway Crossings.

3.3.3 Unloading the Materials

The use of picks in the handling of ties will not be permitted. Rails shall be unloaded from cars with an approved derrick or crane and placed with the head up without dropping and with sufficient support under the base. Rails of proper length shall be distributed as necessary for road crossings, switches, joint spacing, and other special conditions.

3.3.4 Ties

Standard center-to-center spacing of crossties shall be **20 in**. Switch ties and bridge ties shall be spaced as indicated on the drawings. Ties shall be laid perpendicular to the center line of the track with the grain up (heartwood side down). The best ties shall be used at the rail joints. The ends of ties on one side of the track shall be parallel to the rail and the center of the tie shall be on the approximate center line of the track. The ends shall be aligned on the inside of curves and shall continue on that side until reaching a curve in the opposite direction. On double tracks, the ties shall be aligned on the outside ends. The top surface of ties shall provide full bearing for the tie plates. Adzing shall be

restricted to that necessary to provide a sound true bearing for the tie plate. Adzing in excess of 0.2 in will not be permitted. Where adzing is necessary, the cut surface shall be completely saturated with creosote or other approved preservatives.

3.3.5 Tie Plates

Tracks shall be fully tie-plated. Tie plates shall be free of dirt and other foreign material when installed. Tie plates shall be placed so that the rails will have full bearing on the plate, and the plate will have full bearing on the tie. Tie plates shall be set at right angles to the rail with the outside shoulder against the base of the rail, and centered on the tie. Canted tie plates shall be installed to cant the rail inward.

3.3.6 Rail

The base of the rail and the surface of the tie and tie plate shall be free of dirt and other foreign materials prior to laying rail.

3.3.6.1 Laying Rail

Rail shall be laid without bumping or striking, to standard gauge (4 ft 8-1/2 in between points 5/8 in below the top of the rail) on tangents and on curves up to 12 degrees. For curves 12 degrees and greater, the gauge shall be widened 1/8 in for each increment of 2 degrees to a maximum of 4 ft 9 in, in accordance with TABLE V. The track shall be gauged at every third tie as spikes are being driven.

TABLE V. TRACK GAUGE FOR HIGH DEGREE OF CURVATURE

Degree of Curvature per 100-ft chord		
Equal to or Greater Than (Deg - Min)	But Equal to or Less Than (Deg - Min)	Track Gauge (Ft - In.)
0 - 00	12 - 00	4 - 8-1/2
12 - 01	14 - 00	4 - 8-5/8
14 - 01	16 - 00	4 - 8-3/4
16 - 01	18 - 00	4 - 8-7/8
18 - 01	20 - 00	4 - 9

a. Jointed rails shall be laid, one at a time, with space allowance for expansion being provided between rail ends in accordance with TABLE VI.

b. Gaps between rail ends in insulated joints shall only be sufficient to permit insertion of standard end posts.

c. A standard rail thermometer shall be used to determine the rail temperature. The thermometer shall be laid close to the web on the side of the rail base which is shaded from the sun's rays in

advance of the laying operation and left there long enough to accurately record the temperature. The contractor quality control representative shall see that rail temperature is checked frequently and that proper rail expansion shims are used. All thermometers shall be calibrated against the Contracting Officer's rail thermometer which will have been accurately calibrated and will be considered as the standard.

d. Except through turnouts and at insulated joints, the staggering of the joints on one side shall not vary more than 20 in in either direction from the center of the opposite rail.

e. Rails less than 33 ft in length shall not be used in out-of-face rail relay. However, rails not less than 13 ft long may be used for final connections to existing rails to prevent joints from occurring at prohibited locations or to provide the specified joint stagger in curves.

f. Rail joints shall not occur in or within 20 ft of a road crossing, alongside of or within 5 ft of the end of any switch or turnout guard rail, or the end of any open deck bridge.

3.3.6.2 Joints

The joints in opposite rails shall be staggered one-half the rail length but not less than 12 ft apart, except closer joints may be required at turnouts and insulated joints. Rail less than 13 ft in length shall not be installed in track. No joint shall be less than 6 ft from the ends of open-deck bridges, or less than 3 ft from switch points. No joint shall be installed within 20 ft of a road crossing, outer perimeter of any structure, or any location which restricts access to the joint. Where joints are required in these areas, the joints shall be welded.

3.3.6.3 Expansion Allowance

Allowance for expansion shall be provided at rail joints by using rail-expansion metal shims. Shims shall be removed to within 12 rails of the laying. Shims shall be of the thickness shown in TABLE VI. The temperature of the rail shall be determined by use of a thermometer placed on the rail base on the side away from the sun. Typical rail gap gauges are as shown.

TABLE VI. SHIM THICKNESS

33-Ft Rail 160 Joints per Mi		39-Ft Rail 135 Joints per Mi		78-Ft Rail 68 Joints per Mi	
Rail Temperature (degrees F)	Shim Thickness (in.)	Rail Temperature (degrees F)	Shim Thickness (in.)	Rail Temperature (degrees F)	Shim Thickness (in.)
Below -10	5/16	Below 6	5/16	Below 35	5/16

TABLE VI. SHIM THICKNESS

33-Ft Rail 160 Joints per Mi		39-Ft Rail 135 Joints per Mi		78-Ft Rail 68 Joints per Mi	
Rail Temperature (degrees F)	Shim Thickness (in.)	Rail Temperature (degrees F)	Shim Thickness (in.)	Rail Temperature (degrees F)	Shim Thickness (in.)
-10 to 14	1/4	6 to 25	1/4	35 to 47	1/4
15 to 34	3/16	26 to 45	3/16	48 to 60	3/16
35 to 59	1/8	46 to 65	1/8	61 to 73	1/8
over 60	1/16	over 66	1/16	over 74	1/16

3.3.6.4 Cutting Rail

Only rail saws or track chisels shall be used to cut rail. New holes shall be drilled using a standard template. Holes shall not be burned in rail. Holes cut with a torch will not be accepted. When drilling of rail is necessary, all chips and burrs shall be removed before applying joints.

3.3.6.5 Matching Rails

Where relay rail is used, matching adjacent rails shall not cause lipped or uneven joints. Any mismatched rail ends shall be welded to provide proper match. Rail end mismatch shall not exceed 1/8 in on gauge or tread portions of rail.

3.3.6.6 Rail Replacement

The following procedures apply to rail replacement work:

a. Spot rail replacement is defined as replacement of 100 ft or less of contiguous rails, usually with rails of the same section. Installation of relief rail in place of defective rail is considered spot rail replacement. Replacement of more than 100 ft of contiguous rails shall be considered to be out-of-face rail relay.

b. If spikes are withdrawn, the holes shall be plugged with treated tie plugs of proper size to fit the hole, prior to replacement of rail. If spikes are withdrawn and spikes are to be redriven in existing spike holes, the holes shall be plugged with treated tie plugs prior to redriving the spike. Tie plugs shall not be installed in prebored holes unless spikes have been driven and withdrawn.

c. All ties shall be spiked with new spikes in accordance with paragraph Spot Tie Replacement.

d. The Contractor shall ensure that rail ends at joints are not lipped or uneven. Tread portion (vertical) or gauge side

(horizontal) rail end mismatch shall be no greater than 1/16 in. Rail end mismatch greater than 1/16 in shall be corrected by welding and grinding on the smaller rail. Grinding the larger rail is not permitted unless approved by the Contracting Officer. Welded transitions shall be made at a rate of 1 to 80.

e. Rails removed from track will be designated by the Contracting Officer as relay (for use on project), reclaimer (to be salvaged and stockpiled), or scrap. Joint bars removed from track will be designated as relay, reclaimer, or scrap. The Contractor shall mark scrap materials as scrap using bright red paint, transport them off the military installation or to the military installation temporary scrapyard. Relay materials required to complete other repair work of this contract shall be transported to the location of need. Reclaimer materials shall be classified and inventoried and stacked at the military installation storage site, all as indicated for salvage materials in paragraph Removal, Salvage, and Disposition of Materials.

f. Metal rail expansion shims shall be used when laying rail. Wood sticks or other material shall not be used as shims. The Contractor shall have a sufficient supply of each shim available to permit rail laying to progress without delay.

3.3.7 Joint Bars

Joint bars shall be clean, and the contact surfaces coated with petrolatum or petrolatum base compound with a corrosion inhibitor. Rail joints shall be installed so that bars are not cocked between the base and head of the rail. Bars shall be properly seated in the rail and the full number of correct-size bolts, nuts, and spring washers installed. Bolts shall be placed with nuts alternately on inside and outside of rail. A corrosion resistant lubricant shall be applied to the bolt threads prior to application of nuts. Bolts shall be tightened to torque of approximately:

BOLT DIAMETER		TORQUE*	
(mm)	(in.)	(N m)	(ft-lbs)
19	3/4	340	250
22	7/8	408	300
25	1	476	350
29	1-1/8	544	400

*For well oiled bolts with clean threads.

beginning at the center of the joint and working both ways to the ends of the joint. After the track has been in service , but before acceptance of the work, all bolts shall be checked and retightened to a torque of approximately See above schedule ft-lbs. . Defective joint bars designated on the contract drawings, discovered by the Contractor during track repair operations, or as identified by the Contracting Officer shall be replaced with acceptable joint bars.

3.3.8 Spiking

3.3.8.1 Spiking Procedures

Rail shall be spiked promptly after being laid. Spikes shall be started and driven vertically and square with the rail. Spikes shall be driven to allow approximately 1/8 to 3/16 in space between the underside of the spike and the top of the rail base. Spikes shall not be overdriven, or straightened while being driven. Spikes shall not be installed through the slots in skirted-type, slotted joint bars (angle bars). Spikes shall not be driven against the ends of joint bars.

3.3.8.2 Number of Spikes

Four rail-holding spikes shall be used on each tie on tangents and curves less than 4 degrees. Spikes on the gauge side of the running rail shall be placed directly across from each other and the spikes on the field side of the running rail shall be placed directly across from each other. This pattern shall be held consistent. On curves 4 degrees or greater but not more than 8 degrees, six spikes shall be used on each tie with the spikes located as follows: High rail, one rail-holding spike and one plate holding spike on the field side and one on the gauge side; Low rail, one rail-holding spike on the gauge side, one rail-holding spike on the field side, and one plate-holding spike on the field side. Curves 8 degrees and greater shall be spiked with eight spikes per tie, located as follows: High rail, one rail-holding spike and one plate-holding spike on the field side and two rail-holding spikes on the gauge side; Low rail, one rail-holding and one plate-holding spike on both the gauge and field sides. Eight rail-holding spikes shall be used on each tie through road crossings.

3.3.9 Tie Plugs

If spikes are withdrawn, the holes shall be swabbed with creosote and plugged with creosoted tie plugs of proper size to fit the hole. If spikes are withdrawn and spikes are to be reinserted in existing spike holes, the holes shall be swabbed with creosote and plugged with creosoted tie plugs prior to redriving the spike. Tie plugs shall not be installed in prebored holes unless spikes have been driven and withdrawn.

3.3.10 Rail Anchor Placement

Rail anchors shall be located as indicated on the project plans. Where the use of rail anchors is indicated, apply a minimum of AREA for heavy traffic usage anchors per 39 ft of rail in the pattern indicated on the project drawings. The rail anchors shall be spaced approximately uniformly along the rail length. Rail anchors shall be installed to the gauge side of the rail against the same tie face on opposite rails. Rail anchors shall grip the base of the rail firmly and shall have full bearing against the face of the tie. Rail anchors shall not be moved by driving them along the rail. Rail anchors shall not be applied to track on an open-deck bridge. Where anchors are used on track approaching an open deck bridge, every third tie shall be box anchored for at least four rail lengths, off each end of the bridge. Rail shall be anchored immediately after spiking and before rail

has experienced a large temperature change.

3.3.11 Preliminary Surfacing

The preliminary alignment and surfacing gangs shall follow the unloading of the ballast. Rail renewal, tie renewal, bolt tightening, and ballast placement shall be complete prior to commencement of surfacing and alignment work.

3.3.11.1 Lifts

a. The track, after being aligned, shall be brought to grade and surface in lifts not exceeding 4 in each. After each lift, the ballast shall be tamped. When using jacks, they shall be placed close enough together to prevent undue bending of rail or stress of rail and joint. Both rails shall be raised at one time and as uniformly as possible, except where superelevation is required. The track shall be so lifted that after a period of not less that 5 train operations (70 ton ballast car) after the last lift, it will be necessary to give the track a final lift of between 1 and 2 in to bring it to grade.

b. In areas where major track resurfacing is not required, the Contractor shall perform a "skim lift" tamping operation to ensure that the ties are adequately tamped, the ballast section is adequately compacted and dressed, and to correct minor deficiencies in surface and alignment. The rise in skim lift areas shall be 1 in or less and usually will not require that additional ballast be placed.

c. A 2 in rise shall provide an average 2 in. raise in the track being surfaced.

d. A 4 in rise shall provide an average 4 in. raise in the track being surfaced, and shall be made in at least two lifts not to exceed 2 inches per lift.

e. A 6 in raise shall provide an average 6 in. raise in the track being surfaced, and shall be made in at least 2 lifts. The initial lift shall not exceed 4 in with the final lift not to exceed 2-1/2 in

3.3.11.2 Tamping

Raising and tamping of track shall be performed with an automatic, vibratory, squeeze type power tamper with 16 tamping heads, capable of raising both rails simultaneously and maintaining cross-level. The equipment to be used for surfacing operations is subject to approval by the Contracting Officer. Every tie in the track shall receive two or more full insertions of the tamping heads. Ballast shall be power-tamped under both sides of ties from each end to a point 18 in inside each rail for 9 ft ties. The center shall be filled with ballast, but tamping will not be

permitted in the center of the tie between the above stated limits. Both ends of the ties shall be tamped simultaneously and tamping inside and outside of the rail shall be done at the same time. Tamping tools shall be worked opposite each other on the same tie. Ballast under switch ties and road crossing ties shall be tamped the entire length of each tie. All ties shall be tamped to provide solid bearing against the base of the rail after the track or turnout is raised to grade at final surfacing. All down ties shall be brought up to the base of rail and shall be machine tamped. The resultant track surface and alignment shall be uniform and smooth. Tamping of track in snow or frozen ballast conditions will not be permitted.

3.3.11.3 Replacement of Ties

After tamping has been completed and the jacks removed, all ties pulled loose shall be replaced to their proper position, respiked and retamped to provide full bearing against the rail.

3.3.11.4 Horizontal Realignment

Horizontal realignment of curved track shall be established by the Contractor using manual or mechanical means as described in the AREMA Manual Chapter 5, Part 3 article titled, "String Lining of Curves by the Chord Method".

3.3.12 Final Surfacing

After preliminary surfacing has been completed, grade and line stakes shall be checked and the track brought to grade and alignment.

3.3.12.1 Final Tamping

Track shall be brought to grade and the ballast retamped in the manner described for preliminary surfacing, except that the tamping distance inside the rail shall be decreased from 12 to 10 in for 8 ft. ties, 15 to 13 in for 8 ft 6 in ties, and 18 to 16 in for 9 ft ties.

3.3.12.2 Final Alignment

The track shall be given a final aligning conforming to the established track centers.

3.3.12.3 Final Dressing

After the final alignment the ballast shall be dressed to the section indicated. After final dressing ballast shall not cover the tops of the ties. The portion of the subgrade outside the ballast line shall be left with a full, even surface and the shoulder of the subgrade shall be properly dressed to the indicated section to provide proper drainage away from the track.

3.3.12.4 Surplus Ballast

Surplus ballast remaining after final surfacing and dressing of the ballast section shall be distributed or otherwise disposed of as directed by the

Contracting Officer.

3.3.13 Cleanup

Upon completion of the work, the Contractor shall remove all rubbish, waste, and discarded materials generated by the work from the project area. Areas where the Contractor has worked, including but not limited to, project areas, material storage sites, and borrow or disposal areas shall be left in a clean, well-graded, and well-drained condition.

3.3.13.1 Shoulder Removal and Reconstruction

Where track construction or rehabilitation operations result in deposition of materials along the track shoulders that would impede the free drainage of the geotextile and track structure, the Contractor shall remove the material. Where undercutting operations leave fouled shoulder materials that impede free drainage of the geotextile and the track structure, the shoulder material shall be removed, and the ballast shoulders shall be reconstructed using the materials and dimensions as indicated. Areas where shoulder removal and reconstruction are required are not indicated on the drawings.

3.3.13.2 Spoil Materials

Spoil materials removed from the track shall be disposed of off site at the Contractor's expense. Spoil materials shall not be placed on the shoulders, in ditches, in drains, or in other areas where they would impede the flow of water away from the track.

3.3.14 Final Adjustments

Sixty calendar days after the track has been accepted and put into operation, the Contractor shall perform, at no cost to the Government, necessary resurfacing adjustments to leave the track in alignment and on grade.

3.3.15 Tolerances for Finished Track

Completed track shall meet the following tolerances. Track not meeting the tolerances specified below shall be repaired to meet these requirements, at no additional cost to the Government.

3.3.15.1 Gauge

Track gauge shall be within plus 1/4 in or minus 1/8 inch of standard gauge.

3.3.15.2 Alignment

Alignment shall be measured as the deviation of the mid-offset of a 62 ft line, with the ends of the line at points on the gauge side of the line rail, 5/8 in below the top of the railhead. Either rail may be used as the line rail on tangent track; however, the same rail shall be used for the entire length of the tangent. The outside rail in a curve is always the line rail. Alignment on tangents shall not deviate from uniformity more

than 1/2 in. Alignment on curves shall not deviate from uniformity more than 3/8 in.

3.3.15.3 Track Surface

Track surface shall meet the following requirements:

a. The runoff at the end of a raise shall not exceed 1/2 in in any 31 ft of rail.

b b. The deviation from design profile on either rail at the mid-ordinate of a 62 ft chord shall not exceed 1/2 in

c. Deviation from design elevations on spirals shall not exceed 1/2 in

d. Deviation from zero cross level at any point on tangent or from designated superelevation on curves or spirals shall not exceed 1/2 in.

e. The difference in cross level between any two points less than 62 ft apart on tangents, and on curves between spirals shall not exceed 1/2 in.

3.3.15.4 Guard Face Gauge

Guard face gauge is the distance between the guard lines measured across the track at right angles to the gauge line, and is measured at the point of frog on both sides of the turnout. The design value for guard face gauge is 52-3/4 in. Guard face gauge shall be within plus or minus 1/8 in of the design value.

3.3.15.5 Guard Check Gauge

Guard check gauge is the distance between the gauge line of a frog and the guard line of its guard rail, or guarding face, measured across the track at right angles to the gauge line. The design value for guard check gauge is 54-5/8 in. Guard check gauge shall be within plus or minus 1/8 in of the design value.

3.4 BONDING AND GROUNDING TRACK

Track shall be bonded and grounded as indicated. Where track is designated for bonding and grounding, the rails shall be bonded electrically continuous and effectively grounded. Connections shall be made by exothermite welds in accordance with the manufacturer's instructions.

3.4.1 Rail Joint Bond

Rail joints on both rails of designated track shall be bonded using an exothermic type bond . The bond shall be applied to the field side of the rail web unless otherwise approved by the Contracting Officer. Track to be bonded and grounded shall be electrically insulated from the remaining track using one of the specified insulated joints.

3.4.2 Rail Cross-Bond and Ground

Rail cross-bond and ground shall be installed using an exothermic type bond. The cross-bond shall be applied to the rail web. One cross-bond and ground shall be provided for each section of bonded and grounded track. Connections between grounding system or ground rods and rails shall be made with bare stranded copper cable, installed at least 12 in below the bottom of the ties. Ground rods shall be driven vertically full-length. The top of the ground rod shall be located at the toe of the ballast slope and shall be a minimum of 12 in below the top of the subgrade. Maximum resistance to ground from any grounded rail or structure shall not exceed 25 ohms. The Contractor shall make any corrections needed to reduce the resistance to below 25 ohms at no cost to the Government.

3.4.3 Inspection of Rail Bond and Ground

Loose, damaged, or missing rail bond wires, cross bond wires, ground connections, and ground rods shall be visually inspected. If there is a signal failure, bonding can be tested for current loss in the joints using a volt meter. Defective items shall be marked for repair.

3.4.4 Existing Bonds

The Contractor shall protect existing rail bonds, cross-bonds, ground connections, and grounding rods from damage. Except for bonds attached to rails which are designated to be replaced in this contract, replacement of bonds damaged or destroyed by the Contractor's operation shall be replaced at no cost to the Government.

3.4.5 Removal of Defective Bonds

Rail head pin-type and welded-type bonds shall be removed by shear cutting old cables immediately adjacent to the weld or pin. Rail web type pin bonds shall be removed by knocking the old pin out with a drift. Flames or torches shall not be used to remove defective bonds.

3.5 INSTALLATION OF MISCELLANEOUS TRACK MATERIALS

3.5.1 Tie Plates

Tie plates shall be furnished to the work sites as required. Excess tie plates, remaining at the conclusion of the contract, shall be delivered to the military installation storage site and stacked where directed by the Contracting Officer.

3.5.2 Insulated Joints

Insulated joints shall be installed where indicated and in accordance with the manufacturer's installation instructions.

3.5.3 Installation of Joint Bars

Joint bars shall be installed with their full number of bolt assemblies

unless otherwise noted. Bars shall be properly seated on the rail and the bolts tightened beginning at the center of the joint and working toward the ends of the bars, alternating between rails. Bolts used shall be of the proper diameter and length for the rail and joint bars at the joint. The use of extra washers to shim out track bolt nuts is prohibited. Bolts with nuts shall be placed alternately on inside and outside of rail.

3.6 ELECTRIC ARC WELDING

Welding to repair or rebuild frogs, track crossings, switch point, guard rails, switch point protectors and rails (engine burns, battered ends, etc.) shall be done in accordance with AREMA Manual, Chapter 5, Part 5, "Electric Arc Welding".

3.6.1 Welding Supervision

Electric arc welding shall be performed under the direct supervision of an experienced welding supervisor or foreman and by a certified welder.

3.6.2 Weather Conditions

Welding shall not be performed in rain, snow, or other inclement weather without adequate protection of the welding from the elements.

3.6.3 Welding Engine Burns

The damaged steel of the rail shall be removed by grinding or arcair to get below the burn area into sound metal. Sufficient amount of metal shall be removed to eliminate all shatter cracks.

3.6.3.1 Depth and Length Limitations

Engine burns requiring welds greater than 3/8 in. in depth below the top of the rail head shall not be repaired by welding and grinding. While grinding out the damaged metal, the operation shall be stopped when it is discovered that the necessary weld will go too deep into the rail head. The ground out portion shall be welded and joint bars shall be applied at the weld location with the rail undrilled at the middle bolt holes, centering the joint bars under the engine burn. The supervisor of maintenance shall be immediately notified so that the rail can be removed from track. These failed rails shall be disposed of in accordance with current instructions. Engine burns which would require a weld longer than 8 in shall not be welded.

3.6.3.2 Ambient Limitations

Welding and grinding engine burns shall be avoided when the air temperature is below 32 degrees F. When welding is necessary below 32 degrees F, the heated area shall be protected by covering with insulating material to retard cooling. Engine burns shall not be welded during rain or heavy snow.

3.6.3.3 Number of Welds

Contractor shall determine the maximum number of burns in a 39 ft rail, or

equivalent, that can be economically welded. Unless otherwise directed, when a rail has more than 8 burns needing repair, the rail shall be replaced.

3.6.3.4 Welding Procedure

The burn shall be welded with semi-automatic wire feed machine. The skip method shall be used in this process because no preheating or post heating is needed. If engine burns are found in groups close together, ten to fifteen burns shall be ground out at a time, welding one pass at a time on each of the burns. The process shall be repeated until all of the burns are completed to a surface just higher than the normal ball of the rail. The burn shall then be cooled until hand can be placed on it. Welds shall be ground to a level surface with cup wheel attachment grinder.

3.7 THERMITE WELDING PROCEDURES

Thermite welding procedures shall be performed by a technician certified to meet ANSI/ASNT CP-189, level II or III qualifications and comply with the following paragraphs:

3.7.1 End Preparation

Rails to be welded shall meet the requirements of Paragraph 1, "Specifications for Fabrication of Continuous Welded Rail" given in Chapter 4, Part 2 of AREMA Manual. The rail ends shall be aligned in accordance with paragraph GAP AND ALIGNMENT. Rail ends shall show no steel defects, dents, or porosity before welding. Bolt holes shall not be made in, or permitted to remain in, the ends of the rail to be welded. One handling hole may be made in each end of welded string. Rail ends containing such holes shall be cut off during track construction. Rail which must be cut for any reason shall be cut square and clean by means of approved rail saws or abrasive cutting wheels in accordance with Chapter 5 of AREMA Manual, article, "Recommended Practice For Use of Abrasive Wheels".

3.7.1.1 Cleaning

The rails to be welded shall be cleaned of grease, oil, dirt, loose scale, and moisture to a minimum of 6 in back from the rail ends, including the railhead surface. Cleaning shall be accomplished by use of a wire brush, to completely remove dirt and loose oxide and by use of oxygen-acetylene torch to remove grease, oil and moisture. A power grinder with an abrasive wheel shall be used to remove scale rust, burrs, lipped metal and mill brands which would interfere with the fit of the mold, for 2 in on each side of the ends.

3.7.1.2 Gap and Alignment

The minimum and maximum spacing between rail ends shall be as specified by the rail welding kit manufacturer and the approved welding procedures.

a. The ends of the rails to be welded shall be properly gapped and aligned to produce a weld which shall conform to the alignment tolerances below. Alignment of rail shall be done on the head of

the rail. The rail gap and alignment shall be held without change during the complete welding cycle.

b. Vertical alignment shall provide for a flat running surface. Any difference of height of the rails shall be in the base.

c. Horizontal alignment shall be done so that any difference in the width of heads of rails shall occur on the field side. Horizontal offsets shall not exceed 0.04 in. in the head and/or 0.12 inch in the base.

3.7.2 Surface Misalignment Tolerance

Combined vertical offset and crown camber shall not exceed 0.04 inch/feet at 600 degrees F or less. Combined vertical offset and dip camber shall not exceed 0.01 inch/feet at 600 degrees F or less.

3.7.3 Gauge Misalignment Tolerance

Combined horizontal offset and horizontal kink camber shall not exceed 0.04 inch/feet at 600 degrees F or less.

3.7.4 Thermite Welding

Welding shall be done in accordance with Chapter 4, Part 2 of AREMA Manual, articles "Thermite Welding - Rail Joints" and "Specifications for Fabrication of Continuous Welded Rail", except as modified by these specifications. All welds shall be visually inspected at the time of welding.

3.7.4.1 Thermite Weld Preheating

The rail ends shall be preheated prior to welding to a sufficient temperature and for sufficient time as indicated in the approved welding procedures to ensure full fusion of the weld metal to the rail ends without cracking of the rail or weld.

3.7.4.2 Thermite Weld Cooling

The molds shall be left in place after tapping for sufficient time to permit complete solidification of the molten metal and proper slow cooling to prevent cracking and provide a complete weld with proper hardness and ductility.

3.7.5 Weld Finishing and Tolerances

Welded joints in the finished track shall be brought to a true surface and alignment by means of a proper grinding or planing machine (shear). Finish grinding shall be performed with an approved grinder operated by a skilled workman grinding evenly and leaving the joints in a smooth and satisfactory condition. Finishing shall eliminate all cracks. The completed weld shall be finished by mechanically controlled grinding in conformance with the following requirements:

a. A finishing deviation of not more than plus or minus 0.01 in of the parent section of the rail head surface will be allowed. The gauge side of the rail head shall be finished to plus or minus 0.01 in of the parent section.

b. Welds produced by welding kits which are specially designed to produce reinforced welds need not be ground in the finishing area except as necessary to remove fins, burrs, cracks, etc.

3.7.6 Weld Quality

Each completed weld shall have full penetration and complete fusion and be entirely free of cracks or fissures. Welds shall meet the acceptance criteria given in AWS D1.1.

3.7.7 Weld Numbering

The Contractor shall semi-permanently mark a sequential weld number on the rail immediately adjacent to the weld, using a quality lead paint marker at the time the weld is made. Welds shall be numbered sequentially in the order in which they are made. The Contracting Officer will provide the Contractor with the initial weld number. Defective welds which are replaced shall be assigned a new sequential number by adding a letter to the defective weld number (e.g., defective weld 347 would be replaced by 347A).

3.8 TRACK REPAIR

3.8.1 Cutting and Drilling of Rail

The Contractor shall use only rail saws and abrasive cutting wheels for this operation. Other methods for cutting rail will not be acceptable. Cuts shall be square and clean. When given the option of cutting existing rail or new rail being installed, the existing rail shall be cut. When new holes are necessary, they shall be drilled. Holes shall not be punched, slotted, or burned with a torch. Holes shall be of the size and located as shown on the contract drawings. Drilled bolt holes shall be peened or ground to remove sharp edges.

3.8.2 Rail Joints

In areas which do not require out-of-face rail replacement, the Contractor shall tighten all track bolts. Defective track bolts, nuts and lock washers ("bolt assemblies"), and those that cannot be tightened shall be replaced. This work shall include both spot replacement of assemblies at locations to be determined by the Contracting Officer ("Spot Bolt Assembly Replacement") and out-of-face replacement of all bolt assemblies within a rail joint ("Joint Repair").

3.8.2.1 Used Bolt Assemblies

Used bolt assemblies removed from rail joints shall become the Contractor's property and shall not be reincorporated in the work. Existing bolt assemblies designated to be replaced shall be removed by methods which

shall not damage joint bars or rails.

3.8.2.2 Joint Repair

Replacement of defective joint bars and correction of rail-end mismatch, as designated or directed by the Contracting Officer, shall be defined as joint repair work. At designated joint repair locations, both joint bars shall be removed from the rails and the rail ends inspected for damage or defects.

3.8.2.3 Cleaning of Finishing Area

The finishing area shall be cleaned of mill scale, rust, and dirt by wire brushing, compressed air, solvents, or a combination of these or other methods.

3.8.2.4 Rail Ends

The clean rail ends shall be jointly examined by the Contractor and the Contacting Officer for the presence of any rail defects that would make the rail unsuitable for further use at the location. If a rail is determined to have an end defect, the Contractor shall either crop or replace the rail.

3.8.2.5 Joint Gap

Where pull-aparts have occurred, whether currently gapped or not, or where the rail joint gap exceeds 3/4 inch, the joint gap shall be adjusted to the rail joint gap specified in TABLE VI. Rail joint gap adjustment work shall be performed in conjunction with spot rail replacement work and bolt renewal work.

3.8.3 Spiking

The proper gauge, as indicated in this section, shall be verified immediately prior to spiking.

3.8.4 Spot Tie Replacement

The Contractor shall replace defective ties as marked in the field and as directed by the Contracting Officer.

3.8.4.1 Paint Markings and Tie Inspection

Paint markings may exist on the existing rails and crossties. Such markings do not necessarily indicate work within the scope of the contract. The Contractor shall participate in a walk-through tie inspection with the Contracting Officer prior to commencement of tie replacement work. The scope of the tie replacement work will be determined at that time and relevant paint markings made or touched up as required.

3.8.4.2 Additional Tie Work

In areas where existing ballast inhibits tie inspection, additional ties may be required beyond those marked. The scope of such additional tie work

will be identified by the Contracting Officer as adjacent work progresses.

3.8.4.3 Old Spikes, Rail Anchors, and Tie Plates

Old spikes shall be pulled and scrapped. Rail anchors shall be removed, sorted, and salvaged. Tie plates shall be removed, inspected and classified as either relay or scrap. Scrap tie plates shall be marked scrap and shall not be reinstalled in the track. Acceptable relay tie plates may be reused at that location or at other locations as required.

3.8.4.4 Humped Track

Where the track will not be surfaced, in order to prevent permanent distortion ("Humping") of the line and surface of the track when performing spot tie replacement, the tie cribs and ends shall be excavated, the old ties removed, and the new ties installed without jacking the rails. Humped track shall be resurfaced at the Contractor's expense.

3.8.4.5 Minimal Humping

For spot or out-of-face tie replacement, where the track will be surfaced and aligned under this Contract, a minimal amount of humping will be allowed, provided the surfacing tolerances can be met.

3.8.4.6 Fouled or Muddy Ballast

Fouled or muddy ballast, as identified by the Contracting Officer, shall be excavated and wasted outside of the track area where it will not interfere with drainage of the track.

3.8.4.7 Insertion of New Ties

New ties shall be inserted in track with the heartwood down, square to the line of the rails.

a. Ties shall be inserted so that the average tie spacing in any one rail length does not exceed 21 in and so that the maximum spacing between any two ties does not exceed 24 in and the maximum spacing is not less than 18 in.

b. Crosstie position at joints shall result in a "suspended joint" arrangement unless otherwise directed by the Contracting Officer.

3.8.4.8 Positioning of Tie Plates

Tie plates shall be positioned on the tie so that the shoulder has full bearing against the base of the rail. The plate shall be centered on the tie width, except that the plate shall be positioned up to 1/2 in off-center if necessary to avoid spiking into an existing tie split. The Contractor shall ensure that all tie plates in a given stretch of track are either canted or flat. Canted and flat tie plates shall not be mixed within a given stretch of track.

3.8.4.9 Re-spacing of existing ties

Re-spacing of ties is required to straighten slewed ties or to correct uneven tie spacing. Crib and shoulder ballast shall be removed as required to facilitate sliding crossties to their final position or to insert new ties. Spike mauls or sledges shall not be used to slide ties. Rail anchors and ballast shall be installed immediately after ties are re-spaced.

3.8.4.10 Track Gauge

Track gauge shall be set at the time of spiking.

a. Tangent Track. For track rehabilitation or spot rail replacement on tangent, the track shall be regauged if the existing gauge is less than 56 in or is equal to or greater than 57-1/2 in. These sections of track shall be regauged to conform with the gauge of the adjacent track, but the gauge after regaging shall be between 56-1/4 and 57 in.

b. Curved Track. Curved track shall be gauged as shown in TABLE V.

3.8.5 Joint Respiking

Many joints in track will be found with nonstandard spiking patterns and other deficiencies. These include joints with no tie plates, plates which are positioned so that it is not possible to spike through the plate on both sides of the joint, spikes driven against the ends of skirted joint bars, and similar deficiencies. The Contractor shall respike such joints in accordance with the following.

3.8.5.1 Substitution of Tie Plates

When tie plates are available which will permit spiking through the tie plate at the edge of the joint bar skirts on both sides of the rail, they shall be substituted for existing plates.

3.8.5.2 Respiked Joints

All joints which are respiked shall have existing spike holes plugged.

3.8.6 Regaging

Where the existing track gauge is less than 56 in or is equal to or grater than 57-1/2 in, or as designated by the Contracting Officer, the track shall be regauged. These sections of track shall be regauged to conform with the gauge of the adjacent track; the track gauge after regaging shall be between 56-1/4 and 57 in.

3.9 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, or by the Contractor, subject to approval. If the Contractor elects to establish testing facilities, approval of such facilities shall be based on compliance with ASTM D 3740. Work requiring testing will not

be permitted until the Contractor's facilities have been inspected and approved. The first inspection of the facilities will be at the expense of the Government and any subsequent inspections required because of failure of the first inspection shall be at the expense of the Contractor. Such costs will be deducted from the total amount due the Contractor.

3.9.1 Ballast and Subballast Samples

Periodic sampling and testing of ballast and subballast material shall be performed to ensure continued compliance with this specification. During construction, one representative sample of the ballast and subballast material shall be taken from each 2,000 tons of ballast and subballast delivered to determine the material gradation. For each 10,000 tons or a fraction thereof of ballast delivered, an additional amount of material shall be obtained in order to perform the quality and soundness tests specified. Samples for material gradation, quality, and soundness tests shall be taken in conformance with ASTM D 75. Test samples shall be reduced from field samples in conformance with ASTM C 702. Sample sizes shall be sufficient to provide the minimum sample sizes required by the designated test procedures. If any individual sample fails to meet the gradation requirement, placement shall be halted and immediate corrective action shall be taken to restore the specified gradation. If any individual sample fails to meet the specified quality and soundness requirements, placement shall be halted and immediate corrective action shall be taken to restore the specified quality.

3.9.2 Ballast and Subballast Tests

3.9.2.1 Sieve Analyses

Sieve analyses shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11.

3.9.2.2 Bulk Specific Gravity and Absorption

Bulk specific gravity and absorption tests shall be made in conformance with ASTM C 127.

3.9.2.3 Percentage of Clay Lumps and Friable Particles

The percentage of clay lumps and friable particles shall be determined in conformance with ASTM C 142.

3.9.2.4 Degradation Resistance

Resistance to degradation of materials shall be determined in conformance with ASTM C 131 and ASTM C 535. Materials with gradations having 100 percent passing the 1 in sieve, shall be tested in conformance with ASTM C 131. Materials having gradations with particles larger than 1 in shall be tested in conformance with ASTM C 535.

3.9.2.5 Soundness Test

Soundness tests shall be made in conformance with ASTM C 88.

3.9.2.6 Percentage of Flat or Elongated Particles

The percentage of flat or elongated particles shall be determined in conformance with ASTM D 4791.

3.9.3 Tie Inspection

The Contractor shall be responsible for the quality of the treated ties. Each tie shall be permanently marked or branded by the producer in accordance with AWPA M6. Each treated wood tie shall be inspected, in accordance with AWPA M2, for conformance with the specified AWPA standards. The 100 percent inspection shall be performed by an independent inspection agency approved by the Contracting Officer. Inspection shall be made at the wood treatment site. The agency's report of inspection shall accompany delivery of the ties. The Contractor shall core and check preservative treatment once per 1000 ties delivered to the construction site.

3.9.4 Examination of Geotextile

The Contractor shall sample the geotextile upon delivery to the project site. Sampling procedures used shall be those detailed in ASTM D 4759and ASTM D 4354 with the number of sample units selected from TABLE II of ASTM D 4354. An independent testing laboratory shall perform the index property tests specified in TABLE II on each of the sample units and determine conformance with the minimum requirements of TABLE II. Conformance shall be determined in accordance with ASTM D 4759. Geotextile seams expected to perform a reinforcement function shall be tested in accordance with ASTM D 4595. The Contracting Officer may examine any geotextiles for defects, damage, or nonconformance prior to installation. Any geotextile not meeting the minimum property requirements of paragraph GEOTEXTILE, or geotextile that is determined to be damaged or defective shall be removed from the site and shall be replaced with additional geotextile meeting the requirements of this specification at no additional cost to the Government.

3.10 INSPECTION AND FIELD TESTING

Quality control inspection and field testing shall be performed by a technician certified to meet ANSI/ASNT CP-189 level II or III qualifications with a minimum of one year experience in testing rail for defects.

3.10.1 Track

Inspection shall be performed to ensure that all the requirements of these specifications are met. Bolted joints shall be inspected for loose bolts and for smooth transitions between rails of different sections. Rail, tie plates, and ties shall be checked to ensure that the rail is properly seated and has full bearing on the tie plate and tie. Upon completion of construction, measurements of track gauge, cross level, and alignment shall be taken and recorded at least once every 100 feet of track centerline length. A copy of these measurements shall be provided to the Contracting Officer.

3.10.2 Welded Joints - Visual Inspection

Each welded joint shall be inspected by the Contractor in the presence of the Contracting Officer after removal of the mold and grinding of excess metal. The Contractor shall pay particular attention to surface cracking, slag inclusion, gas pockets, and lack of fusion. The Contractor shall correct or replace, at no extra cost to the Government, any weld found defective. The method of correction shall be as approved by the Contracting Officer.

3.10.3 Electric Arc Welding Inspection

Electric arc welds shall be inspected to determine that the item welded conforms to the desired contour and contains no visible cracks or voids.

3.10.4 Thermite Weld Joints Testing

Each thermite weld joint shall be ultrasonically tested following the visual inspection. The method of inspection and acceptance shall be in accordance with AWS D1.1. The Contractor shall correct or replace defective welds, at no additional cost to the Government. The method of correction shall be as approved by the Contracting Officer. Ultrasonic testing shall be performed by the Contractor after the rail has been installed in track. The testing will determine whether or not each weld meets the criteria of paragraphs Gap and Alignment, Weld Finishing and Tolerances, and Weld Quality. Welds made in the track which the Contracting Officer determines to be unacceptable shall be cut out of the rail and replaced by a section of new rail and two new welds. Saw cuts shall be made at least 6 in from the centerline of the faulty weld. Replacement welds and replacement rails shall be at the sole expense of the Contractor. Replacement welds shall be renumbered as indicated. Replacement welds made in track shall be ultrasonically tested.

3.10.5 Electric Arc Weld Testing

The welds shall be visually inspected and the contours checked after completion and later tested by the ultrasonic method. The Contractor shall have the welds tested by the ultrasonic method. The testing will determine whether or not each weld meets the quality criteria. Defective welds will be removed and the item rewelded at the Contractors expense.

3.10.6 Inspection of Geotextile

At the direction of the Contracting Officer, the Contractor shall remove the cover material from the geotextile at 3 locations per mile so that the geotextile may be inspected for damage. At each location, the cover material shall be removed to expose a 4 by 4 feet section of the geotextile. If punctures, tears, improper installation, other impairment or damage are found within this section, additional sections shall be excavated to determine the extent of the damage. Damaged geotextile shall be repaired or replaced and recovered with ballast/subballast at the Contractor's expense.

3.10.7 Testing Relay Rail

3.10.7.1 Testing for Wear

Each relay rail shall be checked for wear by the Contractor's quality control representative in the presence of the Contracting Officer after the material is delivered to the construction site. The Contractor shall monitor the installation of track for defects in rail and joint bars being installed. Rail and joint bars that are found to be defective shall not be installed in track.

3.10.7.2 Testing for Defects

Upon completion of the track construction, the Contractor shall have the rail tested by ultrasonic methods. Ultrasonic testing shall be done by a contractor normally engaged in this type of testing with a minimum of 5 years of experience. The Contractor shall schedule a rail testing machine and notify the Contracting Officer of the type of machine and schedule. Contractor furnished rails which are found to be defective at that time shall be removed and replaced by the Contractor at no additional cost to the Government. Contractor furnished joint bars and compromise joint bars that are found to be cracked or broken shall be removed and replaced at no additional cost to the Government.

TABLE VII

RECORD OF ITEMS REPAIRED OR REBUILT BY THE
ELECTRIC ARC WELDING METHOD AND GRINDING

INSTALLATION _____ TURNOUT NUMBER _____

(Circle)

DATE_____ TIME_____AM/PM AIR TEMP _____C* WEATHER_____

ITEM REBUILT	DESCRIPTION	WEIGHT	LENGTH	LH RH	REINFORCED
Guard Rails	[_____]	[_____]	[_____]	[_____]	[_____]
Rail (Ends)	[_____]	[_____]	[_____]	[_____]	[_____]
Rail-Engine Burns	[_____]	[_____]	[_____]	[_____]	[_____]

*NOTE: Determination will be made to the nearest 1/2 degree.

RECORD OF FIELD WELD

INSTALLATION_____ WELD NUMBER _____

FINAL INSTALLED
LOCATION _____ TRACK _____
STATION _____ RAIL Left Right (Circle)

DATE _____ TIME _____ AM PM (Circle)

AIR TEMPERATURE _____ F*. WEATHER _____
RAIL TEMPERATURE _____ F*. _____

WELD KIT MANUFACTURER _____
RAIL GAP
NEAREST 1/16 IN _____
RAIL CUT REQUIRED? YES NO (Circle)
BACK RAIL
MANUFACTURER _____ USED RAIL? YES NO (Circle)
YEAR/MONTH ROLLED _____ HEAT NUMBER _____
_____

AHEAD RAIL
MANUFACTURER _____ USED RAIL? YES NO (Circle)
YEAR/MONTH ROLLED _____ HEAT NUMBER _____
_____

REMARKS_____
_____
_____

ULTRASONIC TEST DATE & RESULTS _____

KIT MFG. REPRESENTATIVE
PRESENT _____ WELDING FOREMAN _____
(Initial) (Signed)

CONTRACTING OFFICER'S
REPRESENTATIVE
PRESENT _____ RECORDER _____
(Initial) (Signed)

_____ RECORDER _____
(Initial) (Signed)

FOR GOVERNMENT USE ONLY

ULTRASONIC TEST DATE AND RESULTS _____

RECORD OF FIELD WELD

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*NOTE: Determination will be made to the nearest 1/2 degree.

-- End of Section --

PHASE I

DIVISION 6 – WOOD AND PLASTICS

06710 Vinyl Sheet Piling

SECTION 06710

VINYL SHEET PILING

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing all submittals, labor, equipment, plant, materials, and all efforts necessary for vinyl sheet piling acquisition and installation as defined for this project. Vinyl sheet piling is a Contractor requirement for permanent seepage control beneath the Q2 gap pile cap. Vinyl sheet piling interlocks shall be compatible with the adjacent steel sheet piling interlocks in line with the vinyl sheet piling or the Contractor may use field joint fabrication as indicated in the drawings.

1.2 REFERENCES

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

AMERICAN ASSOCIATION FOR TESTING AND MATERIALS (ASTM)

ASTM D-638	(1999) Tensile Properties of Plastics
ASTM D-790	(1999) Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulation Materials
ASTM D 4216	(1998) Rigid Poly (Vinyl Chloride) (PVC) and Related Plastic Building Products Components
ASTM D-4226	(1999) Impact Resistance of Rigid Poly (Vinyl Chloride) (PVC) Building Products

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Plan of Operations ; GA-GL.

A detailed plan of operations shall be submitted to the Contracting Officer Representative (COR) and work shall not begin until the submittal has been approved. The submittal shall include, as a minimum, acquisition, storage, protection, and installation of vinyl sheet piling. Installation shall include method of embedment into the ground; method of connection to

adjacent steel sheet piling, where appropriate; and, layout of the vinyl sheet piling relative to the project features. The Plan of Operations shall include a section describing the proposed method of mitigation should voids develop during driving between the sheet piling and the soil. Grouting will be considered an acceptable mitigation technique. Should the Contractor wish to pursue the grouting option, the Plan of Operations shall contain a section describing the proposed grout type, the grout mix, and the proposed method of placement for the Contracting Officer's review and approval.

Conformance With Specification Certification;GA-GL

The Contractor shall provide written certification stamped by a professional engineer registered in the State of Missouri stating that the vinyl sheet piling provided for this contract meets or exceeds the requirements of this specification section. This certification shall include a listing of the requirements.

SD-14 Samples

Vinyl Sheet Piling Sample;GA-GL

A sample of the vinyl sheet piling shall be submitted as well as a specification sheet on the vinyl sheet piling to be used for the seepage cut-off. The sample and specification sheet shall demonstrate compliance with the requirements of these plans and specifications and minimum requirements necessary for the approved installation method. Vinyl sheet piling shall not be acquired and brought on site until the material is approved by the COR.

1.4 VINYL SHEET PILING STORAGE, HANDLING, AND PROTECTION

Vinyl sheet piling shall be stored and handled in accordance with the manufacturer's recommendations. Vinyl sheet piling storage and handling shall be addressed in the Contractor's Plan of Operations submittal and shall reference specific manufacturer's recommendations. Ultraviolet inhibitor within the vinyl sheet piling will not be required. However, until the vinyl sheet piling is embedded in the earth, the vinyl sheet piling shall be protected against exposure to ultraviolet rays. The duration of exposure to ultraviolet rays shall not exceed the manufacturer's recommendations. Vinyl sheet piling exceeding the manufacturer's ultraviolet exposure duration limit or damaged during shipment, storage, handling, or other means shall be immediately removed from the project site. Vinyl sheet piling damaged during installation shall be removed from the ground and immediately removed from the project site. Damaged vinyl sheet piling or vinyl sheet piling exceeding manufacturer's limits for ultraviolet exposure shall be replaced, and reinstalled, as appropriate, at no cost to the Government.

1.5 SUBSURFACE INFORMATION

The Contractor shall review and become familiar with subsurface conditions where the vinyl sheet piling is to be installed and account for the subsurface conditions in the Plan of Operations' sections on installation and protection of the vinyl sheet piling.

PART 2 PRODUCTS

2.1 GENERAL

The Contractor is responsible for providing vinyl sheet piling that meets the requirements of these plans and specifications and as necessary to meet the minimum requirements for the approved installation procedure. Requirements in these plans and specifications shall be considered the minimum requirements. A certification stamped by a professional engineer registered in the State of Missouri shall be provided by the Contractor stating the vinyl sheet piling meets or exceeds the requirements of this specification section. This certification shall include a listing of the requirements.

2.2 VINYL SHEET PILING

2.2.1 Minimum Requirements

Vinyl sheet piling shall be commercial grade and co-extruded with the Z or U-type section configuration conforming to ASTM D 4216. Vinyl sheet piling shall be rigid, impact modified, and have a weatherable virgin capstock. The sheet piling shall have a minimum section depth of 7 inches but not to **exceed 9 inches**. The minimum web and outer flat thickness shall be 0.250 inches. The vinyl sheet piling shall have a minimum warranty of 50 years against measurable degradation of physical dimensions or composition, strength, and ductility. Series 300, ShoreGuard vinyl sheet piling manufactured by Materials International, Inc. of Atlanta, Georgia or equivalent having the following material properties shall be used for this project.

Vinyl Sheet Pile Properties

Property	Units	Value
Design Strength	Pounds/Sq. Inch	2,667
Impact Strength	In.-Lbs./Sq. Inch	13,750
Strength Rating	Ft. Lbs./Linear Ft.	2,889
Weight/Foot	Pounds	3.2
Nominal Thickness	Inches	0.250
Section Modulus	Cubic In./Linear Ft.	13
Modulus of Elasticity	Pounds/Sq. Inch	380,000
Tensile Strength	Pounds/Sq. Inch	6,300

Modulus of elasticity shall be as measured according to ASTM D-790. Tensile Strength shall be as measured according to ASTM D-638. Impact Strength shall be as measured according to ASTM D-4226.

2.2.2 Additional Requirements

In addition to the minimum requirements, vinyl sheet piling shall also comply with the minimum manufacturer's requirements for the approved installation procedure. The Contractor shall ensure the additional requirements do not violate the minimum requirements of paragraph 2.1 of this specification section and shall ensure compliance with manufacturer's recommendations when developing the vinyl sheet pile installation procedure.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall be responsible for the proper installation of the vinyl sheet piling. The vinyl sheet piling shall be handled and installed in accordance with the requirements of these plans and specifications and with the manufacturer's recommendations. Selection of the vinyl sheet piling shall be such as to not violate the requirements of these plans and specifications. Installation shall be to the limits shown in the drawings: layout and connections shall be such to ensure continuity throughout the length of the combined vinyl and steel sheet piling system.

3.2 EQUIPMENT

Equipment proposed for installation of vinyl sheet piling shall be identified in the Plan of Operations. If the vinyl sheet piling is to be driven into position, a template shall be provided by the Contractor for the installation per the manufacturer's recommendations. An installation mandrel will be allowed for the installation of the vinyl sheet piling. The "Stompper" mandrel manufactured by Stab Cat of Louisiana, Plaquemine, LA, or equivalent as approved by the Contracting Officer may be utilized by the Contractor for this project.

3.3 INSTALLATION

Installation shall include the placement of continuous lengths of vinyl sheet piling extending from an elevation of 6-inches below the base of pile cap elevation to the tip elevations as indicated on the drawings. The vinyl sheet piling shall be installed into a pre-excavated surface trench having a depth of 12-inches as measured from the base of pile cap elevation and a width sufficient to allow 6-inches of clear space between the edges of the installed vinyl sheet piling and the trench walls. Project drawings shall be referenced by the Contractor for other details of the trench dimensions, backfilling requirements, and trench completion prior to placement of pile cap concrete. Field fabrication of vinyl to vinyl sheet piling horizontal couplings shall not be allowed. For vinyl to steel sheet piling connections the Contractor has the option of selecting vinyl and steel sheet piling having compatible interlocks or the Contractor may choose to field manufacture a connection as indicated on the drawings. The Contractor shall allow for extra pile length as necessary for sacrifice due to damage from the installation. Sacrificial lengths shall not be considered part of the pay item. The installation method shall be proposed by the Contractor in the Plan of Operations. The installation method proposed shall not result in voids or gaps between the vinyl sheet piling and the soil, shall not result in reduced subsurface soil density, and shall not promote fracturing or heave of the subsurface soils. Grouting will be considered acceptable to mitigate voids developing during sheet piling installation upon successful demonstration of complete filling without detriment to the subsurface. The proposed grout type, mix, and placement technique shall be included as part of the Plan of Operations.

3.4 CONNECTIONS

The Contractor shall include in the Plan of Operations a proposed detail for the vertical coupling of vinyl to steel sheet piling. A field fabrication detail is included in the drawings and will be considered an acceptable procedure for vertical coupling of vinyl to steel.

-- End of Section --

PHASE I

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

NOT APPLICABLE

PHASE I

DIVISION 8 – DOORS AND WINDOWS

NOT APPLICABLE

PHASE I

DIVISION 9 – FINISHES

09965 Painting: Hydraulic Structures

SECTION 09965

PAINTING: HYDRAULIC STRUCTURES
09/98

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 basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z87.1	(1989; Errata; Z87.1a) Occupational and Educational Eye and Face Protection
ANSI Z358.1	(1990) Emergency Eyewash and Shower Equipment

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 153	(1984; R 1996) Specific Gravity of Pigments
ASTM D 235	(1995) Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
ASTM D 281	(1995) Oil Absorption of Pigments by Spatula Rub-Out
ASTM D 304	(1995) N-Butyl Alcohol (Butanol)
ASTM D 520	(1984; R 1995) Zinc Dust Pigment
ASTM D 561	(1982; R 1996) Carbon Black Pigment for Paint
ASTM D 740	(1994) Methyl Ethyl Ketone
ASTM D 770	(1995) Isopropyl Alcohol
ASTM D 841	(1995) Nitration Grade Toluene
ASTM D 843	(1995) Nitration Grade Xylene
ASTM D 962	(1981; R 1994) Aluminum Powder and Paste Pigments for Paints
ASTM D 1045	(1995) Sampling and Testing Plasticizers Used in Plastics
ASTM D 1152	(1989; R 1993) Methanol (Methyl Alcohol)
ASTM D 1153	(1994) Methyl Isobutyl Ketone
ASTM D 1186	(1993) Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings

	Applied to a Ferrous Base
ASTM D 1200	(1994) Viscosity by Ford Viscosity Cup
ASTM D 1210	(1996) Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage
ASTM D 1400	(1994) Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base
ASTM D 1763	(1994) Epoxy Resins
ASTM D 2917	(1991; R 1994) Methyl Isoamyl Ketone
ASTM D 3721	(1983; R 1991) Synthetic Red Iron Oxide Pigment
ASTM D 4360	(1990; R 1995) Methyl n-Amyl Ketone
ASTM D 4417	(1993) Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM E 1347	(1997) Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.20	Access to Employee Exposure and Medical Records
29 CFR 1910.94	Ventilation
29 CFR 1910.139	Respiratory Protection
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1910, Subpart I	Personal Protective Equipment
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.62	Lead
40 CFR 50.6	National Primary and Secondary Ambient Air Quality Standards for Particulate Matter
40 CFR 50.12	National Primary and Secondary Ambient Air Quality Standards for Lead
40 CFR 50, App B	Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere
40 CFR 58, App E	Probe Siting Criteria for Ambient Air Quality Monitoring

40 CFR 60, App A, Mtd 22	Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares
40 CFR 117	Determination of Reportable Quantities for Hazardous Substances
40 CFR 122	EPA Administered Permit Programs: The National Pollutant Discharge Elimination System
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 261, App III	Chemical Analysis Test Methods
40 CFR 261, App II, Mtd 1311	Toxicity Characteristic Leaching Procedure (TCLP)
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 262.22	Number of Copies
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 355	Emergency Planning and Notification
49 CFR 171, Subchapter C	Hazardous Materials Regulations

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-2246	(Rev B) Paint, Latex
CID A-A-2962	Enamel, Alkyd
CID A-A-2994	Primer Coating, Interior, For Wall and Wood
CID A-A-3127	Coating System: Aluminum Epoxy Mastic, For Minimally Prepared Atmospheric Steel
CID A-A-3132	Coating System: Epoxy Primer/Polyurethane Topcoat, For Minimally Prepared Atmospheric Steel
CID A-A-50542	(Rev A) Coating System: Reflective, Slip-Resistant, Chemical-Resistant Urethane for Maintenance Facility Floors
CID A-A-50574	Enamel, Odorless, Alkyd, Interior, Semigloss, White and Tints

ENGINEERING MANUALS (EM)

EM 385-1-1	(1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

FEDERAL SPECIFICATIONS (FS)

FS TT-P-38	(Rev E) Paint, Aluminum (Ready-Mixed)

GRETAGMACBETH (GM)

GM-40291	(Matte Edition) Munsell Book of Color: Matte Finish Collection

MILITARY SPECIFICATIONS (MS)

MS MIL-P-24441/GEN	(Rev B; Am 1, Supple 1) Paint, Epoxy-Polyamide (Inch-Pound)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996; Errata 96-4) National Electrical Code

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH Pub No. 84-100	(1984; Supple 1985, 1987, 1988, & 1990) NIOSH Manual of Analytical Methods

SSPC: THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Guide 6	(1995) Containing Debris Generated During Paint Removal Operations
SSPC Paint 16	(1991) Coal Tar Epoxy-Polyamide Black (or Dark Red) Paint
SSPC Paint 20	(1991) Zinc-Rich Primers (Type I - 'Inorganic' and Type II - 'Organic')
SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)
SSPC Paint 27	(1991) Basic Zinc Chromate-Vinyl Butyral Wash Primer
SSPC Paint 33	(1994) Coal Tar Mastic, Cold-Applied
SSPC SP 1	(1982) Solvent Cleaning
SSPC SP 3	(1995) Power Tool Cleaning
SSPC SP 5	(1994) White Metal Blast Cleaning
SSPC SP 6	(1994) Commercial Blast Cleaning
SSPC SP 7	(1994) Brush-Off Blast Cleaning

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 3110	(1992; Rev G) Primer Zinc Chromate
SAE AMS 3132	(1994; Rev F) Varnish, Phenolic Resin Corrosion-Preventive

1.2 MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for work covered under this Section and all costs shall be included in the contract unit or lump sum price for the item of work.

1.3 WORK PERFORMANCE

Work shall be performed in accordance with the requirements of 29 CFR 1910, 29 CFR 1926, EM 385-1-1, and other references as listed herein. Matters of interpretation of the standards shall be submitted to the Contracting Officer for resolution before starting work. Where the regulations conflict, the most stringent requirements shall apply.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Accident Prevention Plan; GA-RE.

The requirements included in Section 01 of EM 385-1-1 shall be followed by the Contractor when preparing the Accident Prevention Plan. The plan shall be prepared for all sites and shall include, but is not limited to, each of the topic areas listed in Table 1-1 therein and the requirements of paragraph, "SAFETY AND HEALTH PROVISIONS;" each topic shall be developed in a concise manner to include management and operational aspects.

Waste Classification, Handling, and Disposal Plan; GA-RE.

The Contractor is responsible for assuring the proper disposal of all hazardous and nonhazardous waste generated during the project. Therefore, the contractor shall develop a Waste Classification, Handling, and Disposal Plan for all job sites in accordance with the requirements of 40 CFR 261 and 40 CFR 262. In addition, the following provisions shall be included:

a. In the case of waste generated from abrasive blasting lead-containing paints with recyclable steel or iron abrasives, the spent abrasive shall be disposed of as a hazardous waste or shall be stabilized with proprietary blast additives regardless of the results of 40 CFR 261, App II, Mtd 1311. Where stabilization is preferred, the contractor shall employ a proprietary blast additive during blasting operations.

b. Hazardous waste shall be placed in closed containers and shall be shielded adequately to prevent dispersion of the waste by wind or water. Any evidence of improper storage shall be cause for immediate shutdown of the project until corrective action is taken.

c. Nonhazardous waste shall be stored in closed containers separate

from hazardous waste storage areas.

d. All hazardous waste shall be transported by a licensed transporter in accordance with 40 CFR 263 and 49 CFR 171, Subchapter C.

e. All nonhazardous waste shall be transported in accordance with local regulations regarding waste transportation.

f. In addition to the number of manifest copies required by 40 CFR 262.22, one copy of each manifest will be supplied to the Contracting Officer prior to transportation.

Visible Emissions; GA-RE.

For all jobs requiring tight control on emissions where lead is not present, the Contractor shall develop a plan monitoring the visible emissions from the project. The time of emissions shall be measured in accordance with 40 CFR 60, App A, Mtd 22. The plan shall also include the provisions for halting work and correcting the containment in the event unacceptable emissions are observed. General statements shall not be used; specific methods, procedures, and details are required. Random emissions from the containment shall not exceed 1 percent of the work day. The Contractor shall document each time that the work is halted due to a violation of the visible emissions criteria. Documentation shall include the cause for shutdown and the corrective action taken to resolve the problem.

SD-14 Samples

Special Paint Formulas; GA-RE.

Samples of special paint formulas, listed in paragraph PAINT FORMULATIONS, shall be submitted. For all vinyl-type paints submitted for laboratory testing, separate1/2-pint samples of ingredient raw materials shall be furnished. The ingredient samples shall be clearly identified by commercial name, trade designation, manufacturer, batch or lot number, and such other data as may be required. For all epoxy type paints submitted for laboratory testing, a list of ingredient raw materials identifying commercial name, trade designation, manufacturer, batch or lot number, and such other data as may be required shall be furnished.

Specification and Proprietary Paints; GA-RE.

Federal, Military, Commercial Item Description, and SSPC: The Society for Protective Coatings specification paints are those formulated to meet federal, military, government and industry specifications. When the required quantity of any type is50 gallons or less, the Contractor can submit:

a. A certified test report showing the results of required tests made on the material and a statement that it meets all of the specification requirements.

b. A certified test report showing the results of required tests made on a previous batch of paint produced by the same firm using the same ingredients and formulation except for minor differences necessitated by a color change and a statement that the previous batch met all of the specification requirements. A report of tests on the proposed batch showing the following properties applicable to the material

specifications shall be furnished: color, gloss, drying time, opacity, viscosity, weight per gallon, and fineness of grind.

c. A proprietary paint - When the required quantity of a particular type or color of a paint is10 gallons or less, a proprietary, name-brand, shelf item paint of the same type and with similar properties to the material specified may be proposed without sampling. Proprietary paints are any which do not follow the formulas in paragraph PAINT FORMULATIONS or the complete specification requirements of the government or industry specifications. To receive consideration, a statement from the supplier that the paint is appropriate as to type, color, and gloss and is a premium grade of paint shall be furnished.

Thinners; GA-RE.

Samples shall be submitted of the thinners which are those solvents used to reduce the viscosity of the paint.

SD-18 Records

Inspections and Operations; GA-RE.

The Contractor shall document and submit records of inspections and operations performed. Submittals shall be made on a daily basis and shall include but are not limited to:

a. Inspections performed, including the area of the structure involved and the results of the inspection.

b. Surface preparation operations performed, including the area of the structure involved, the mode of preparation, the kinds of solvent, abrasive, or power tools employed, and whether contract requirements were met.

c. Thinning operations performed, including thinners used, batch numbers, and thinner/paint volume ratios.

d. Application operations performed, including the area of the structure involved, mode of application employed, ambient temperature, substrate temperature, dew point, relative humidity, type of paint with batch numbers, elapsed time between surface preparation and application, elapsed time for recoat, condition of underlying coat, number of coats applied, and if specified, measured dry film thickness or spreading rate of each new coating.

1.5 SAMPLING AND TESTING

The Contractor shall allow at least 30 days for sampling and testing. Sampling may be at the jobsite or source of supply. The Contractor shall notify the Contracting Officer when the paint is available for sampling. Sampling of each batch shall be witnessed by the Contracting Officer unless otherwise specified or directed. A1-quart sample of paint and thinner shall be submitted for each batch proposed for use. The sample shall be labeled to indicate formula or specification number and nomenclature, batch number, batch quantity, color, date made, and applicable project contract number. Testing will be performed by the Government. Costs for retesting rejected material will be deducted from payments to the Contractor at the rate of $1500.00 dollars for each sample retested.

1.6 SAFETY AND HEALTH PROVISIONS

Paragraph SAFETY AND HEALTH PROVISIONS supplements the requirements of EM 385-1-1, paragraph (1). In any conflict between Section 01 of EM 385-1-1 and this paragraph, the provisions herein shall govern.

PART 2 PRODUCTS

2.1 SPECIAL PAINT FORMULAS

Special paints shall have the composition as indicated in the formulas listed herein. Where so specified, certain components of a paint formulation shall be packaged in separate containers for mixing on the job. If not specified or otherwise prescribed, the color shall be that naturally obtained from the required pigmentation.

2.2 PAINT FORMULATIONS

Special paint formulas shall comply with the following:

2.2.1 Formula E-303d, Epoxy Zinc-Rich Paint

INGREDIENTS	PERCENT BY WEIGHT	POUNDS	GALLONS
COMPONENT A			
Epoxy Resin, Type 1	35.9	277.8	28.1
Methyl n-Amyl Ketone	44.2	342.5	50.3
Toluene	6.0	46.3	6.9
Butanol	6.0	46.3	6.9
Suspending Agent M	6.5	50.0	6.9
Phthalocyanine Blue Pigment	1.4	11.0	0.9
	100.0	773.9	100.0
COMPONENT B			
Polyamide Resin	38.1	277.8	34.3
Isopropanol	12.7	92.6	14.2
Toluene	12.7	92.6	12.3
Butanol	35.4	257.6	38.2
Catalyst	1.1	8.1	1.0
	100.0	728.7	100.0
COMPONENT C			
Zinc Dust Pigment	100.0	5,000.0	85.0

a. Components A, B, and C of Formula E-303d shall be packaged separately as kits (unitized packaging permissible). The standard size kit shall be2.85 gallons (mixed paint volume) consisting of1 gallon of Component A,1 gallon of Component B, and50 pounds of zinc dust (Component C), packaged in a2-gallon pail. Kits of larger or smaller sizes will be permitted, provided that the quantity relationship of the components shall be the same as the standard kit.

b. In addition to standard labeling requirements, each container of each component shall be properly identified as to component type and each container label of Component A shall carry the following: MIXING INSTRUCTIONS: To prepare this paint for application, combine Components A and B and, while the mixture is being vigorously stirred with a heavy-duty power stirrer, sift in the zinc dust (Component C). Continue the stirring until the zinc dust has been well dispersed and the mixture is smooth. The mixed paint shall at some point be strained through a 30- to 60-mesh screen to prevent any undispersed zinc dust slugs from reaching the spray gun nozzle. Thin with an appropriate thinner where necessary to obtain satisfactory application results. The pot life of the mixed material, extended from time to time by the addition of small amounts of thinner, will normally be in excess of 24 hours but may be less in very warm weather. Stir the material continuously after mixing and during application.

2.2.2 Formula C-200a, Coal Tar-Epoxy (Black) Paint

The paint shall conform to SSPC Paint 16 manufactured with Type 1 pitch. In addition to standard labeling, container labels shall include the term, Corps of Engineers Formula C-200a.

2.3 INGREDIENTS FOR SPECIAL PAINT FORMULAS

The following ingredient materials and thinners apply only to those special paints whose formulas are shown above in detail.

2.3.1 Pigments and Suspending Agents

2.3.1.1 Zinc Dust

Zinc dust pigment shall conform to ASTM D 520, Type II.

2.3.1.2 Phthalocyanine Blue

Phthalocyanine blue pigment for epoxy zinc-rich paint shall have properties similar and equal to Peacock Blue 249-1282 manufactured by Sun Chemical Co.

2.3.1.3 Suspending Agent M

Suspending Agent M shall be of soft translucent paste consisting of a thixotropic agent dispersed in toluene. It shall have a nonvolatile content of approximately 25 percent and a specific gravity of approximately 0.872. It shall be capable of minimizing the tendency of zinc dust to settle hard without increasing the viscosity of the paint significantly. MPA-60 (toluene), produced by Rheox, Inc., has these properties.

2.3.2 Resins, Plasticizer, and Catalyst

2.3.2.1 Catalyst

The catalyst for Formula E-303d shall be 2, 4, 6 tri(dimethylamino methyl) phenol. DMP-30, Rohm & Haas Co., is such a chemical.

2.3.2.2 Epoxy Resin, Type I

The epoxy resin for Formula E-303d shall be of the solid type conforming to ASTM D 1763 for a Type I, Grade 1, Class D resin except that it shall have weight per epoxy equivalent (WPE) of 425-550 and the softening point shall

be between 65 and 75.

2.3.2.3 Polyamide Resin

The polyamide resin for Formula E-303d shall be a condensation product of a dimerized fatty acid and polyamines. It shall be a solid resin at room temperature and have the following characteristics:

	MINIMUM	MAXIMUM
Amine value	85	95
Color (Gardner)	----	12
Specific Gravity, 25/25 degree C	0.97	0.99
Viscosity, Poises, 150 degrees C (Brookfield)	7	9

2.3.3 Solvent and Thinners

2.3.3.1 Isopropanol

Isopropyl alcohol shall conform to ASTM D 770.

2.3.3.2 Butanol

Butanol (butyl alcohol) shall conform to ASTM D 304.

2.3.3.3 Methyl n-Amyl Ketone

Methyl n-amyl ketone (MAK) shall conform to ASTM D 4360.

2.3.3.4 Toluene

Toluene shall conform to ASTM D 841.

2.4 TESTING

2.4.1 Chromatographic Analysis

Solvents in vinyl and epoxy paints and thinners shall be subject to analysis by programmed temperature gas chromatographic methods and/or spectrophotometric methods, employing the same techniques that give reproducible results on prepared control samples known to meet the specifications. If the solvent being analyzed is of the type consisting primarily of a single chemical compound or a mixture or two or more such solvents, interpretation of the test results shall take cognizance of the degree of purity of the individual solvents as commercially produced for the paint industry.

PART 3 EXECUTION

3.1 CLEANING AND PREPARATION OF SURFACES TO BE PAINTED

3.1.1 General Requirements

Surfaces to be painted shall be cleaned before applying paint or surface treatments. Deposits of grease or oil shall be removed in accordance with SSPC SP 1, prior to mechanical cleaning. Solvent cleaning shall be accomplished with mineral spirits or other low toxicity solvents having a flashpoint above100 degrees F. Clean cloths and clean fluids shall be used

to avoid leaving a thin film of greasy residue on the surfaces being cleaned. Items not to be prepared or coated shall be protected from damage by the surface preparation methods. Machinery shall be protected against entry of blast abrasive and dust into working parts. Cleaning and painting shall be so programmed that dust or other contaminants from the cleaning process do not fall on wet, newly painted surfaces, and surfaces not intended to be painted shall be suitably protected from the effects of cleaning and painting operations. Welding of, or in the vicinity of, previously painted surfaces shall be conducted in a manner to prevent weld spatter from striking the paint and to otherwise reduce coating damage to a minimum; paint damaged by welding operations shall be restored to original condition. Surfaces to be painted that will be inaccessible after construction, erection, or installation operations are completed shall be painted before they become inaccessible.

3.1.2 Ferrous Surfaces Subject to Normal Exposure

Ferrous surfaces that are to be continuously in exterior or interior atmospheric exposure and other surfaces as directed shall be cleaned by means of power tools or by dry blasting to the brush-off grade. Cleaning and priming shall be done in the shop unless otherwise directed or permitted. Power tool cleaning shall conform to the requirements of SSPC SP 3. Brush-off blast cleaning shall conform to the requirements of SSPC SP 7. Regardless of the overall cleaning method used, welds and adjoining surfaces within a fewinches thereof shall be cleaned of weld flux, spatter, and other harmful deposits by blasting, power impact tools, power wire brush, or such combination of these and other methods as may be necessary for complete removal of each type of deposit. The combination of cleaning methods need not include blasting when preparation of the overall surfaces is carried out by the power tool method. However, brush scrubbing and rinsing with clean water, after mechanical cleaning is completed, will be required unless the latter is carried out with thoroughness to remove all soluble alkaline deposits. Wetting of the surfaces during water-washing operations shall be limited to the weld area required to be treated, and such areas shall be dry before painting. Welds and adjacent surfaces cleaned thoroughly by blasting alone will be considered adequately prepared provided that weld spatter not dislodged by the blast stream shall be removed with impact or grinding tools. All surfaces shall be primed as soon as practicable after cleaning but prior to contamination or deterioration of the prepared surfaces. To the greatest degree possible, steel surfaces shall be cleaned (and primed) prior to lengthy outdoor storage to minimize breakdown of mill scale and consequent rusting.

3.1.3 Ferrous Surfaces Subject to Severe Exposure

Ferrous surfaces subject to extended periods of immersion or as otherwise required shall be dry blast-cleaned to SSPC SP 5. The blast profile, unless otherwise specified, shall be1.5 to 2.5 mils as measured by ASTM D 4417, Method C. Appropriate abrasive blast media shall be used to produce the desired surface profile and to give an angular anchor tooth pattern. If recycled blast media is used, an appropriate particle size distribution shall be maintained so that the specified profile is consistently obtained. Steel shot or other abrasives that do not produce an angular profile shall not be used. Weld spatter not dislodged by blasting shall be removed with impact or grinding tools and the areas reblasted prior to painting. Surfaces shall be dry at the time of blasting. Blast cleaning to SSPC SP 5 shall be done in the field and, unless otherwise specifically authorized, after final erection. Within 8 hours after cleaning, prior to the deposition of any detectable moisture, contaminants, or corrosion, all

ferrous surfaces blast cleaned to SSPC SP 5 shall be cleaned of dust and abrasive particles by brush, vacuum cleaner, and/or blown down with clean, dry, compressed air, and given the first coat of paint. Upon written request by the Contractor, the Contracting Officer may authorize mill or shop cleaning of assembled or partially assembled components specified to receive one of the vinyl-type paint systems or Systems Nos. 6-A-Z, 21-A-Z, and 21-B-Z employing the epoxy zinc-rich primer. The surfaces, if shop blasted, shall be shop coated with the first and second coats of the specified paint system except that the epoxy zinc-rich primed surfaces shall receive an extra single spray coat of the zinc primer at the time field painting is started, as specified in the paint system instructions. The shop coating shall be maintained in good condition by cleaning and touching up of areas damaged during the construction period. If pinpoint or general rusting appears, surfaces shall be reblasted and repainted at no added cost to the Government. Prior to the field application of subsequent coats, soiled areas of the shop coating shall be thoroughly cleaned and all welds or other unpainted or damaged areas shall be cleaned and coated in a manner to make them equivalent to adjacent, undamaged paint surfaces.

3.1.4 Galvanized, Aluminum, Aluminum Alloy, or Copper Surfaces

Where surfaces are specified to be painted, they shall be first washed with clean mineral spirits and then pretreated with a primer conforming to SSPC Paint 27 in accordance with the following instructions. The pretreatment primer shall be mixed by adding one volume of acid component (diluent) to four volumes of resin component (base solution) slowly and with constant stirring. After mixing, the material shall be used within 8 hours. The pretreatment primer shall be spray applied at a coverage rate of250 to 300 square feet per gallon (of resin component) to give a dry film thickness of 0.3 to 0.5 mil. Small areas may be coated by brush or swab. Care shall be exercised in spray application to avoid the deposition of dry particles on the surface. A wet spray shall be maintained at all times by additional thinning with Normal Butanol ASTM D 304. The acid component (diluent), over and above the amount prescribed above, shall not be used for thinning purposes. Surfaces shall receive the first coat of paint after at least 1 but not more than 24 hours drying of the pretreatment primer film.

3.1.5 Concrete Surfaces

New concrete surfaces, including concrete floors, shall be permitted to age for a minimum of 30 days prior to painting. Grease and oil removal shall be accomplished by solvent cleaning and/or detergent washing followed by rinsing. Loosely adherent materials such as dirt, dust, laitance, efflorescence, bleed water residues, or other foreign substances shall be removed by wire or fiber brushing, scrapers, light sandblasting, or other approved means. For interior walls and floors, sandblasting, unless otherwise specifically authorized, shall be restricted to the wet or vacuum type. Surface glaze, if present, shall be removed by light blasting or by scrubbing with a 5-percent solution of phosphoric acid. The texture of the surface after etching shall be roughly equivalent to the texture of an 80-120 grit sandpaper. If acid etching is used, the surface shall be thoroughly rinsed with clean water to remove all traces of the acid. Prior to painting, the concrete shall be dry. Adequate dryness shall be determined visually at the time of application by performing the following test. Tape2-foot by 2-foot squares of polyethylene to the surface at random locations. The test patches shall remain in place overnight. Coatings may be applied if there are no traces of moisture and surfaces are dry beneath the polyethylene the following day.

3.2 PAINT APPLICATION

3.2.1 General

The finished coating shall be free from holidays, pinholes, bubbles, runs, drops, ridges, waves, laps, excessive or unsightly brush marks, and variations in color, texture, and gloss. Application of initial or subsequent coatings shall not commence until the Contracting Officer has verified that atmospheric conditions and the surfaces to be coated are satisfactory. Each paint coat shall be applied in a manner that will produce an even, continuous film of uniform thickness. Edges, corners, crevices, seams, joints, welds, rivets, corrosion pits, and other surface irregularities shall receive special attention to ensure that they receive an adequate thickness of paint. Spray equipment shall be equipped with traps and separators and where appropriate, mechanical agitators, pressure gauges, pressure regulators, and screens or filters. Air caps, nozzles, and needles shall be as recommended by the spray equipment manufacturer for the material being applied. Airless-type spray equipment may be used only on broad, flat, or otherwise simply configured surfaces, except that it may be employed for general painting if the spray gun is equipped with dual or adjustable tips of proper types and orifice sizes. Airless-type equipment shall not be used for the application of vinyl paints.

3.2.2 Mixing and Thinning

Paints shall be thoroughly mixed, strained where necessary, and kept at a uniform composition and consistency during application. Paste or dry-powder pigments specified to be added at the time of use shall, with the aid of powered stirrers, be incorporated into the vehicle or base paint in a manner that will produce a smooth, homogeneous mixture free of lumps and dry particles. Where necessary to suit conditions of the surface temperature, weather, and method of application, the paint may be thinned immediately prior to use. Thinning shall generally be limited to the addition of not more than1 pint per gallon of the proper thinner; this general limitation shall not apply when more specific thinning instructions are provided. Paint that has been stored at low temperature, shall be brought up to at least70 degrees F before being mixed and thinned, and its temperature in the spray tank or other working container shall not fall below60 degrees F during the application. Paint that has deteriorated in any manner to a degree that it cannot be restored to essentially its original condition by customary field-mixing methods shall not be used and shall be removed from the project site. Paint and thinner that is more than 1 year old shall be resampled and resubmitted for testing to determine its suitability for application.

3.2.3 Atmospheric and Surface Conditions

Paint shall be applied only to surfaces that are above the dew point temperature and that are completely free of moisture as determined by sight and touch. Paint shall not be applied to surfaces upon which there is detectable frost or ice. Except as otherwise specified, the temperature of the surfaces to be painted and of air in contact therewith shall be not less than45 degrees F during paint application nor shall paint be applied if the surfaces can be expected to drop to32 degrees F or lower before the film has dried to a reasonably firm condition. During periods of inclement weather, painting may be continued by enclosing the surfaces and applying artificial heat, provided the minimum temperatures and surface dryness requirements prescribed previously are maintained. Paint shall not be applied to surfaces heated by direct sunlight or other sources to

temperatures that will cause detrimental blistering, pinholing, or porosity of the film.

3.2.4 Time Between Surface Preparation and Painting

Surfaces that have been cleaned and/or otherwise prepared for painting shall be primed as soon as practicable after such preparation has been completed but, in any event, prior to any deterioration of the prepared surface.

3.2.5 Method of Paint Application

Unless otherwise specified, paint shall be applied by brush or spray to ferrous and nonferrous metal surfaces. Special attention shall be directed toward ensuring adequate coverage of edges, corners, crevices, pits, rivets, bolts, welds, and similar surface irregularities. Other methods of application to metal surfaces shall be subject to the specific approval of the Contracting Officer. Paint on plaster, concrete, or other nonmetallic surfaces shall be applied by brush, roller, and/or spray.

3.2.6 Coverage and Film Thickness

Film thickness or spreading rates shall be as specified hereinafter. Where no spreading rate is specified, the paint shall be applied at a rate normal for the type of material being used. In any event, the combined coats of a specified paint system shall completely hide base surface and the finish coats shall completely hide undercoats of dissimilar color.

3.2.6.1 Measurement on Ferrous Metal

Where dry film thickness requirements are specified for coatings on ferrous surfaces, measurements shall be made with one of the thickness gages listed below. They shall be calibrated and used in accordance with ASTM D 1186. They shall be calibrated using plastic shims with metal practically identical in composition and surface preparation to that being coated, and of substantially the same thickness (except that for measurements on metal thicker than1/4 inch, the instrument may be calibrated on metal with a minimum thickness of1/4 inch). Frequency of measurements shall be as recommended for field measurements by ASTM D 1186 and reported as the mean for each spot determination. The instruments shall be calibrated or calibration verified prior to, during, and after each use. Authorized thickness gages:

a. Mikrotest, Elektro-Physik, Inc.
b. Inspector Gage, Elcometer Instruments, Ltd.
c. Positest, Defelsko Corporation
d. Minitector, Elcometer Instruments, Ltd.
e. Positector 2000, Defelsko Corporation

3.2.6.2 Measurements on Nonferrous Metal

Where dry film thickness requirements are specified for coatings applied to nonferrous metal surfaces, measurements shall be made with one of the thickness gages listed. They shall be calibrated and used in accordance with ASTM D 1400. Calibration shall be on metal identical in composition and surface preparation to that being coated and of substantially the same thickness (except that for measurements on metal thicker than1/4 inch, the instrument may be calibrated on metal with a minimum thickness of 1/4 inch). Frequency of measurements shall be as recommended for field

measurements by ASTM D 1400 and reported as the mean for each spot determination. The instruments shall be calibrated or calibration verified prior to, during, and after each use. Authorized thickness gages:

a. Positector 3000 (aluminum and copper only)

b. Defelsko Corporation Minitector Model 250N, 150N, or 150FN, Elcometer Instruments, Ltd.

3.2.7 Progress of Painting Work

Where field painting on any type of surface has commenced, the complete painting operation, including priming and finishing coats, on that portion of the work shall be completed as soon as practicable, without prolonged delays. Sufficient time shall elapse between successive coats to permit them to dry properly for recoating, and this period shall be modified as necessary to suit adverse weather conditions. Paint shall be considered dry for recoating when it feels firm, does not deform or feel sticky under moderate pressure of the finger, and the application of another coat of paint does not cause film irregularities such as lifting or loss of adhesion of the undercoat. All coats of all painted surfaces shall be unscarred and completely integral at the time of application of succeeding coats. At the time of application of each successive coat, undercoats shall be cleaned of dust, grease, overspray, or foreign matter by means of airblast, solvent cleaning, or other suitable means. Cement and mortar deposits on painted steel surfaces, not satisfactorily removed by ordinary cleaning methods, shall be brush-off blast cleaned and completely repainted as required. Undercoats of high gloss shall, if necessary for establishment of good adhesion, be scuff sanded, solvent wiped, or otherwise treated prior to application of a succeeding coat. Field coats on metal shall be applied after erection except as otherwise specified and except for surfaces to be painted that will become inaccessible after erection.

3.2.8 Contacting Surfaces

When riveted or ordinary bolted contact is to exist between surfaces of ferrous or other metal parts of substantially similar chemical composition, such surfaces will not be required to be painted, but any resulting crevices shall subsequently be filled or sealed with paint. Contacting metal surfaces formed by high-strength bolts in friction-type connections shall not be painted. Where a nonmetal surface is to be in riveted or bolted contact with a metal surface, the contacting surfaces of the metal shall be cleaned and given three coats of the specified primer. Unless otherwise specified, corrosion-resisting metal surfaces, including cladding therewith, shall not be painted.

3.2.9 Drying Time Prior to Immersion

Minimum drying periods after final coat prior to immersion shall be: epoxy systems at least 5 days, vinyl-type paint systems at least 3 days, and cold-applied coal tar systems at least 7 days. Minimum drying periods shall be increased twofold if the drying temperature is below 65 degrees F and/or if the immersion exposure involves considerable abrasion.

3.2.10 Protection of Painted Surfaces

Where shelter and/or heat are provided for painted surfaces during inclement weather, such protective measures shall be maintained until the

paint film has dried and discontinuance of the measures is authorized. Items that have been painted shall not be handled, worked on, or otherwise disturbed until the paint coat is fully dry and hard. All metalwork coated in the shop or field prior to final erection shall be stored out of contact with the ground in a manner and location that will minimize the formation of water-holding pockets; soiling, contamination, and deterioration of the paint film, and damaged areas of paint on such metalwork shall be cleaned and touched up without delay. The first field coat of paint shall be applied within a reasonable period of time after the shop coat and in any event before weathering of the shop coat becomes extensive.

3.2.11 Coal Tar-Epoxy (Black) Paint (Formula C-200a)

3.2.11.1 Mixing

Component B shall be added to previously stirred Component A and thoroughly mixed together with a heavy-duty mechanical stirrer just prior to use. The use of not more than1 pint of xylene thinner per gallon of paint will be permitted to improve application properties and extend pot life. The pot life of the mixed paint, extended by permissible thinning, may vary from 2 hours in very warm weather to 5 or more hours in cool weather. Pot life in warm weather may be extended by precooling the components prior to mixing; cooling the mixed material; and/or by slow, continuous stirring during the application period. The mixed material shall be applied before unreasonable increases in viscosity take place.

3.2.11.2 Application

Spray guns shall be of the conventional type equipped with a fluid tip of approximately0.09 inch in diameter and external atomization, seven-hole air cap. Material shall be supplied to the spray gun from a bottom withdrawal pot or by means of a fluid pump; hose shall be1/2 inch in diameter. Atomization air pressure shall not be less than80 psi. High-pressure airless spray equipment may be used only on broad, simply configured surfaces. Brush application shall be with a stiff-bristled tool heavily laden with material and wielded in a manner to spread the coating smoothly and quickly without excessive brushing. The coverage rate of the material is approximately110 square feet per gallon per coat to obtain20 mils (dry thickness) in a two-coat system. The paint shall flow together and provide a coherent, pinhole-free film. The direction of the spray passes (or finish strokes if brushed) of the second coat shall be at right angles to those of the first where practicable.

3.2.11.3 Subsequent Coats

Except at the high temperatures discussed later in this paragraph, the drying time between coal tar-epoxy coats shall not be more than 72 hours, and application of a subsequent coat as soon as the undercoat is reasonably firm is strongly encouraged. Where the temperature for substrate or coating surfaces during application or curing exceeds or can be expected to exceed125 degrees F as the result of direct exposure to sunlight, the surfaces shall be shaded by overhead cover or the interval between coats shall be reduced as may be found necessary to avoid poor intercoat adhesion. Here, poor intercoat adhesion is defined as the inability of two or more dried coats of coal tar-epoxy paint to resist delamination when tested aggressively with a sharp knife. Under the most extreme conditions involving high ambient temperatures and sun-exposed surfaces, the drying time between coats shall not exceed 10 hours, and the reduction of this interval to a few hours or less is strongly encouraged. Where the curing

time of a coal tar-epoxy undercoat exceeds 72 hours of curing at normal temperatures, 10 hours at extreme conditions, or where the undercoat develops a heavy blush, it shall be given one of the following treatments before the subsequent coat is applied:

a. Etch the coating surface lightly by brush-off blasting, using fine sand, low air pressure, and a nozzle-to-surface distance of approximately3 feet.

b. Remove the blush and/or soften the surface of the coating by wiping it with cloths dampened with 1-methyl-2-pyrrolidone. The solvents may be applied to the surface by fog spraying followed by wiping, but any puddles of solvent must be mopped up immediately after they form. The subsequent coat shall be applied in not less than 15 minutes or more than 3 hours after the solvent treatment.

3.2.11.4 Ambient Temperature

Coal tar-epoxy paint shall not be applied when the receiving surface or the ambient air is below50 degrees F nor unless it can be reasonably anticipated that the average ambient temperature will be50 degrees F or higher for the 5-day period subsequent to the application of any coat.

3.2.11.5 Safety

In addition to the safety provisions in paragraph SAFETY AND HEALTH PROVISIONS, other workmen as well as painters shall avoid inhaling atomized particles of coal tar-epoxy paint and contact of the paint with the skin.

3.2.12 Epoxy Zinc-Rich Paint (Formula E-303d)

3.2.12.1 Mixing

Primer shall be field mixed combining components A, B, and C. The pot life of the mixed material may be extended by the addition of small amounts of thinner; normal pot life will be in excess of 24 hours but may be less in warm weather. Mixing shall be in accordance with label instructions.

3.2.12.2 Thinning

When the ambient and/or steel temperatures are below about80 degrees F, this paint will not normally require over 15 percent thinning; but in any event, the paint shall at all times contain sufficient volatiles (thinners) to permit it to be satisfactorily atomized to provide a wet spray and avoid deposition of particles that are semidry when they reach the surface. Where thinning is required, either methyl ethyl ketone (MEK) or Alc-50 shall be used, with the latter preferred for general use.

3.2.12.3 Application

Conventional type (air atomization) spray equipment consisting of a paint pot with an agitator,3/8-inch material hose, and a spray gun with an air cap, tip, and needle suitable for spraying lacquers and vinyl-type paints is preferred for applying this paint; however, airless equipment may be approved for use provided that application results are satisfactory. The paint shall be stirred continuously during application at a rate that will prevent the zinc dust from settling. When spraying is resumed after any interruption of longer than 15 minutes, the entire length of material hose shall be whipped vigorously until any settled zinc is redispersed. The

hose shall be emptied whenever the painting operation is to be suspended for more than 1 hour. Paint shall be spray applied, except that areas inaccessible to spraying shall be brushed. The paint shall not be applied when the temperature of the ambient air and the receiving surfaces is less than50 degrees F. It shall be applied in not less than two single spray coats with no limitations as to the minimum drying time between coats, provided that recoating does not cause running and sagging. The second coat shall be applied within 8 days, and the spray passes of the second coat shall be at right angles to those of the first coat where practicable.

Each coat of paint shall consist of a preliminary pass on edges, corners, interior angles, seams, crevices, junctions of joining member, rivets, weld lines, pits and similar surface irregularities, followed by an overall pass at a spreading rate of350 square feet per gallon (based upon unthinned paint). Pits, cracks, and crevices shall be filled with paint insofar as practicable, but in any event, all pits surfaces shall be thoroughly covered and all cracks and crevices shall be sealed against the entrance of moisture. Rivets, bolts, and similar surface projections shall receive sprayed paint from every direction to ensure complete coverage of all faces.

3.3 PAINT SYSTEMS APPLICATION

The required paint systems and the surfaces to which they shall be applied are shown in this paragraph, and/or in the drawings. Supplementary information follows.

3.3.1 Fabricated and Assembled Items

Items that have been fabricated and/or assembled into essentially their final form and that are customarily cleaned and painted in accordance with the manufacturer's standard practice will be exempted from equivalent surface preparation and painting requirements described herein, provided that:

a. Surfaces primed (only) in accordance with such standard practices are compatible with specified field-applied finish coats.

b. Surfaces that have been primed and finish painted in accordance with the manufacturer's standard practice are of acceptable color and are capable of being satisfactorily touched up in the field.

c. Items expressly designated herein to be cleaned and painted in a specified manner are not coated in accordance with the manufacturer's standard practice if different from that specified herein.

3.3.2 Surface Preparation

The method of surface preparation and pretreatment shown in the tabulation of paint systems is for identification purposes only. Cleaning and pretreatment of surfaces prior to painting shall be accomplished in accordance with detailed requirements previously described.

3.3.3 System No. 2

The first coat shall be brush or spray applied in the shop or field as indicated at a maximum spreading rate of500 square feet per gallon and touched up in the field as necessary to maintain its integrity at all times. The second or third coats of the system shall be applied in the field at a maximum spreading rate of450 square feet per gallon. Prior to

applying field coats, all field welds, other bare metal, and damaged areas of the shop-primed surfaces shall be cleaned and primed as previously specified except that application shall be by brush.

3.3.4 System No. 6-A-Z

Epoxy zinc-rich primer shall be applied with a minimum of two single, half-lapped spray coats to an average minimum dry film thickness of3.0 mils, and the thickness at any point shall not be less than 2.5 mils for the primer. After a minimum drying period of 6 hours and no more than 96 hours for the second zinc-rich coat, at least two coats of coal tar epoxy paint shall be applied to provide a minimum thickness at any point of16 mils for the completed system. If the second coat of epoxy zinc-rich paint has been applied in the shop or otherwise has been permitted to cure for longer than 96 hours, it shall be recoated with an additional thin tack coat of the zinc-rich paint, which in turn shall be overcoated within 96 hours with the first coat of coal tar-epoxy paint. The specified film thicknesses shall be attained in any event, and any additional coats needed to attain specified thickness shall be applied at no additional cost to the Government.

3.3.5 System No. 13

Apply FS TT-P-38 coats at a maximum spreading rate of 450 square feet per gallon.

3.4 PAINTING SCHEDULES

3.4.1 L385-Final Plan for painting/galvanizing

The following painting schedule order shall be used over all painting requirements for System No 2, 6-A-2 and 13(fresh concrete or grout only).

Stoplog posts and supports, recesses for posts, embedded steel and misc. steel associated with stoplog closures will be galvanized after fabrication. The stoplogs are aluminum and do not require galvanizing or painting.

3.4.2 **Surfaces Not to be Painted.**

Paint shall not be applied to aluminum, rubber, corrosion-resisting steel, non-ferrous, finished or machined surfaces or to galvanized parts. Metal surfaces to be embedded in concrete shall not be painted.

SYSTEM NO. 2

Items or surfaces to be coated: Ferrous Metals which are non Submerged Items

SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
Power tool or brush-off blast cleaning	SSPC Paint 25 Type I	FS TT-P-38 (Aluminum)	FS TT-P-38 (Aluminum)

SYSTEM NO. 6-A-Z

Items or surfaces to be coated: Submerged Items

SURFACE PREPARATION	1st & 2nd COAT	3rd COAT
White metal blast cleaning	Epoxy zinc-rich paint E-303d (3 mils DFT)	Coal tar epoxy C-200a (black) (8 mils DFT)

SYSTEM NO. 13

Items or surfaces to be coated:
Aluminum that shall be in contact with fresh grout or concrete shall be protected from galvanic or corrosive action by being given a coat of zinc-chromate primer SSPC Paint 27 and a coat of aluminum paint FS TT-P-38. Aluminum in contact with structural steel shall be protected against galvanic or corrosive action by being given a coat of zinc-chromate primer and a coat of aluminum paint. The zinc-chromate primer shall conform to SAE AMS 3110. The aluminum paint shall consist of a aluminum paste conforming to ASTM D 962, spar varnish conforming to SAE AMS 3132 and thinner compatible with the varnish. The aluminum paint shall be field mixed in proportion of 2 pounds of paste, not more than one gallon of spar varnish and not more than one pint of thinner.

SURFACE PREPARATION	1st COAT	2nd COAT
Solvent clean and apply SSPC Paint 27 pretreatment	FS TT-P-38 (Aluminum)	FS TT-P-38 (Aluminum)

-- End of Section --

PHASE I

DIVISION 10 – SPECIALTIES

NOT APPLICABLE

PHASE I

DIVISION 11 – EQUIPMENT

NOT APPLICABLE

PHASE I

DIVISION 12 – FURNISHINGS

NOT APPLICABLE

PHASE I

DIVISION 13 – SPECIAL CONSTRUCTION

13121 Sandblast Building Relocation

SECTION 13121

SANDBLAST BUILDING RELOCATION
10/00

PART 1 GENERAL

Intercontinental Sandblast Building shall be raised to a first floor elevation of 750'-6". The existing 13' x 19' reinforced concrete slab shall remain in place. A new insulated wall foundation and slab shall be built on top of the old slab foundation system. A 2" perimeter insulation shall be on the interior side. The 12 inch thick concrete slab shall have upper and lower #4 reinforcing bars 12 inchs on center each way on a 4 mil plastic vapor barrier on 5" thick aggregate base course. The exterior perimeter wall shall also have #4 reinforcing bars at 12 inch on center horizontally on both vertical faces and #4 stirrups at 16 inches on center 8 inchs into the existing slab. The existing columns shall be reset on metal base plates on the four corners of the 11 ft by 17 ft new slab and foundation system. See drawing for details.

The Intercontinental Sandblast Building shall be keep operational while the new foundation system is built. A temporary foundation and utilities system shall be built using a metal skid, concrete or other means approved by the Contracting Officer.

The Intercontinental Sandblast Building can be off line for two periods of 48 hour. All utilities must be disconnected and reconnected for both temporarily and final usage.

New 1 inch diameter anchor bolts 24 inchs long shall be cast into 24 inch reinforced square corner plasters doweled to the existing foundation.

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 basic designation only.

ALUMINUM ASSOCIATION (AA)

AA Design Manual	(1994) Aluminum Design Manual: Specification & Guidelines for Aluminum Structures

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Manual	(1989) Manual of Steel Construction - Allowable Stress Design, Plastic Design
AISC Pub No. S342 L	(1993) Load and Resistance Factor Design Specification for Structural Steel

Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1997ael) Carbon Structural Steel
ASTM A 53	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 252	(1998) Welded and Seamless Steel Pipe Piles
ASTM A 463/A 463M	(1999a) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(1999) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 529/A 529M	(1996) High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A 570/A 570M	(1998) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM A 572/A 572M	(1999a) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 588/A 588M	(1997) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 606	(1998) Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A 607	(1998) Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled
ASTM A 618	(1999) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A 653/A 653M	(1999) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 792/A 792M	(1999) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 241/B 241M	(1996) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 308/B 308M	(1996) Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B 429	(1995) Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM C 518	(1998) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 553	(1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 612	(1993) Mineral Fiber Block and Board Thermal Insulation
ASTM C 991	(1998) Flexible Glass Fiber Insulation for Pre-Engineered Metal Buildings
ASTM C 1289	(1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 2244	(1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 4214	(1998) Evaluating Degree of Chalking of Exterior Paint Films
ASTM D 4397	(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM E 96	(1995) Water Vapor Transmission of Materials

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(1995) Minimum Design Loads for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1998) Structural Welding Code - Steel

ENGINEERING TECHNICAL INSTRUCTIONS AND ENERGY SAVINGS ANALYSIS

TI 809-04	(1998) Seismic Design for Buildings
TI 809-07	(1998) Design of Cold-Formed Load Bearing Steel Systems and Masonry Veneer/Steel Stud Walls

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA Low Rise Manual	(1996) Low Rise Building Systems Manual

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Arch. Manual	(1993; Errata; Addenda Oct 1997) Architectural Sheet Metal Manual

STEEL DOOR INSTITUTE (SDOI)

SDOI SDI-100	(1991) Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL 580	(1994; Rev thru Feb 1998) Tests for Uplift Resistance of Roof Assemblies

ENGINEERING MANUALS (EM)

EM 385-1-1	(1996) U.S. Army Corps on Engineers Safety and Health Requirements Manual

1.2 GENERAL REQUIREMENTS

The metal sand blasting facility relocation work is covered under this specification and shall include all components and assemblies.

1.2.1 Building Configurations

Roof slope shall be not be changed. The structure is a self-framing rigid frame. With a exterior door and no windows. .

1.2.2 Qualifications

1.2.2.1 Mover and Reinstaller

Erector shall have specialized experience in the erection of steel building systems for a period of at least 3 years. The erector shall furnish temporary guys and bracing where needed for squaring and securing the structural framing against loads acting on the exposed framing, such as wind loads and seismic forces, as well as loads due to erection equipment and erection operation. Structural members shall may be field cut or altered. Welds, abrasions, and surfaces not shop primed shall be primed after erection.

1.3 DESIGN REQUIREMENTS

Criteria and definitions shall be in accordance with ASCE 7.

1.3.1 Foundations

Foundations shall be built as designed and a concrete compressive strength as specified in Section 03301 CAST-IN-PLACE STRUCTURAL CONCRETE for CIVIL WORKS.

1.3.2 New Structural Members and Connections

Structural steel members and their connections shall be designed in accordance with AISC ASD Manual or AISC Pub No. S342 L. Structural cold-formed steel framing members and their connections shall be designed in accordance with TI 809-07. Aluminum structural members and their connections shall be designed in accordance with AA Design Manual. Framed openings shall be designed to structurally replace the covering and framing displaced.

1.3.3 New Roofing and Siding Design

New Steel or aluminum roofing and siding shall be designed in accordance with MBMA Low Rise Manual.

1.4 MOVING PLAN

The Contractor shall obtain the services of a licensed Professional Engineer to design the lifting or jacking system and plan.

1.5 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-08 Statements

Qualifications; GA-RE.

Qualifications of the movers and builders, and qualifications and experience of the building erector. A brief list of locations where buildings of similar design have been used shall be included with the detail drawings and shall also include information regarding date of completion, name and address of owner, and how the structure is used.

Moving Plan; GA-RE.

Moving Plan

Accident Prevention Plan; GA.

The requirements included in Section 01 of EM 385-1-1 shall be followed by the Contractor when preparing the Accident Prevention Plan. The plan shall be prepared for the move, site and shall include, but is not limited to, each of the topic areas listed in Table 1-1 therein and the requirements of paragraph SAFETY AND HEALTH PROVISIONS; each topic shall be developed in a concise manner to include management and operational aspects.

1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials other than framing and structural members shall be covered with weathertight coverings and kept dry. Storage accommodations for roofing and siding shall provide good air circulation and protection from surface staining.

PART 2 PRODUCTS

2.1 NEW FRAMING AND STRUCTURAL MEMBERS

Steel 1/8 inch or more in thickness shall conform to ASTM A 36/A 36M, ASTM A 529/A 529M, ASTM A 572/A 572M, or ASTM A 588/A 588M. Uncoated steel less than 1/8 inch in thickness shall conform to ASTM A 570/A 570M, ASTM A 606, or ASTM A 607. Galvanized steel shall conform to ASTM A 653/A 653M, G 90 coating designation, 0.045 inch minimum thickness. Aluminum-zinc coated steel shall conform to ASTM A 792/A 792M, AZ 55 coating designation, 0.045 inch minimum thickness. Aluminum sheet shall conform to ASTM B 209; 0.032 inch minimum thickness. Aluminum structural shapes and tubes shall conform to ASTM B 221, or ASTM B 308/B 308M. Structural pipe shall conform to ASTM A 53, ASTM A 252, ASTM A 500, ASTM A 501, ASTM A 618, ASTM B 221, ASTM B 241/B 241M or ASTM B 429. Holes for structural connections shall be made in the shop.

2.2 NEW ROOFING AND SIDING

Roofing and siding shall match existing.

2.3 Rigid Board Insulation

2.3.1 Polystyrene

Insulation shall conform to ASTM C 578, Type IV

2.4 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be clear and shall cure to a rubber like consistency.

2.5 SHOP PRIMING

Ferrous surfaces shall be cleaned of oil, grease, loose rust, loose mill scale, and other foreign substances and shop primed. Primer coating shall be in accordance with the manufacturer's standard system.

PART 3 EXECUTION

3.1 ERECTION

Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Improper or mislocated drill holes in panels shall be plugged with an oversize screw fastener and gasketed washer; however, panels with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces shall be kept clean and free from sealant, metal cuttings, excess material from thermal cutting, and other foreign materials. Exposed surfaces which have been thermally cut shall be finished smooth within a tolerance of 1/8 inch. Stained, discolored or damaged sheets shall be removed from the site. Welding of steel shall conform to AWS D1.1; welding of aluminum shall conform to AA Design Manual.

3.1.1 New Framing Members and Anchor Bolts

Onsite flame cutting of framing members, with the exception of small access holes in structural beam or column webs, will be permitted. Concrete work is specified in Section 03301 CAST-IN-PLACE STRUCTURAL CONCRETE for CIVIL WORKS. Anchor bolts shall be accurately set by template while the concrete is in a plastic state. Members shall be accurately spaced to assure proper fitting of panels. As erection progresses, the work shall be securely fastened to resist the dead load and wind and erection stresses.

3.1.2 New Roofing and Siding Installation

Siding shall be applied with the longitudinal configurations in the vertical position. Roofing shall be applied with the longitudinal configurations in the direction of the roof slope. Accessories shall be fastened into framing members, except as otherwise approved. Closure strips shall be provided where necessary to provide weathertight construction. Fastener and fastener spacing shall be in accordance with manufacture design.

3.1.3 Insulation Installation

Insulation shall be installed as indicated and in accordance with manufacturer's instructions.

3.2 FIELD PAINTING

Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Shop-primed ferrous surfaces exposed on the outside of the building and all shop-primed surfaces of doors and windows shall be painted with two coats of an approved exterior enamel. Factory color finished surfaces shall be touched up as necessary with the manufacturer's recommended touch-up paint.

-- End of Section --

PHSAE I

DIVISION 14 – CONVEYING SYSTEMS

NOT APPLICABLE

PHASE I

DIVISION 15 – MECHANICAL

NOT APPLICABLE

PHASE I

DIVISION 16 – ELECTRICAL

16375 Electrical Distribution System, Underground

SECTION 16375

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND
11/92

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 basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.4	(1984; R 1996) Mechanical Demand Registers
ANSI C12.10	(1987) Electromechanical Watthour Meters
ANSI C12.11	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
ANSI C29.1	(1988; R 1996) Electrical Power Insulators - Test Methods
ANSI C37.16	(1988; C37.16a; R 1995) Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
ANSI C37.46	(1981; R 1992) Power Fuses and Fuse Disconnecting Switches
ANSI C37.50	(1989; R 1995) Switchgear, Low-Voltage AC Power Circuit Breakers Used in Enclosures - Test Procedures
ANSI C37.72	(1987) Manually-Operated Dead-Front, Padmounted Switchgear with Load-Interrupting Switches and Separable Connectors for Alternating-Current Systems
ANSI C37.121	(1989; R 1995) Switchgear, Unit Substations Requirements
ANSI C57.12.13	(1982) Conformance Requirements for Liquid-Filled Transformers Used in Unit Installations, Including Unit Substations

ANSI C57.12.21	(1995) Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with High-Voltage Bushings; (High-Voltage, 34 500 Grd Y/19 920 Volts and Below; Low-Voltage, 240/120; 167 kVA and Smaller)
ANSI C57.12.26	(1993) Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVa and Smaller
ANSI C57.12.27	(1982) Conformance Requirements for Liquid-Filled Distribution Transformers Used in Pad-Mounted Installations, Including Unit Substations
ANSI C57.12.28	(1996) Switchgear and Transformers - Padmounted Equipment - Enclosure Integrity
ANSI C80.1	(1995) Rigid Steel Conduit - Zinc Coated
ANSI C119.1	(1986) Sealed Insulated Underground Connector Systems Rated 600 Volts
ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction
ANSI O5.1	(1992) Specifications and Dimensions for Wood Poles

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(1994a) Gray Iron Castings
ASTM A 123/A 123M	(1997a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(1995) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B 3	(1995) Soft or Annealed Copper Wire
ASTM B 8	(1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM B 231	(1995) Concentric-Lay-Stranded Aluminum 1350 Conductors
ASTM B 400	(1994) Compact Round

	Concentric-Lay-Stranded Aluminum 1350 Conductors
ASTM B 496	(1992) Compact Round Concentric-Lay-Stranded Copper Conductors
ASTM B 609	(1997) Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes
ASTM B 609M	(1991) Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes (Metric)
ASTM B 800	(1994) 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers
ASTM B 801	(1995) Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Mahhole Sections (Metric)
ASTM D 923	(1991) Sampling Electrical Insulating Liquids
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2472	(1992) Sulfur Hexafluoride
ASTM D 4059	(1996) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5	(1994) Cross-linked Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 kV
AEIC CS6	(1996) Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 Through 69 kV

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(1998) Approval Guide Fire Protection

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
IEEE ANSI/IEEE C37.1	(1994) IEEE Standard Definition, Specification, and Analysis of Systems Used for Supervisory Control, Data Acquisition, and Automatic Control
IEEE ANSI/IEEE C37.2	(1996) Electrical Power System Device Function Numbers and Contact Designations
IEEE ANSI/IEEE C37.13	(1990; R 1995) Low-Voltage AC Power Circuit Breakers Used in Enclosures
IEEE ANSI/IEEE C37.20.1	(1993) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
IEEE ANSI/IEEE C37.20.2	(1993; C37.20.2b) Metal-Clad and Station-Type Cubicle Switchgear
IEEE ANSI/IEEE C37.20.3	(1987; R 1992) Metal-Enclosed Interrupter Switchgear
IEEE ANSI/IEEE C37.23	(1987; R 1991) Guide for Metal-Enclosed Bus and Calculating Losses in Isolated-Phase Bus
IEEE ANSI/IEEE C37.30	(1997)Requirements for High-Voltage Switches
IEEE ANSI/IEEE C37.34	(1994) Test Code for High-Voltage Air Switches
IEEE ANSI/IEEE C37.41	(1994; C37.41e) Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories
IEEE ANSI/IEEE C37.63	(1997) Requirements for Overhead, Pad-Mounted, Dry-Vault, and Submersible Automatic Line Sectionalizer for AC Systems
IEEE ANSI/IEEE C37.90	(1989; R 1994) Relays and Relay Systems Associated with Electric Power Apparatus
IEEE ANSI/IEEE C37.90.1	(1989; R 1994) IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems
IEEE ANSI/IEEE C37.98	(1987; R 1990) Seismic Testing of Relays
IEEE ANSI/IEEE C57.12.00	(1993) IEEE Standard General Requirements

	for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE ANSI/IEEE C57.13	(1993) Instrument Transformers
IEEE ANSI/IEEE C57.98	(1993) Guide for Transformer Impulse Tests
IEEE C62.1	(1989; R 1994) Surge Arresters for AC Power Circuits
IEEE C62.2	(1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems
IEEE C62.11	(1993) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits
IEEE Std 48	(1996) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 100	(1996) IEEE Standard Dictionary of Electrical and Electronics Terms
IEEE Std 242	(1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE Std 386	(1995) Separable Insulated Connector Systems for Power Distribution Systems Above 600V
IEEE Std 399	(1997) Recommended Practice for Industrial and Commercial Power Systems Analysis
IEEE Std 404	(1993; errata) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V through 138 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V
IEEE Std 592	(1990; R 1996) Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches

NEMA BU 1	(1994) Busways
NEMA FB 1	(1993) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit and Cable Assemblies
NEMA FU 1	(1986) Low Voltage Cartridge Fuses
NEMA LA 1	(1992) Surge Arresters
NEMA PB 1	(1990) Panelboards
NEMA PB 2	(1995) Deadfront Distribution Switchboards
NEMA SG 2	(1993) High Voltage Fuses
NEMA SG 3	(1995) Power Switching Equipment
NEMA SG 5	(1990) Power Switchgear Assemblies
NEMA TC 5	(1990) Corrugated Polyolefin Coilable Plastic Utilities Duct
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA TC 7	(1990) Smooth-Wall Coilable Polyethylene Electrical Plastic Duct
NEMA WC 7	(1991; Rev 1) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8	(1991; Rev 1; Rev 2) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6	(1997) Rigid Metal Conduit
UL 198C	(1986; Rev thru Feb 1998) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198D	(1995) Class K Fuses

UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 198H	(1988; Rev thru Nov 1993) Class T Fuses
UL 467	(1993; Rev thru Aug 1996) Grounding and Bonding Equipment
UL 486A	(1997) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997; Rev Jun 1997) Wire Connectors for Use with Aluminum Conductors
UL 489	(1996; Rev thru Nov 1997) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 510	(1994; Rev thru Nov 1997) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(1996; Rev Jul 1998) Metallic Outlet Boxes
UL 651	(1995; Rev thru Oct 1998) Schedule 40 and 80 Rigid PVC Conduit
UL 854	(1996; Rev Apr 1998) Service-Entrance Cables
UL 857	(1994; Rev thru Nov 1996) Busways and Associated Fittings
UL 1072	(1995; Rev Mar 1998) Medium-Voltage Power Cable
UL 1242	(1996; Rev Apr 1997) Intermediate Metal Conduit
UL 1684	(1996) Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

1.2.2 Service Conditions

Items provided under this section shall be specifically suitable for the following service conditions. Seismic details shall be as indicated.

b. Altitude 750 feet

f. Seismic Parameters Zone 2

g. Humidity Control 100%

h. Corrosive Areas are highly corrosive atmosphere

i.

1.3 SUBMITTALS

Governmental approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Fault Current and Protective Devices Coordination Studies; GA.

The study shall be submitted with protective device equipment submittals. No time extension or similar contract modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed shall be based on recommendations of this study. The Government shall not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

Manufacturer's Catalog Data; GA-RE.

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists; GA-RE.

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each such item.

Installation Procedures; GA-RE.

As a minimum, installation procedures for transformers, substations, switchgear, and splices.

Procedures shall include cable pulling plans, diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

SD-04 Drawings

Electrical Distribution System; GA-RE.

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams manufacturers standard installation drawings and other information necessary to define the installation and enable the Government to check conformity with the requirements of the contract drawings.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures shall be included with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Detail drawings shall show how components are assembled, function together and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall consist of the following:

a. Detail drawings showing physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. All optional items shall be clearly identified as included or excluded.

b. Internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

Detail drawings shall as a minimum depict the installation of the following items:

b. Transformers.

c. Substations.

d. Switchgear.

e. Pad-mounted loadbreak switches.

f. Busways.

g. Surge arresters.

As-Built Drawings; GA-RE.

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings

as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall provide three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within 10 calendar days from the time the drawings are returned to the Contractor.

SD-09 Reports

Factory Test; GA-RE.

Certified factory test reports shall be submitted when the manufacturer performs routine factory tests, including tests required by standards listed in paragraph REFERENCES. Results of factory tests performed shall be certified by the manufacturer, or an approved testing laboratory, and submitted within 7 days following successful completion of the tests. The manufacturer's pass-fail criteria for tests specified in paragraph FIELD TESTING shall be included.

Field Testing; GA-RE.

A proposed field test plan, 20 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Test Reports; GA-RE.

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The condition specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

Cable Installation Reports; GA-RE.

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

a. Site layout drawing with cable pulls numerically identified.

b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.

c. The cable manufacturer and type of cable.

d. The dates of cable pulls, time of day, and ambient temperature.

e. The length of cable pull and calculated cable pulling tensions.

f. The actual cable pulling tensions encountered during pull.

SD-13 Certificates

Materials and Equipment; GA-RE.

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

Cable Installer Qualifications; GA-RE.

The Contractor shall provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. A resume shall be provided showing the cable installers' experience in the last three years, including a list

of references complete with points of contact, addresses and telephone numbers.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements. Wood poles held in storage for more than 2 weeks shall be stored in accordance with ANSI O5.1. Handling of wood poles shall be in accordance with ANSI O5.1, except that pointed tools capable of producing indentations more than 1 inch in depth shall not be used. Metal poles shall be handled and stored in accordance with the manufacturer's instructions.

1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the contracting officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 CORROSION PROTECTION

2.2.1 Aluminum Materials

Aluminum shall not be used.

2.2.2 Ferrous Metal Materials

2.2.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

2.2.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in Section 09900 PAINTING, GENERAL.

2.3 CABLES

Cables shall be single conductor type unless otherwise indicated.

2.3.1 Low-Voltage Cables

Cables shall be rated 600 volts and shall conform to the requirements of NFPA 70, and must be UL listed for the application or meet the applicable section of either ICEA or NEMA standards.

2.3.1.1 Conductor Material

Underground cables shall be annealed copper complying with ASTM B 3 and ASTM B 8. Intermixing of copper and aluminum conductors is not permitted.

2.3.1.2 Insulation

Insulation must be in accordance with NFPA 70, and must be UL listed for the application or meet the applicable sections of either ICEA, or NEMA standards.

2.3.1.3 Jackets

Multiconductor cables shall have an overall PVC outer jacket.

2.3.1.4 Direct Buried

Single and multi-conductor cables shall of a type identified for direct burial. Service entrance cables shall conform to UL 854 for Type USE service entrance cable.

2.3.1.5 In Duct

Cables shall be single-conductor cable, in accordance with NFPA 70. Cables in factory-installed, coilable-plastic-duct assemblies shall conform to NEMA TC 5 or NEMA TC 7.

2.4 CABLE JOINTS, TERMINATIONS, AND CONNECTORS

2.4.1 Low-Voltage Cable Splices

Low-voltage cable splices and terminations shall be rated at not less than 600 Volts. Splices in conductors No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in conductors No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A and UL 486B. Splices shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

2.4.2 Terminations

Terminations shall be in accordance with IEEE Std 48, Class 1 or Class 2; of the molded elastomer, wet-process porcelain, prestretched elastomer, heat-shrinkable elastomer, or taped type. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, and armor.

2.4.2.1 Factory Preformed Type

Molded elastomer, wet-process porcelain, prestretched, and heat-shrinkable terminations shall utilize factory preformed components to the maximum extent practicable rather than tape build-up. Terminations shall have basic impulse levels as required for the system voltage level. Anti-tracking tape shall be applied over exposed insulation of preformed molded elastomer terminations.

2.4.2.2 Taped Terminations

Taped terminations shall use standard termination kits providing terminal connectors, field-fabricated stress cones, and rain hoods. Terminations shall be at least 20 inches long from the end of the tapered cable jacket to the start of the terminal connector, or not less than the kit manufacturer's recommendations, whichever is greater.

2.5 CONDUIT AND DUCTS

Ducts shall be single, round-bore type, with wall thickness and fittings suitable for the application under all roads or where it may be exposed. Low-voltage lines run elsewhere may be direct-burial, thick-wall type.

2.5.1 Metallic Conduit

Intermediate metal conduit shall comply with UL 1242. Rigid galvanized steel conduit shall comply with UL 6 and ANSI C80.1. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1.

2.5.2 Nonmetallic Ducts

2.5.2.1 Bituminized Fiber Duct

UL 1684 for Type II (Thickwall).

2.5.2.2 Concrete Encased Ducts

UL 651 Schedule 40 or NEMA TC 6 Type EB.

2.5.2.3 Direct Burial

UL 651 Schedule 80, or NEMA TC 6 Type DB.

2.5.3 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

2.6 MANHOLES, HANDHOLES, AND PULLBOXES

Strength of manholes, handholes, and pullboxes and their frames and covers shall conform to the requirements of IEEE C2. Precast-concrete manholes shall have the required strength established by ASTM C 478, ASTM C 478M. Frames and covers shall be made of gray cast iron and a machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with ASTM A 48, Class 30B, minimum. Handholes for low voltage cables installed in parking lots, sidewalks, and turfed areas shall be fabricated from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least 10,000 psi and a flexural strength of at least5,000 psi. Pullbox and handhole covers in sidewalks, and turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

2.7 GROUNDING AND BONDING

2.7.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to UL 467 not less than 5/8 inch in diameter by 15 feet in length. Sectional type rods may be used.

2.7.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.8 CONCRETE AND REINFORCEMENT

Concrete work shall have minimum 3000 psi compressive strength and conform

to the requirements of Section 03301 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete reinforcing shall be as specified in Section 03200 CONCRETE REINFORCEMENT.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Circuits installed aerially shall conform to the requirements of Section 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

3.2 CABLE JOINTS

Medium-voltage cable joints shall be made by qualified cable splicers only. Qualifications of cable splicers shall be submitted in accordance with paragraph SUBMITTALS. Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed joints. Shields shall be grounded at each joint or in accordance with manufacturer's recommended practice. Cable joints shall provide insulation and jacket equivalent to that of the associated cable. Armored cable joints shall be enclosed in compound-filled, cast-iron or alloy, splice boxes equipped with stuffing boxes and armor clamps of a suitable type and size for the cable being installed.

3.3 DUCT LINES

3.3.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius

shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in manholes or handholes.

3.3.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.3.3 Concrete Encasement

Ducts requiring concrete encasements shall comply with NFPA 70, except that electrical duct bank configurations for ducts 6 inches in diameter shall be determined by calculation and as shown on the drawings. The separation between adjacent electric power and communication ducts shall conform to IEEE C2. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. The Contractor shall submit proposed bonding method for approval in accordance with the detail drawing portion of paragraph SUBMITTALS. At any point, except railroad and airfield crossings, tops of concrete encasements shall be not less than the cover requirements listed in NFPA 70. At railroad and airfield crossings, duct lines shall be encased with concrete and reinforced as indicated to withstand specified surface loadings. Tops of concrete encasements shall be not less than 5 feet below tops of rails or airfield paving unless otherwise indicated. Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 50 feet in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 6 inches vertically.

3.3.4 Nonencased Direct-Burial

Top of duct lines shall be below the frost line depth of 48 inches, but not less than 48 inches below finished grade and shall be installed with a minimum of 3 inches of earth around each duct, except that between adjacent

electric power and communication ducts, 12 inches of earth is required. Bottoms of trenches shall be graded toward manholes or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least 6 inches. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in3 to 6 inch layers. Duct banks may be held in alignment with earth. However, high-tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

3.3.5 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved.

3.3.5.1 Bituminized-Fiber Ducts

Bituminized-fiber ducts shall be used to interface with existing bituminized-fiber duct as shown. To ensure a watertight joint, tapered ends or joints of the same material as the ducts shall be swabbed with bituminous or joint-sealing compound before couplings are applied. Plastic or nonmetallic couplings shall be tightly driven onto unswabbed ducts. Due to the brittleness of plastic couplings at low temperatures, such couplings shall not be installed when temperatures are below 0 degrees F. Couplings shall be warmed in hot water or by another approved method when installed at temperatures below 32 degrees F.

3.3.5.2 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

3.3.6 Duct Line Markers

Duct line markers shall be provided at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures. In addition to markers, a 5 mil brightly colored plastic tape, not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion-resistant 1 mil metallic foil core to permit easy location of the duct line, shall be placed approximately 12 inches below finished grade levels of such lines.

3.4 MANHOLES, HANDHOLES, AND PULLBOXES

3.4.1 General

The exact location of each manhole shall be determined after careful

consideration has been given to the location of other utilities, grading, and paving. The location of each manhole shall be approved by the Contracting Officer before construction of the manhole is started. Manholes shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. The Contractor may at his option utilize monolithically constructed precast-concrete manholes having the required strength and inside dimensions as required by the drawings or specifications. In paved areas, frames and covers for manhole and handhole entrances in vehicular traffic areas shall be flush with the finished surface of the paving. In unpaved areas, the top of manhole covers shall be approximately 1/2 inch above the finished grade. Where existing grades that are higher than finished grades are encountered, concrete assemblies designed for the purpose shall be installed to elevate temporarily the manhole cover to existing grade level. All duct lines entering manholes must be installed on compact soil or otherwise supported when entering a manhole to prevent shear stress on the duct at the point of entrance to the manhole. Duct lines entering cast-in-place concrete manholes shall be cast in-place with the manhole. Duct lines entering precast concrete manholes through a precast knockout penetration shall be grouted tight with a portland cement mortar. PVC duct lines entering precast manholes through a PVC endbell shall be solvent welded to the endbell. A cast metal grille-type sump frame and cover shall be installed over the manhole sump. A cable-pulling iron shall be installed in the wall opposite each duct line entrance.

3.4.2 Pullboxes

Pullbox tops shall be flush with sidewalks or curbs or placed 1/2 inchabove surrounding grades when remote from curbed roadways or sidewalks. Covers shall be marked "Low-Voltage" and provided with 2 lifting eyes and 2 hold-down bolts. Each box shall have a suitable opening for a ground rod. Conduit, cable, ground rod entrances, and unused openings shall be sealed with mortar.

3.5 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

Connections between aerial and underground systems shall be made as shown. Underground cables shall be extended up poles in conduit to cable terminations. Conduits shall be secured to the poles by 2-hole galvanized steel pipe straps spaced not more than 10 feet apart and with 1 strap not more than 12 inches from any bend or termination. Cable guards shall be secured to poles in accordance with the manufacturer's published procedures. Conduits shall be equipped with bushings to protect cables and minimize water entry. Capnut potheads shall be used to terminate medium-voltage multiple-conductor cable. Cables shall be supported by devices separate from the conduit or guard, near their point of exit from the conduit or guard.

3.6 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated, and shall be connected to the first applicable termination point in each building.

Interfacing with building interior conduit systems shall be at conduit stubouts terminating 5 feet outside of a building and 2 feet below finished grade as specified and provided under Section 16415 ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed with caulking compound to prevent entrance of moisture or gases into buildings.

3.7 GROUNDING

A ground mat consisting of the indicated configuration of bare copper conductors and driven ground rods shall be installed around pad-mounted equipment as shown. Equipment frames of metal-enclosed equipment, and other noncurrent-carrying metal parts, such as cable shields, cable sheaths and armor, and metallic conduit shall be grounded. At least 2 connections shall be provided from a transformer, a switchgear ground bus, and a unit substation to the ground mat. Metallic frames and covers of handholes and pull boxes shall be grounded by use of a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.7.1 Grounding Electrodes

Grounding electrodes shall be installed as shown on the drawings and as follows:

a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade.

3.7.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

3.7.3 Grounding and Bonding Conductors

Grounding and bonding conductors include conductors used to bond transformer enclosures and equipment frames to the grounding electrode system. Grounding and bonding conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

3.7.4 Metal Splice Case Grounding

Metal splice cases for medium-voltage direct-burial cable shall be grounded by connection to a driven ground rod located within 2 feet of each splice box using a grounding electrode conductor having a current-carrying

capacity of at least 20 percent of the individual phase conductors in the associated splice box, but not less than No. 6 AWG.

3.7.5 Riser Pole Grounding

A single continuous vertical grounding electrode conductor shall be installed on each riser pole and connected directly to the grounding electrodes indicated on the drawings or required by these specifications. All equipment, neutrals, surge arresters, and items required to be grounded shall be connected directly to this vertical conductor. The grounding electrode conductor shall be sized as shown. Grounding electrode conductors shall be stapled to wood poles at intervals not exceeding2 feet.

3.8 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all the electrical work and after all defects in installation, material or operation have been corrected.

-- End of Section --