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## SECTION 01312

## QUALITY CONTROL SYSTEM (QCS)

## PART 1 GENERAL

## 1.1 GENERAL

The Government will use the Resident Management System for Windows (RMS-W) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS-Windows, referred to as QCS (QC for Quality Control), to record, maintain, and submit various information throughout the contract period. This joint Government-Contractor use of RMS-W 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 01320, "Project Schedule", Section 01330, SUBMITTAL PROCEDURES, and Section 01451, 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 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. ARMY CORPS OF ENGINEER (USACE)

EM 385-1-1

(2003) Safety and Health Requirement Manual

## 1.3 HARDWARE/SOFTWARE REQUIREMENTS

## 1.3.1 Installing the QCS Program

The QCSSetup.exe is the program that you will begin the installation with. Launch the program through your Windows Explorer, the Run command, or however you are used to doing that sort of thing. This is self-extracting file and will create the necessary files and folders and complete the installation and set up your program. The window will close automatically when the extraction process is completed.

The program should install itself, asking only minimal questions. The program will tailor the installation to suit the computer it is being installed on. That is, the program will install a "new" program if one has not already been installed, it will install an "update" if the program is already installed on the computer and will determine each client or server requirement and automatically install/update what is required. Each screen and instruction is shown on the following pages.

## 1.4 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" 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.

## 1.5 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 500 MHz Pentium or higher processor

128+ MB RAM for workstation / 256+ MB RAM for server.

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

3-1/2 inch high-density floppy drive.

Compact Disk (CD) Reader 8x speed or higher.

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

Mouse or other pointing device.

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

Connection to the Internet, minimum 56k BPS

#### **Software**

MS Windows 98, ME, NT, or 2000.

Word Processing software compatible with MS Word 97 or newer.

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

Electronic mail (E-mail) MAPI compatible.

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

### 1.6 RELATED INFORMATION

#### 1.6.1 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.

#### 1.6.2 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.

### 1.7 CONTRACT DATABASE

Prior to the pre-construction conference, the Government will 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.

### 1.8 DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in 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:

#### 1.8.1 Administration

##### 1.8.1.1 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.

##### 1.8.1.2 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.

##### 1.8.1.3 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".

##### 1.8.1.4 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.

##### 1.8.1.5 EM 385-1-1, Corps of Engineers Safety Manual and RMS Linkage

Upon request, the Contractor can obtain a copy of the current version of the Safety Manual, EM 385-1-1, on CD. Data on the CD will be accessible through QCS, or in stand-alone mode.

#### 1.8.2 Finances

##### 1.8.2.1 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 the 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.

#### 1.8.2.2 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.

#### 1.8.3 Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01451, 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.

##### 1.8.3.1 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 01451, 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.

##### 1.8.3.2 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. 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.

#### 1.8.3.3 Three-Phase Control Meetings

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

#### 1.8.3.4 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.

#### 1.8.3.5 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.

#### 1.8.3.6 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.

#### 1.8.4 Submittal Management

When available, 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 as described in Section 01330, SUBMITTAL PROCEDURES. 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-W will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

#### 1.8.5 Schedule

The Contractor shall develop a construction schedule consisting of pay activities, in accordance with Section 01320, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually or by using the Standard Data Exchange Format (SDEF) (see Section 01320 PROJECT SCHEDULE). The updated schedule data shall be included with each pay request submitted by the Contractor.

#### 1.8.6 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.

#### 1.9 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.

#### 1.10 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:

##### 1.10.1 File Medium

The Contractor shall submit required data on 3-1/2" 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.

##### 1.10.2 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, project name, project location, data date, name and telephone number of person responsible for the data.

##### 1.10.3 File Names

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

#### 1.11 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.

#### 1.12 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

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## SECTION 01320

## PROJECT SCHEDULE

## PART 1 GENERAL

## 1.1 ELECTRONIC SCHEDULE REQUIREMENT

The Project Schedule to be prepared by the Contractor shall be electronically prepared using software capable of generating a data file in the Standard Data Exchange Format (SDEF). The Project Schedule shall consist of a network analysis system as described in this Section. In preparing this system the scheduling of Construction is the sole responsibility of the contractor. The requirement for the system is included to assure adequate planning in the execution of the work and to assist the Contracting Officer in appraising the reasonableness of the proposed schedule and evaluating progress of the work for the purposes of payment.

## 1.2 SUBMITTALS

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

## SD-01 Preconstruction Submittals

Preliminary Project Schedule; G.  
Initial Project Schedule; G.  
Periodic Schedule Updates; G.

Two copies of the schedules showing codes, values, categories, numbers, items, etc., as required.

Periodic schedule updates schedules shall be submitted together with the monthly progress payment request.

## SD-06 Test Reports

Narrative Report.  
Schedule Reports.

Two copies of the reports showing numbers, descriptions, dates, float, starts, finishes, durations, sequences, etc., as required.

## SD-07 Certificates

Qualifications; G.

Documentation showing qualifications of personnel preparing schedule reports.

1.3 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports. This person shall have previously created and reviewed computerized schedules. Qualifications of this individual shall be submitted to the Contracting Officer for review with the Preliminary Project Schedule submission

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

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 shall result in an inability of the Contracting Officer to evaluate Contractor 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, then 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 ELECTRONIC 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. Manually generated schedules will not be accepted.

The system noted below is capable of generating a file in the Standard Data Exchange Format (SDEF). All electronic data submittals shall be in SDEF. SDEF information is available from the Contracting Officer.

Vendor/System with SDEF support:

Primavera Systems           PRIMAVERA PROJECT PLANNER (P3)

### 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 either the Precedence Diagram Method (PDM) or the Arrow Diagram Method (ADM).

### 3.3.2 Level of Detail Required

With the exception of the preliminary schedule submission, 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 shall be 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, delivery, installation, start-up, and testing.

#### 3.3.2.3 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 for phasing requirements.

#### 3.3.2.4 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. The responsible party for each activity shall be identified by the Responsibility Code.

#### 3.3.2.5 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.

#### 3.3.2.6 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.

#### 3.3.2.7 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.

#### 3.3.2.8 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 notice-to-proceed to the contract completion date.

#### 3.3.3.1 Project Start Date

The schedule shall start no earlier than the date that the Notice to Proceed (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: a "ES" constraint, a 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: a "LF" constraint, a 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 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.

#### 3.3.3.4 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.

#### 3.3.3.5 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 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.

#### 3.3.3.6 Out-of-Sequence Progress

Activities that have posted progress without predecessors being completed (Out-of-Sequence Progress) will be allowed only on a case-by-case approval of the Contracting Officer. The Contracting Officer may direct that changes in schedule logic be made to correct any or all out-of-sequence work.

#### 3.3.3.7 Extended Non-Work Periods

Designation of Holidays to account for non-work periods of over 5 days will not be allowed. Non-work periods of over 5 days shall be identified by addition of activities that represent the delays. Modifications to the logic of the project schedule shall be made to link those activities that may have been impacted by the delays to the newly added delay activities.

#### 3.3.3.8 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 90 calendar days shall be submitted for approval within 20 calendar days after Notice to Proceed is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed 90 calendar days after Notice to Proceed.

#### 3.4.2 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 60 calendar days after Notice to Proceed. 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 or 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 submit, with the Initial Project Schedule, a coding scheme that shall be used throughout the project for all activity codes contained in the schedule. The coding scheme submitted shall list the values for each activity code category and translate those values into project specific designations. For example, a Responsibility Code Value, "ELE", may be identified as "Electrical Subcontractor." Activity code values shall represent the same information throughout the duration of the contract. Once accepted with the Initial Project Schedule submission, changes to the activity coding scheme must be accepted by the Contracting Officer.

### 3.5 SUBMISSION REQUIREMENTS

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

### 3.5.1 Data Disks

Two data disks or two sets of data disks containing the project schedule shall be provided. Data on the disks shall be in the Standard Data Exchange Format (SDEF), in accordance with ER-1-1-11, PROGRESS, SCHEDULES, AND NETWORK ANALYSIS SYSTEMS, Appendix A, Standard Data Exchange Format Specification (attached at the end of this Project Schedule specification.

#### 3.5.1.1 File Medium

Required data shall be submitted on 3.5-inch disks, formatted to hold 1.44 MB of data, under the MS-Windows operating system.

#### 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 (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 operating system and 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 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 critical path(s), a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken.

### 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 and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.

#### 3.5.4.2 Logic Report

A list of Preceding and Succeeding activities for every activity in ascending order by activity number and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.

#### 3.5.4.3 Total Float Report

A list of all 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.

#### 3.5.4.4 Earnings Report

A compilation of the Contractor's Total Earnings on the project from the Notice to Proceed 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: Activity Number or "i-node" and "j-node", Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), 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 activity or event number, description, duration, and estimated earned value shall be shown on the diagram. 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 or event 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

A graph of anticipated earnings (S-Curves) showing cumulative earnings for the duration of the project. The vertical scale shall show earnings/percent complete from 0%-100%. The horizontal scale shall be a time scale showing the calendar months of the project. Three curves shall be plotted on the same graph; the earnings/percent complete based on early finish dates; the earnings/percent complete based on late finish dates; the actual earnings/percent complete to date.

#### 3.5.5.6 Bar Chart

A bar chart covering the previous month's activities and progress, and the planned activities over 3 months projected into the future. The chart shall also include actual and anticipated earnings.

### 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. The following is a minimum set of items which the Contractor shall address, 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 activities.

#### 3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations must 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 Notice to Proceed 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, and 3) a schedule which does not represent the actual 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, he shall furnish such justification, project schedule data and supporting evidence as the Contracting Officer may deem necessary for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. 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 Notice to Proceed 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 Notice to Proceed (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 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 --

## STANDARD DATA EXCHANGE FORMAT SPECIFICATION

## PART 1- GENERAL

**1. Application of This Provision:** The Standard Data Exchange Format (SDEF) provides a nonproprietary protocol to exchange project planning and progress data between scheduling systems.

**2. File Type and Format:** The data file shall consist of a 132 character, freed format, "ASCII" file. Text shall be left-justified and numbers shall be right-justified in each field. Data records must conform, exactly, to the sequence, column position, maximum length, mandatory values, and field definitions described below to comply with the SDEF. Unless specifically stated, all numbers shall be whole numbers. Fields containing numbers shall not be zero filled. All data columns shall be separated by a single blank column. The file shall not contain blank lines.

**3. Usage Notes:** Where appropriate, notes regarding proper usage of systems to support the SDEF have been included in brackets ( [ ] ). These notes are included to assist users in creating SDEFcompatible files, given the variety of software systems that support the SDEF.

**4. Recommended Systems:** Several systems have been tested to determine the accuracy of importing and exporting SDEF files. For information on the current list of recommended systems please contact Mr. Brad James at HQUSACE, (202) 761-5541. Although the currently listed system have been tested other systems may also be acceptable provided those systems correctly import and export SDEF files.

**5. SDEF Checker Program:** To verify SDEF files meet the specified guidelines download the SDEF Checker utility from the winrms website. Go to <http://winrms.usace.army.mil>, click on the **User Manuals** Link to the left and then click on the **P3 SDEF** Link to the left.

## PART 2- SDEF SPECIFICATION

**6. SDEF Organization:** The SDEF shall consist of the following records provided in the exact sequence shown below:

\* Change in POC information.

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Paragraph Record

| <u>Reference</u> | <u>Description</u>   | <u>Remarks</u>                   |
|------------------|----------------------|----------------------------------|
| 6.a              | Volume Record        | Mandatory First Line of File     |
| 6.b              | Project Record       | Mandatory Second Line of File    |
| 6.c              | Calendar Record(s)   | Mandatory One Record Minimum     |
| 6.d              | Holiday Record(s)    | Mandatory if Holidays Used       |
| 6.e              | Activity Record(s)   | Mandatory Records                |
| 6.f              | Precedence Record(s) | Mandatory for Precedence         |
| 6.g              | Unit Cost Record(s)  | Mandatory for Unit Costs         |
| 6.h              | Progress Record(s)   | Mandatory Records                |
| 6.i              | File End Record      | Mandatory Last Line of Disk/File |

**6.a. Volume Record:** The Volume Record shall be used to control the transfer of data that may not fit on a single disk. The first line in every file used to store SDEF data shall be the Volume Record. The Volume Record shall sequentially identify the number of the data transfer disk(s). The Volume Record shall have the following format:

| <u>Description</u> | <u>Column</u>   | <u>Max.</u> | <u>Req.</u>  | <u>Type</u> | <u>Notes</u>    |
|--------------------|-----------------|-------------|--------------|-------------|-----------------|
|                    | <u>Position</u> | <u>Len.</u> | <u>Value</u> |             |                 |
| RECORD IDENTIFIER  | 1 - 4           | 4           | VOLM         | Fixed       | Filled          |
| DISK NUMBER        | 6 - 7           | 2           | √            | Number      | Right Justified |

6.a.(1) The RECORD IDENTIFIER is the first four characters of this record. The required value for this field shall be "VOLM". The VOLM record must appear on the first line of the SDEF data file.

6.a.(2) The DISK NUMBER field shall identify the number of the data disk used to store the data exchange information. If all data may be contained on a single disk, this field shall contain the value of "1". If more disks are required, then the second disk shall contain the value "2", the third disk shall be designated with a "3", and so on. Identification of the last data disk is accomplished in the Reject End Record.

**6.b. Project Record:** The Project Identifier Record shall contain general project information. Because more than one SDEF file may be required for data transfer between large projects, the PROJ record shall be the second line of the first SDEF file transferred. The PROJ record shall contain information in the following format:

| <u>Description</u>  | <u>Column<br/>Position</u> | <u>Max.<br/>Len.</u> | <u>Req.<br/>Value</u> | <u>Type</u> | <u>Notes</u>   |
|---------------------|----------------------------|----------------------|-----------------------|-------------|----------------|
| RECORD IDENTIFIER   | 1- 4                       | 4                    | PROJ                  | Fixed       | Filled         |
| DATA DATE           | 6- 12                      | 7                    | √                     | ddmmmyy     | Filled         |
| PROJECT IDENTIFIER  | 14-17                      | 4                    | √                     | Alpha.      | Left Justified |
| PROJECT NAME        | 19-66                      | 48                   | √                     | Alpha.      | Left Justified |
| CONTRACTOR NAME     | 68-103                     | 36                   | √                     | Alpha.      | Left Justified |
| ARROW OR PRECEDENCE | 105-105                    | 1                    | A,P                   | Fixed       | Filled         |
| CONTRACT NUMBER     | 107-112                    | 6                    | √                     | Alpha.      | Left Justified |
| PROJECT START       | 114-120                    | 7                    | √                     | ddmmmyy     | Filled         |
| PROJECT END         | 122-128                    | 7                    | √                     | ddmmmyy     | Filled         |

6.b.(1) The RECORD IDENTIFIER is the first four characters of this record. The required value for this field shall be "PROJ". This record shall contain the general project information and indicates which scheduling method shall be used.

6.b.(2) The DATA DATE is the date of the schedule calculation. The abbreviation "ddmmmyy" refers to a date format that shall translate a date into two numbers for the day, three letters for the month, and two numbers for the year. For example, March 1, 1999 shall be translated into 01Mar99. This same convention for date formats shall be used throughout the entire data format. To ensure that dates are translated consistently, the following abbreviations shall be used for the three character month code:

Abbreviation Month

|     |           |
|-----|-----------|
| JAN | January   |
| FEB | February  |
| MAR | March     |
| APR | April     |
| MAY | May       |
| JUN | June      |
| JUL | July      |
| AUG | August    |
| SEP | September |
| OCT | October   |
| NOV | November  |
| DEC | December  |

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6.b.(3) The PROJECT IDENTIFIER is a maximum four character abbreviation for the schedule. These four characters shall be used to uniquely identify the project and specific update as agreed upon by Contractor and Contracting Officer. When utilizing scheduling software these four characters shall be used to select the project. Software manufacturers shall provide information to users to ensure that data importing programs do not automatically overwrite other schedules with the same PROJECT IDENTIFIER.

6.b.(4) The PROJECT NAME field shall contain the name and location of the project edited to fit the space provided. The data appearing here shall appear on scheduling software reports. The abbreviation "Alpha." refers to an "Alphanumeric" field value and shall be used throughout the remainder of this specification.

6.b.(5) The CONTRACTOR NAME field shall contain the Construction Contractor's name, edited to fit the space provided.

6.b.(6) The ARROW OR PRECEDENCE field shall indicate which method shall be used for calculation of the schedule. The value "A" shall signify the Arrow Diagramming Method. The value "P" shall signify the Precedence Diagramming Method. The ACTIVITY ID field of the Activity Record shall be interpreted differently depending on the value of this field. The Precedence Record shall be required if the value of this field is "P". [Usage note: software systems may not support both arrow and precedence diagramming. It is recommended that the selection of the type of network be based on the capabilities of the software used by project partners.]

6.b.(7) The CONTRACT NUMBER field shall contain the contract number for the project. For example, the construction contract number DACA85-89-C-0001 shall be entered into this field as "890001".

6.b.(8) The PROJECT START field shall contain the date that the Contractor acknowledges the Notice to Proceed (NTP). [Usage note: Software systems may use a project start date to constrain the first activity of a network. To ensure consistent scheduling calculations across products, it is recommended that the first activity in the schedule contain an EARLY START constraint and a software system's PROJECT START date only be used to report on the project's start date.]

6.b.(9) The PROJECT END field shall contain the date that the Contractor plans to complete the work as approved by the Contracting Officer. [Usage note: software systems may use a project end date to constrain the last activity of a network. To ensure consistent scheduling calculations across products, it is recommended that the last activity in the schedule contain an EARLY START constraint and a software system's PROJECT END date only be used to report on the project's end date.]

**6.c. Calendar Record:** The Calendar Record(s) shall follow the Project Identifier Record in the first disk of data transferred. A minimum of one Calendar Record shall be required for all data exchange activity files. The format for the Calendar Record shall be as follows:

| <u>Description</u>   | <u>Column Position</u> | <u>Max. Len.</u> | <u>Req. Value</u> | <u>Type</u> | <u>Notes</u>   |
|----------------------|------------------------|------------------|-------------------|-------------|----------------|
| RECORD IDENTIFIER    | 1 - 4                  | 4                | CLDR              | Fixed       | Filled         |
| CALENDAR CODE        | 6 - 6                  | 1                | √                 | Alpha.      | Filled         |
| WORKDAYS             | 8 - 14                 | 7                | SMTWTFS           | Fixed       | Filled         |
| CALENDAR DESCRIPTION | 16-45                  | 30               | √                 | Alpha.      | Left Justified |

6.c.(1) The RECORD IDENTIFIER shall always begin with "CLDR" to identify it as a Calendar Record. Each Calendar Record used shall have this identification in the first four columns. [Usage note: Systems contain a variety of calendar options. It is recommended that the least common denominator of calendar features between the systems be used as the basis for creating the SDEF file for a given project.]

6.c.(2) The CALENDAR CODE shall be used in the activity records to signify that this calendar is associated with the activity. [Usage note: Some systems do not allow for alphanumeric CALENDAR CODES, but only allow positive integers from 1 to 9. It is recommended that only positive integers be used for the CALENDAR CODE field to support the widest variety of scheduling systems.]

6.c.(3) The WORKDAYS field shall contain the work-week pattern selected with "Y", for Yes, and "N", for No. The first character shall be Sunday and the last character Saturday. An example of a typical five (5) day work-week would be NYYYYYN. A seven (7) day work-week would be YYYYYYY.

6.c.(4) The CALENDAR DESCRIPTION shall be used to briefly describe the calendar used.

**6.d. Holiday Record:** The Holiday Record(s) shall follow the Calendar Record(s) in the first disk of data transferred. There may be calendars without any holidays designated or several Holiday Records for each Calendar Record(s). The format for the Holiday Record shall be as follows:

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| <u>Description</u> | <u>Column<br/>Position</u> | <u>Max.<br/>Len.</u> | <u>Req.<br/>Value</u> | <u>Type</u> | <u>Notes</u>  |
|--------------------|----------------------------|----------------------|-----------------------|-------------|---------------|
| RECORD IDENTIFIER  | 1 - 4                      | 4                    | HOLI                  | Fixed       | Filled        |
| CALENDAR CODE      | 6 - 6                      | 1                    | √                     | Alpha.      | Filled        |
| HOLIDAY DATE       | 8 - 14                     | 7                    | √                     | ddmmyy      | Filled        |
| HOLIDAY DATE       | 16-22                      | 7                    | -                     | ddmmyy      | May be Filled |
| HOLIDAY DATE       | 24-30                      | 7                    | -                     | ddmmyy      | May be Filled |
| HOLIDAY DATE       | 32-38                      | 7                    | -                     | ddmmyy      | May be Filled |
| HOLIDAY DATE       | 40-46                      | 7                    | -                     | ddmmyy      | May be Filled |
| HOLIDAY DATE       | 48-54                      | 7                    | -                     | ddmmyy      | May be Filled |
| HOLIDAY DATE       | 56-62                      | 7                    | -                     | ddmmyy      | May be Filled |
| HOLIDAY DATE       | 64-70                      | 7                    | -                     | ddmmyy      | May be Filled |
| HOLIDAY DATE       | 72-78                      | 7                    | -                     | ddmmyy      | May be Filled |
| HOLIDAY DATE       | 80-86                      | 7                    | -                     | ddmmyy      | May be Filled |
| HOLIDAY DATE       | 88-94                      | 7                    | -                     | ddmmyy      | May be Filled |
| HOLIDAY DATE       | 96-102                     | 7                    | -                     | ddmmyy      | May be Filled |
| HOLIDAY DATE       | 104-110                    | 7                    | -                     | ddmmyy      | May be Filled |
| HOLIDAY DATE       | 112-118                    | 7                    | -                     | ddmmyy      | May be Filled |
| HOLIDAY DATE       | 120-126                    | 7                    | -                     | ddmmyy      | May be Filled |

6.d.(1) The RECORD IDENTIFIER shall always begin with "HOLI". Each Holiday Record used shall have this identification in the first four columns.

6.d.(2) The CALENDAR CODE indicates which work-week calendar the holidays shall be applied to. More than one HOLI record may be used for a given CALENDAR CODE.

6.d.(3) The HOLIDAY DATE shall contain the date of each individual non-work day.

**6.e. Activity Records:** Activity Records shall follow any Holiday Record(s). If there are no Holiday Record(s), then the Activity Records shall follow the Calendar Record(s). There shall be one Activity Record for every activity in the network. Each activity shall have one record in the following format:

| <u>Description</u>  | <u>Column<br/>Position</u> | <u>Max.<br/>Len.</u> | <u>Req.<br/>Value</u> | <u>Type</u> | <u>Notes</u>      |
|---------------------|----------------------------|----------------------|-----------------------|-------------|-------------------|
| RECORD IDENTIFIER   | 1 - 4                      | 4                    | ACTV                  | Fixed       | Filled            |
| ACTIVITY ID         | 6 - 15                     | 10                   | √                     | Integer     | See Comment Below |
| ACTIVITY DESCR.     | 17-46                      | 30                   | √                     | Alpha.      | Left Justified    |
| ACTIVITY DURATION   | 48-50                      | 3                    | √                     | Integer     | Right Justified   |
| CONSTRAINT DATE     | 52-58                      | 7                    |                       | ddmmmyy     | May be Filled     |
| CONSTRAINT TYPE     | 60-61                      | 2                    |                       | ES or LF    | May be Filled     |
| CALENDAR CODE       | 63-63                      | 1                    | √                     | Alpha.      | Filled            |
| HAMMOCK CODE        | 65-65                      | 1                    | Y, blank              | Fixed       | May be Filled     |
| WORKERS PER DAY     | 67-69                      | 3                    |                       | Integer     | Right Justified   |
| RESPONSIBILITY CODE | 71-74                      | 4                    |                       | Alpha.      | Left Justified    |
| WORK AREA CODE      | 76-79                      | 4                    |                       | Alpha.      | Left Justified    |
| MOD OR CLAIM NO.    | 81-86                      | 6                    |                       | Alpha.      | Left Justified    |
| BID ITEM            | 88-93                      | 6                    |                       | Alpha.      | Left Justified    |
| PHASE OF WORK       | 95-96                      | 2                    |                       | Alpha.      | Left Justified    |
| CATEGORY OF WORK    | 98-98                      | 1                    |                       | Alpha.      | May be Filled     |
| FEATURE OF WORK     | 100-128                    | 30                   |                       | Alpha.      | Left Justified    |

6.e.(1) The RECORD IDENTIFIER for each activity description record must begin with the four character "ACTV" code. This field shall be used for both the Arrow Diagram Method (ADM) and Precedence Diagram Method (PDM),

6.e.(2) The ACTIVITY ID consists of coding that shall differ, depending on whether the ADM or PDM method was selected in the Project Record. If the ADM method was selected then the field shall be interpreted as two right-justified fields of five (5) integers each. If the PDM method was selected the field shall be interpreted as one (1) right-justified field of ten (10) integers each. The maximum activity number allowed under this arrangement is 99999 for ADM and 999999999 for the PDM method. [Usage note: Many systems allow alphanumeric ACTIVITY IDs. While the SDEF does not strictly, allow the use of alphanumeric values, users may agree to use the ACTIVITY ID field to exchange alphanumeric data. It is recommended that the ACTIVITY ID be restricted to integers when one or more of the systems being used for scheduling allows only integer ACTIVITY ID values.]

6.e.(3) The ACTIVITY DESCRIPTION shall be a maximum of 30 characters. Descriptions must be limited to the space provided.

6.e.(4) The ACTIVITY DURATION contains the estimated original duration for the activity on the schedule. The duration shall be based upon the work-week designated by the activity's related calendar.

6.e.(5) The CONSTRAINT DATE field shall be used to identify a date that the scheduling system may use to modify float calculations. If there is a date in this field, then there must be a valid entry in the CONSTRAINT TYPE field.

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6.e.(6) The CONSTRAINT TYPE field shall be used to identify the way that the scheduling system shall use the CONSTRAINT DATE to modify schedule float calculations. If there is a value in this field, then there must be a valid entry in the CONSTRAINT DATE field. The valid values for the CONSTRAINT TYPE are as follows:

| <u>Code</u> | <u>Definition</u>  |
|-------------|--|
| ES          | The CONSTRAINT DATE shall replace an activity's early start date, if the early start date is prior to the CONSTRAINT DATE. |
| LF          | The CONSTRAINT DATE shall replace an activity's late finish date, if the late finish date is after the CONSTRAINT DATE.    |

[Usage note: Systems provide a wide variety of constraint types that may not be supported by other systems. It is recommended that constraint types be restricted to the values above regardless of the capabilities of the various systems being used for scheduling.]

6.e.(7) The CALENDAR CODE relates this activity to an appropriate work-week calendar. The ACTIVITY DURATION must be based on the valid work-week referenced by this CALENDAR CODE field.

6.e.(8) The HAMMOCK CODE indicates that a particular activity does not have its own independent duration, but takes its start dates from the start date of the preceding activity (or node) and takes its finish dates from the finish dates of its succeeding activity (or node). If the value of the HAMMOCK CODE field is "Y", then the activity is a hammock activity.

6.e.(9) The WORKERS PER DAY shall contain the average number of workers expected to work on the activity each day the activity is in progress. If this code is required by project scheduling specifications, values for this data will be right justified. Activities without workers per day shall have a value of "0".

6.e.(10) The RESPONSIBILITY CODE shall identify the subcontractors or major trade involved with completing the work for the activity. If this code is required by project scheduling specifications, value for this data will be left justified.

6.e.(11) The WORK AREA CODE shall identify the location of the activity within the project. If this code is required by project scheduling specifications, value for this data will be left justified.

6.e.(12) The MOD OR CLAIM NUMBER shall uniquely identify activities that are added or changed on a construction contract modification, or activities that justify any claimed time extensions. If this code is required by project scheduling specifications, value for this data will be left justified.

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6.e.(13) The BID ITEM shall identify the bid item number associated with each activity. If this code is required by project scheduling specifications, value for this data will be left justified.

6.e.(14) The PHASE OF WORK shall identify the timing of a specific activity within the entire project. If this code is required by project scheduling specifications, value for this data will be left justified.

6.e.(15) The CATEGORY OF WORK shall identify the general type of work performed by every activity. If this code is required by project scheduling specifications, value for this data will be placed in the field.

6.e.(16) The FEATURE OF WORK shall identify a very broad designation of the general type of work that is being accomplished by the activity. If this code is required by project scheduling specifications, value for this data will be left justified. [Usage note: Many systems require that FEATURE OF WORK values be placed in several activity code fields. It is recommended that users review SDEF documentation to determine the correct way to use a given software system to produce the FEATURE OF WORK code.]

**6.f. Precedence Record:** The Precedence Record(s) shall follow the Activity Records if a Precedence Diagram Method schedule (PDM) is identified in the ARROW OR PRECEDENCE field of the Project Record. The Precedence Record has the following format:

| <u>Description</u> | <u>Column</u>   | <u>Max.</u> | <u>Req.</u>  | <u>Type</u> | <u>Notes</u>      |
|--------------------|-----------------|-------------|--------------|-------------|-------------------|
|                    | <u>Position</u> | <u>Len.</u> | <u>Value</u> |             |                   |
| RECORD IDENTIFIER  | 1 - 4           | 4           | PRED         | Fixed       | Filled            |
| ACTIVITY ID        | 6-15            | 10          | √            | Integer     | See Comment Below |
| PRECEDING ACTIVITY | 17 -26          | 10          | √            | Integer     | See Comment Below |
| PREDECESSOR TYPE   | 28-28           | 1           | √            | S, F, C     | Filled            |
| LAG DURATION       | 30-33           | 4           | √            | Integer     | Right Justified   |

6.f.(1) The RECORD IDENTIFIER shall begin with the four characters "PRED" in the first four columns of the record.

6.f.(2) The ACTIVITY ID identifies the activity whose predecessor shall be specified in this record.

6.f.(3) The PRECEDING ACTIVITY number is the number of an activity that precedes the activity noted in the ACTIVITY ID field.

6.f.(4) The PREDECESSOR TYPE field indicates the type of relation that exists between the chosen pair of activities. Valid PREDECESSOR TYPE fields areas follows:

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| <u>Code</u> | <u>Definition</u>         |
|-------------|---------------------------|
| S           | Start-to-Start relation   |
| F           | Finish-to-Finish relation |
| C           | Finish-to-Start relation  |

[Usage note: Some systems provide additional predecessor types that may not be supported by all other systems. It is recommended that predecessor types be restricted to the values above regardless of the capabilities of the various systems being used for scheduling.]

6.f.(5) The LAG DURATION field contains the number of days delay between the preceding and current activity. [Usage note: Some systems allow negative values for the LAG DURATION. Because these values are not supported by all other systems, it is recommended that values be restricted to zero and positive integers.]

**6.g. Unit Cost Record:** The Unit Cost Record shall follow all Precedence Records. If the schedule utilizes the Arrow Diagram Method, then the Unit Cost Record shall follow any Activity records. There shall be one Unit Cost Record for every activity that is not a lump sum activity. [Usage note: (1) It is recommended that users who wish to exchange unit cost data contact SDEF vendor representatives to determine the ability of the software system to import/export unit cost information. (2) If the software being used by each member of the project team supports unit cost data then users may wish to conduct a trial run of the SDEF data exchange with a two or three-activity network to ensure that unit cost data transfers as expected. If problems are found please consult vendor representatives for resolution prior to exchange of full project schedules. (3) Unit cost record data does not, in most systems, result in the correct values being placed in the ACTIVITY COST and COST TO DATE fields of the Progress (PROG) Record. Users must, at this time, manually transfer the data from the Unit Cost Record to the Progress Record.

The fields for this record shall take the following format:

| <u>Description</u> | <u>Column Position</u> | <u>Max. Len.</u> | <u>Req. Value</u> | <u>Type</u> | <u>Notes</u>      |
|--------------------|------------------------|------------------|-------------------|-------------|-------------------|
| RECORD IDENTIFIER  | 1 - 4                  | 4                | UNIT              | Fixed       | Filled            |
| ACTIVITY ID        | 6-15                   | 10               | √                 | Integer     | See Comment Below |
| TOTAL QTY          | 17-29                  | 13               | √                 | Format 8.4  | Right Justified   |
| COST PER UNIT      | 31-43                  | 13               | √                 | Format 8.4  | Right Justified   |
| QTY TO DATE        | 45-57                  | 13               | √                 | Format 8.4  | Right Justified   |
| UNIT OF MEASURE    | 59-61                  | 3                | √                 | Alpha.      | Left Justified    |

6.g.(1) The RECORD IDENTIFIER shall be identified with the four characters "UNIT" placed in the first four columns of the record.

6.g.(2) The ACTIVITY ID for each activity shall match the format described in the activity record. Each activity may have only one Unit Cost Record.

6.g.(3) The TOTAL QTY is the total amount of material to be used in this activity. This number consists of eight digits, one decimal point and four more digits. An example of a number in this format is "11111111.1111". If decimal places are not needed this field shall still contain a ".0000" in columns 25-29. [Usage note: Many systems support a different format for this value that does not include as many decimal places. It is recommended that users determine their requirements for significant digits based on the lowest common denominator of the software systems being used for a given project.]

6.g.(4) The COST PER UNIT is the cost, in dollars and cents, for each unit to be used in this activity. This number consists of eight digits, one decimal point, and four more digits. An example of a number in this format is "11111111.1111". If decimal places are not needed this field shall still contain a ".0000" in columns 39-43. [Usage note: Many systems support a different format for this value that does not include as many decimal places. It is recommended that users determine their requirements for significant digits based on the lowest common denominator of the software systems being used for a given project.]

6.g.(5) The QTY TO DATE is the quantity of material installed in this activity up to the data date. This number consists of eight digits, one decimal point, and four more digits. An example of a number in this format is "11111111.1111". If decimal places are not needed this field shall still contain a ".0000" in columns 53-57. [Usage note: Many systems support a different format for this value that does not include as many decimal places. It is recommended that users determine their requirements for significant digits based on the lowest common denominator of the software systems being used for a given project.]

6.g.(6) The UNIT OF MEASURE is an abbreviation that may be used to describe the units being measured for this activity. Valid values for this field are any meaningful English or metric unit, except "LS" for Lump Sum. Lump Sum activities are not to have Unit Cost Records.

**6.h. Progress Record:** Progress Record(s) shall follow all Unit Cost Record(s). If there are no Unit Cost Record(s), then the Progress Record(s) shall follow all Precedence Records. If the schedule utilizes the Arrow Diagram Method, then the Progress Record shall follow any Activity Records. One Progress Record is required for every activity in the Activity Record. The fields for this Record shall be provided in the following format:

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| <u>Description</u> | <u>Column</u><br><u>Position</u> | <u>Max.</u><br><u>Len.</u> | <u>Req.</u><br><u>Value</u> | <u>Type</u> | <u>Notes</u>             |
|--------------------|----------------------------------|----------------------------|-----------------------------|-------------|--------------------------|
| RECORD IDENTIFIER  | 1-4                              | 4                          | PROG                        | Fixed       | Filled                   |
| ACTIVITY ID        | 6-5                              | 10                         | √                           | Integer     | See Comment Below        |
| ACTUAL START DATE  | 17-23                            | 7                          | √                           | ddmmyy      | Filled if Started        |
| ACTUAL FINISH DATE | 25-31                            | 7                          | √                           | ddmmyy      | Filled if Finished       |
| REMAINING DURATION | 33-35                            | 3                          | √                           | Integer     | Right Justified          |
| ACTIVITY COST      | 37-48                            | 12                         | √                           | Format 9.2  | Right Justified          |
| COST TO DATE       | 50-61                            | 12                         | √                           | Format 9.2  | Right Justified          |
| STORED MATERIAL    | 63-74                            | 12                         | √                           | Format 9.2  | Right Justified          |
| EARLY START DATE   | 76-82                            | 7                          | √                           | ddmmyy      | Filled if Not Started    |
| EARLY FINISH DATE  | 84-90                            | 7                          | √                           | ddmmyy      | Filled if Not Finished   |
| LATE START DATE    | 92-98                            | 7                          | √                           | ddmmyy      | Filled if Not Started    |
| LATE FINISH DATE   | 100-1067                         |                            | √                           | ddmmyy      | Filled if Not Finished   |
| FLOAT SIGN         | 108-1081                         |                            | +,-                         | Fixed       | Filled if Not Finished   |
| TOTAL FLOAT        | 110-1123                         |                            | √                           | Integer     | R. Just. if Not Finished |

6.h.(1) The RECORD IDENTIFIER shall begin with the four characters "PROG" in the first four columns of the record.

6.h.(2) The ACTIVITY ID for each activity for which progress has been posted shall match the format described in the Activity Record.

6.h.(3) An ACTUAL START DATE is required for all in-progress activities. The ACTUAL START DATE shall be the same as, or later than, the PROJECT START date contained in the Project Record. The ACTUAL START DATE shall also be the same as, or prior to, the DATA DATE contained in the Project Record. If there is an ACTUAL START DATE for an activity that there must also be a REMAINING DURATION, and the values for the EARLY START DATE and LATE START DATE are blank. [Usage note: Some systems allow default values for ACTUAL START DATE if the date is not entered by the user. Because the failure to include a start date for activities may result in different schedule calculations, it is recommended that the ACTUAL START DATE be required for all activities in progress.]

6.h.(4) An ACTUAL FINISH DATE is required for all completed activities. If the REMAINING DURATION of an activity is zero, then there must be an ACTUAL FINISH DATE. If there is an ACTUAL FINISH DATE, then values for the EARLY START DATE, LATE START DATE, EARLY FINISH DATE, LATE FINISH DATE, FLOAT SIGN, and TOTAL FLOAT shall be blank. [Usage note: Some systems allow default values for ACTUAL FINISH DATE if the date is not entered by the user. Because the failure to include a finish date for activities may result in different schedule calculations, it is recommended that the ACTUAL FINISH DATE be required for all activities in progress.]

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6.h.(5) REMAINING DURATION is required for all activities. Activities that have not started shall have a remaining duration equal to their original duration. Activities completed based on time, shall have a zero (0) REMAINING DURATION. [Usage note: Systems have a variety of "short-cut" methods to determine the REMAINING DURATION value. It is recommended that users actually consider the time required to complete the remaining work on a given task, rather than allow a system to calculate the remaining duration based on the amount of work that has already been accomplished.]

6.h.(6) The ACTIVITY COST contains the estimated earned value of the work to be accomplished in the activity. An example of a number in this format is "1111111 11.11". If decimal places are not needed this field shall still contain a ".00" in the last three columns of this field. [Usage note: Users should inquire of software vendors if the user needs to add a zero in the data field to produce the default value "0.00".]

6.h.(7) The COST TO DATE contains the earned value for the activity. If there is an ACTUAL START DATE, then there must also be some value for COST TO DATE. An example of a number in this format is "11111111.11". If decimal places are not needed, this field shall still contain a ".00" in the last three columns of this field. The COST TO DATE is not tied to REMAINING DURATION. For example, if the REMAINING DURATION is "0", the COST TO DATE may only be 95% of the ACTIVITY COST. This difference may be used to reflect 5% retainage for punch list items. [Usage note: Systems implement cost information in different ways. It is recommended that users carefully review SDEF documentation and test results to determine how to ensure that SDEF data is exported correctly.]

6.h.(8) The STORED MATERIAL field contains the value of the material that the Contractor has paid for and is on site or in secure storage areas that is a portion of the COST TO DATE. An example of a number in this format is "11111111.11". If decimal places are not needed, this field shall still contain a ".00" in the last three columns of this field. [Usage note: Systems implement the stored materials field in a variety of ways. Many systems do not enforce STORED MATERIAL + COST TO DATE < ACTIVITY COST. To avoid potential confusion between systems, it is recommended that new activities be added to a schedule to reflect the cost of large equipment procurement rather than use the STORED MATERIALS field.]

6.h.(9) The EARLY START DATE indicates the earliest date possible that an activity can start as calculated by a CPM scheduling system or other Contracting Officer approved planning method. If the progress record for an activity contains an ACTUAL START DATE, then this field shall be blank.

6.h.(10) The EARLY FINISH DATE indicates the earliest date possible that an activity can finish as calculated by a CPM scheduling system or other Contracting Officer approved planning method. If the progress record for an activity contains an ACTUAL FINISH DATE, then this field shall be blank.

6.h.(11) The LATE START DATE indicates the latest date that an activity can begin as calculated by a CPM scheduling system or other Contracting Officer approved planning method. If the progress record for an activity contains an ACTUAL START DATE, then this field shall be blank.

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6.h.(12) The LATE FINISH DATE indicates the latest date that an activity can finish as calculated by a CPM scheduling system or other Contracting Officer approved planning method. If the progress record for an activity contains an ACTUAL FINISH DATE, then this field shall be blank.

6.h.(13) The FLOAT SIGN indicates whether the float time calculated using a CPM scheduling system or other Contracting Officer approved planning method, is positive or negative in nature. If the progress record for an activity contains an ACTUAL FINISH DATE, then this field shall be blank. In the case of zero float this field shall be blank.

6.h.(14) The TOTAL FLOAT indicates the total float time. In the Precedence Diagram Method (PDM), the total float is the difference between the early and late start or finish dates. In the Arrow Diagram Method (ADM), the total float is equal to the late event time at the end of the activity, minus the sum of the early event time at the start of the activity plus the duration of the activity.

**6.i. Project End Record:** The Project End Record shall be used to identify that the data file is completed. If the ASCII End of File character is encountered, then data import programs shall use that character to infer that the data continues on the next disk. The user shall then be prompted for the next disk number, based on the VOLM record data. The Project End Record shall be the last record of the entire data file, and shall have the following format:

| <u>Description</u> | <u>Column</u>   | <u>Max.</u> | <u>Req.</u>  | <u>Type</u> | <u>Notes</u> |
|--------------------|-----------------|-------------|--------------|-------------|--------------|
|                    | <u>Position</u> | <u>Len.</u> | <u>Value</u> |             |              |
| RECORD IDENTIFIER  | 1-3             | 3           | END          | Fixed       | Filled       |

6.i.(1) The RECORD IDENTIFIER for the Project End Record shall be "END". Data contained in the data exchange file that occurs after this record shall not be used.

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## SECTION 01330

## SUBMITTAL PROCEDURES

## PART 1 GENERAL

## 1.1 SUBMITTAL IDENTIFICATION

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

## SD-01 Preconstruction Submittals

Project Schedule.  
Submittal Register.  
Safety Plan.  
Construction Quality Control Plan.  
Environmental Control Plan.  
Waste Management Plan.

## SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.  
Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the contractor for integrating the product or system into the project.  
Drawings prepared by or for the contractor to show how multiple systems and interdisciplinary work will be coordinated.

## SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials or equipment for some portion of the work.  
Samples of warranty language when the contract requires extended product warranties.

## SD-04 Samples

Physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of materials or product and establish standards by which the work can be judged.  
Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.  
Field samples and mock-ups constructed on the project site to establish standards by which the ensuing work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project

and those which will be removed at the conclusion of the work.

#### SD-05 Design Data

Calculations, mix designs, analyses and other data pertaining to a part of the work.

#### SD-06 Test Reports

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

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

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

Investigation reports.

Final testing and acceptance reports.

#### SD-07 Certificates

Statements signed by a responsible official of the company that manufactured a product, system or material attesting that product, system or material meets the specified requirements. Must be dated after award of the project contract, clearly name the project and identify the product, system or material being certified, including the specified required being met.

Documentation required of the Contractor, or of a supplier, installer or subcontractor through the contractor, the purpose of which is to verify the orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

#### SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by the manufacturer's representative to confirm compliance with the manufacturer's standards or instructions.

Factory test reports.

### 1.2 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

#### 1.2.1 Government Approved

Governmental 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 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. 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 incorporated in the work will not be made if required approvals have not been obtained and/or complete, satisfactory "FIO" submittals have not been received by the Government.

#### 1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with this Section.

##### SD-01 Preconstruction Submittals

Submittal Register (ENG Form 4288); G.  
Monthly updates (ENG form 4288)

Four copies of the completed ENG Form 4288.

Two copies of the monthly update as specified shall be submitted together with the monthly progress payment requests.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

### 3.1 GENERAL

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

### 3.2 SUBMITTAL REGISTER

At the end of this section is one set of Submittal Forms listing 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 use the government-provided software, QCS (see Section 01312), to create the ENG Form 4288. The Contractor is responsible for completing the columns labeled: Activity Number, Transmittal Number, and Contract Schedule Dates on the submittal register form. The completed Submittal Register shall be submitted to the Contracting Officer for approval within 30 calendar days after Notice to Proceed. The submit dates and need dates in the submittal register shall be coordinated with the dates in the Contractor's progress schedule. Updates to the Submittal Register showing the Contractor action codes and actual submittal dates with Government action codes and action dates shall be submitted monthly together with the monthly payment request, or until all submittals have been satisfactory completed. When the progress schedule is revised, the submittal register shall also be revised and both resubmitted for approval. The approval submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period.

### 3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted

concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 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 incorrect, incomplete and/or late submittals. An additional 15 calendar days shall be allowed and shown on the register for review and approval of submittals for food service equipment, fire sprinkler and fire alarm systems, and refrigeration and HVAC control systems.

### 3.4 TRANSMITTAL FORM (ENG FORM 4025)

#### 3.4.1 USE

A transmittal form (ENG Form 4025) shall be used for submitting both Government approved and information only submittals. The Contractor shall use the government provided software, QCS (see Section 01312), to create the Eng Form 4025. A separate transmittal form shall be used for each specification section. 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 the contract drawings pertinent to the date submitted or each item.

#### 3.4.2 NUMBERING

Transmittals will be automatically numbered by QCS. The transmittal number will consist of 2 parts, the specification number and the sequence number, e.g. 01330-001. Each specification section will begin with the sequence number, 001. Resubmittals will be identified by a decimal number appended to the original transmittal number, e.g. 01330-001.1, will identify resubmittals.

### 3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

#### 3.5.1 Procedures

The Contractor shall establish procedures for purchasing materials and equipment, subcontracting, and processing of shop drawings, outlining the responsibilities at each level to insure that adequate review and approval, timely delivery, verification of procedures and proper storage are provided. Delays in the review and approval process shall not be given consideration for a time extension or additional cost, when such delays are the result of the Contractor's late submittal or failure to provide proper submittals; or make corrections in compliance with the contract documents or the Contracting Officer's comments; or provide a resubmittal because if an unacceptable original submittal.

Submittals to the Contracting Officer are required in the number of copies identified in paragraphs 3.7 and 3.8 and shall be submitted to:

U.S. Army Corps of Engineer District, Honolulu  
Fort Shafter Resident Office  
Bldg 230  
Fort Shafter, Hawaii 96858-5440

### 3.5.2 Deviations

- a. 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.
- b. In cases where "trade names or equal" are used in the plans and/or Technical Specifications, any "equal" substitution by the Contractor is considered a variance and will require the Government's approval. Approval action by the Contracting Officer will not relieve the Contractor of his quality control responsibility and compliance with the contract, except for those specific portions of the submittal which clearly highlight the departures from the contract, and which are brought to the attention of the Government. The Contractor shall be responsible for all corrective actions, when submittals containing provisions of non-compliance with the contract are not specifically brought to the Government's attention. Any associated cost or time loss from such corrective actions shall not be made subject to a claim against the Government.
- c. Variations from the contract requirements may require an appropriate contract modification prior to acceptance by the Government; however, such pending action shall not be a basis of claim for time or additional cost against the Government, since the Contractor still has the option to comply with the original contract requirements. If the variation is of a minor nature and does not affect a change in cost or time of performance, a modification may not be issued. All variations shall meet the standards set by the contract documents.

### 3.6 COORDINATION OF LAYOUTS

The Contractor Quality Control (CQC) organization is responsible for insuring that the shop drawings and submittals of the different trades are coordinated in order that space conflicts during installation/construction of mechanical, electrical, architectural, civil, structural and other items of work are avoided. The Contractor shall be required to prepare/develop coordinated working layout drawings prior to commencement of any feature of work, at any contractor tier, unless otherwise directed by the Contracting Officer. These layout drawings shall be reviewed and certified by the CQC organization prior to the start of work in any area. The CQC shall insure that layout drawings indicate all necessary features of work, providing for a coordinated arrangement of the various installations, giving full consideration for access to installed equipment/systems and the future maintenance of these items. Interference between equipment and systems or construction materials which cannot be resolved between Contractor and subcontracting tiers shall be resolved by the Contracting Officer at no additional cost to the Government, if it is determined that adequate space

was available and installations could have been accommodated within the designated construction area through properly coordinated layout drawings. One (1) CQC certified copy of all layout drawings shall be available for Government's review five (5) working days prior to scheduled commencement of the work. Submission shall be made upon Government's request.

### 3.7 CONTROL OF SUBMITTALS

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

#### 3.7.1 Monthly Updates of Submittal Register

Monthly updates of the initially accepted Submittal Registers, ENG Form 4288, shall be submitted in duplicate at the time the monthly progress payment is requested and be current to within one (1) week of the date of submission. When a monthly payment is not being requested, the update shall be submitted on the 15th of each month or the workday closest to the 15th. If the Contractor fails to provide the Government acceptable initial submittal registers or monthly updates within the specified time frames, the Government may issue a stop work order and/or withhold a portion of pending progress payments due to non-performance. Any resulting cost or time loss to the Contractor due to such Government action shall not be subject to a claim for the time extensions, additional cost or for damages by the Contractor. Furnishing of the submittal registers by the Contractor and subsequent review/acceptance by the Government do not relieve the Contractor of the obligation to comply with all of the contract submittal requirements; for example, even if a required submittal was not originally listed on the initial register accepted by the Government, the Contractor will still be responsible for providing such submittal in accordance with the contract. The following shall be provided on the monthly updates to the initially accepted schedule:

- a. Activity No., Transmittal No., and entries under other columns, as appropriate.
- b. Distinguish those submittals which are VARIANCES, as appropriate.
- c. Furnish a separate LISTING of required SUBMITTALS, together with the Government's review comments, and appropriate Contractor's status report on pending resubmittal actions.
- d. Furnish a separate LISTING of SUBMITTALS provided by the Contractor to the Government; and another separate LISTING of SUBMITTALS returned by the Government to the Contractor, for the particular month the update is furnished.

### 3.8 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. 3 copies of the submittal will be retained by the Contracting Officer and 1 copy of the submittal will be returned to the

Contractor.

### 3.9 INFORMATION ONLY SUBMITTALS

Submittals provided For Information Only (FIO) to the Government shall be submitted in three (3) copies, including resubmittals. Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

3.10 STAMPS

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

|   |
|---|
| <p>CONTRACTOR</p> <p>(Firm Name)</p> <p>_____ I hereby certify that the (material) (equipment) (article) shown and marked in this submittal and proposed to be incorporated in Contract No. (DACA83- - - ), is in compliance with the contract drawings and specifications, can be installed in the allocated spaces, and is approved for use.</p> <p>SIGNATURE: _____</p> <p>TITLE: _____</p> <p>DATE: _____</p> |
|---|

-- End of Section --

**SUBMITTAL REGISTER**  
(ER 415 1-10)

CONTRACT NO.

TITLE AND LOCATION

CONTRACTOR

SPECIFICATION SECTION

**KAUMALAPAU HARBOR BREAKWATER REPAIR, LANAI HAWAII**

**01320**

| ACTIVITY NO. | TRANS-MITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | TYPE OF SUBMITTAL |   |   |   |   |   |   |   |   |   | CLASSIFICATION | CONTRACTOR SCHEDULE DATES |   |   |   | CONTRACTOR ACTION |   | GOVERNMENT ACTION |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
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**SUBMITTAL REGISTER**  
(ER 415 1-10)

CONTRACT NO.

TITLE AND LOCATION

CONTRACTOR

SPECIFICATION SECTION

**KAUMALAPAU HARBOR BREAKWATER REPAIR, LANAI HAWAII**

**03110**

| ACTIVITY NO. | TRANS-MITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | TYPE OF SUBMITTAL |   |   |   |   |   |   |   |   |   | CLASSIFICATION | CONTRACTOR SCHEDULE DATES |   |   |   | CONTRACTOR ACTION |   | GOVERNMENT ACTION |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
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|              |                  |          |                                |                               | D                 | R | U | A | W | D | I | U | E | O |                | A                         | P | O | U | T                 | O | M                 | O | E | S | U | M | I | T | O | G | O | V | E | R | E | P | V | N | R | I | E | V | W | E | D | L | O | L | N | E | R | S | T | B | Y | M | A | T | E | R | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M | A | R | K | S | U | B | Y | C | O | D | E | D | A | T | E | R | M |

**SUBMITTAL REGISTER**  
(ER 415 1-10)

CONTRACT NO.

TITLE AND LOCATION

CONTRACTOR

SPECIFICATION SECTION

**KAUMALAPAU HARBOR BREAKWATER REPAIR, LANAI HAWAII**

**03310**

| ACTIVITY NO. | TRANS-MITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | TYPE OF SUBMITTAL |   |   |   |   |   |   |   |   |   | CLASSIFICATION | CONTRACTOR SCHEDULE DATES |   |   |   | CONTRACTOR ACTION |   | GOVERNMENT ACTION |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
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## 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.   | E --  | Disapproved (See attached).   |
| B -- | Approved, except as noted on drawings.   | F --  | Receipt acknowledged.   |
| C -- | Approved, except as noted on drawings.<br>Refer to attached sheet resubmission required. | FX -- | Receipt acknowledged, does not comply as<br>noted with contract requirements. |
| D -- | Will be returned by separate correspondence.   | G --  | Other (Specify)   |
10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

(Reverse of ENG Form 4025-R)

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SECTION 01420

SOURCES FOR REFERENCE PUBLICATIONS

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1.2 ORDERING INFORMATION

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## SECTION 01420

## SOURCES FOR REFERENCE PUBLICATIONS

## PART 1 GENERAL

## 1.1 REFERENCES

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

## 1.2 ORDERING INFORMATION

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

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)  
444 N. Capital St., NW, Suite 249  
Washington, DC 20001  
Ph: 800-231-3475 202-624-5800  
Fax: 800-525-5562 202-624-5806  
Internet: <http://www.aashto.org>

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)  
100 Bureau Drive  
Stop 3460  
Gaithersburg, MD 20899-3460  
Ph: 301-975-NIST  
Internet: <http://www.nist.gov>  
Order Publications From:  
Superintendent of Documents  
U.S. Government Printing Office

732 North Capitol Street, NW  
Mailstop: SDE  
Washington, DC 20401  
Ph: 866-512-1800 or 202-512-1800  
Fax: 202-512-2250  
Internet: <http://www.gpo.gov>

or  
National Technical Information Services (NTIS)  
5285 Port Royal Rd.  
Springfield, VA 22161  
Ph: 703-605-6000  
Fax: 703-605-6900  
Internet: <http://www.ntis.gov>

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)  
900 Spring St.  
Silver Spring, MD 20910  
Ph: 301-587-1400  
Fax: 301-585-4219  
Internet: <http://www.nrmca.org>

-- End of Section --

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SECTION 01430

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- 1.2 GENERAL REQUIREMENTS
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  - 1.2.2 Notification
- 1.3 SUBMITTALS

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    - 3.1.2.2 Chemical Wastes:
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  - 3.1.3 Historical, Archeological, and Cultural Resources
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  - 3.1.5 Fish and Wildlife Resources
  - 3.1.6 Air Resources
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- 3.2 POST CONSTRUCTION CLEANUP
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## SECTION 01430

## ENVIRONMENTAL PROTECTION

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## 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.

## STATE OF HAWAII DEPARTMENT OF HEALTH (HIDOH)

|                   |  |
|-------------------|--|
| HIDOH, Chapter 43 | Administrative Rules, Title 11, Community Noise Control for Oahu |
| HIDOH, Chapter 59 | Administrative Rules, Ambient Air Quality Standards              |
| HIDOH, Chapter 60 | Administrative Rules, Air Pollution Control                      |

## 1.2 GENERAL REQUIREMENTS

This section covers prevention of environmental pollution and damage as the result of construction operations under this contract and for those measures set forth in the TECHNICAL REQUIREMENTS. For the purpose of this specification, environmental pollution and damage is defined as 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 man; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of air, water, and land, and includes management of visual aesthetics, noise, solid waste, radiant energy and radioactive materials, as well as other pollutants.

## 1.2.1 Subcontractors

Assurance of compliance with this section by subcontractors will be the responsibility of the Contractor.

## 1.2.2 Notification

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the aforementioned Federal, State or local 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 proposed corrective action and

take such action as may be approved. If the Contractor fails 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 time extensions will be granted or costs or damages allowed to the Contractor for any such suspension.

### 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-06 Test Reports

##### Environmental Protection Plan; G.

Within 30 calendar days of receipt of Notice to Proceed, the Contractor shall submit in writing an environmental protection plan. Approval of the Contractor's plan will not relieve the Contractor of his responsibility for adequate and continuing control of pollutants and other environmental protection measures.

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

- a. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
- b. Methods for protection of features to be preserved within authorized work areas. The Contractor shall prepare a listing of methods to protect resources needing protection; i.e., trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, archeological, and cultural resources.
- c. Procedures to be implemented to provide the required environmental protection and to comply with the applicable laws and regulations. The Contractor shall set out the procedures to be followed to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures set out in accordance with the environmental protection plan.
- d. Location of the solid waste disposal area.
- e. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials.

- f. Environmental monitoring plans for the job site, including land, water, air, and noise monitoring.
- g. Traffic control plan.
- h. Methods of protecting surface and ground water during construction activities.
- i. 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.
- j. Plan of borrow area(s).
- k. Training for his personnel during the construction period.

## PART 2 PRODUCTS (NOT APPLICABLE)

## PART 3 EXECUTION

### 3.1 PROTECTION OF ENVIRONMENTAL RESOURCES

The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract. The Contractor shall confine his activities to areas defined by the drawings and specifications.

#### 3.1.1 Land Resources

Prior to the beginning of any construction, the Contractor shall identify all land resources to be preserved within the Contractor's 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 special permission from the Contracting Officer. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such special emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs.

##### 3.1.1.1 Work Area Limits

Prior to any construction, the Contractor shall mark the areas that are not required to accomplish all work to be performed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, the markers shall be visible. The Contractor shall convey to his personnel the purpose of marking and/or protection of all necessary objects.

#### 3.1.1.2 Protection of 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.

#### 3.1.1.3 Reduction of Exposure of Unprotected Erodible Soils

Earthwork brought to final grade shall be finished as indicated and specified. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in instances where the constructed feature obscures borrow areas, quarries, and waste material areas, these areas shall not initially be cleared in total. Clearing of such areas shall progress in reasonably sized increments as needed to use the areas developed as approved by the Contracting Officer.

#### 3.1.1.4 Protection of Disturbed Areas

Such methods as necessary shall be utilized to effectively prevent erosion and control sedimentation, including but not limited to the following:

- a. Retardation and Control of Runoff: Runoff from the construction site shall be controlled by construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses, and any measures required by areawide plans approved under Paragraph 208 of the Clean Water Act.
- b. Erosion and Sedimentation Control Devices: The Contractor shall construct or install all temporary and permanent erosion and sedimentation control features as indicated on the drawings. Temporary erosion and sediment control measures such as berms, dikes, drains, grassing, and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative.

#### 3.1.1.5 Contractor Facilities and Work Areas

- a. Location of Field Offices, Storage, and Other Contractor Facilities: The Contractors' 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 on approval by the Contracting Officer.
- b. Borrow Areas on Government Property: Borrow areas shall be managed to minimize erosion and to prevent sediment from entering nearby waters.
- c. Spoil Areas on Government Property: Spoil areas shall be managed and controlled to limit spoil to areas designated on the drawings

and prevent erosion of soil or sediment from entering nearby waters. Spoil areas shall be developed in accordance with the grading plan indicated on the drawings.

- d. Temporary Excavations and Embankments: Temporary excavations and embankments for plant and/or work areas shall be controlled to protect adjacent areas from despoilment.

### 3.1.2 Disposal of Wastes

Disposal of wastes shall be as specified in Section 01900 MISCELLANEOUS PROVISIONS and as specified hereinafter.

#### 3.1.2.1 Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. All handling and disposal shall be conducted to prevent contamination. Segregation measures shall be employed such that no hazardous or toxic waste will become commingled with solid waste. The Contractor shall transport all solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. Designated by the Contracting Officer. The Contractor shall comply with site procedures and with Federal, State, and local laws and regulations pertaining to the use of landfill areas.

#### 3.1.2.2 Chemical Wastes:

Chemical wastes shall be stored in corrosion resistant containers, removed from the work area and disposed of in accordance with Federal, State, and local laws and regulations.

#### 3.1.2.3 Hazardous Wastes:

The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing and shall collect waste in suitable containers observing compatibility. The Contractor shall transport all hazardous waste off Government property and dispose of it in compliance with Federal 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 responsibility of the Contractor.

### 3.1.3 Historical, Archeological, and Cultural Resources

Existing historical, archeological, and cultural resources within the Contractor's work area will be so designated by the Contracting Officer if any has been identified. The Contractor shall take precautions to preserve all such resources as they existed at the time they were pointed out to him. The Contractor shall provide and install all protection for these resources so designated and shall be responsible for their preservation during this contract. If during excavation or other construction

activities, any previously unidentified or unanticipated resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. These resources or cultural remains (prehistoric or historic surface or subsurface) include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rocks or coral alignments, paving, wall, or other constructed features; and any indication of agricultural or other uses. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer. When so notified, the Contracting Officer will initiate action so that prompt and proper data recovery can be accomplished. In the mean time, recording and preservation of historical and archeological finds during construction activities shall be reported in accordance with the SPECIAL CONTRACT REQUIREMENTS.

#### 3.1.4 Water Resources

The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Special management techniques as set out below shall be implemented to control water pollution by the listed construction activities which are included in this contract.

##### 3.1.4.1 Washing and Curing Water

Waste waters directly derived from construction activities shall not be allowed to enter water areas. These waste waters shall be collected and placed in retention ponds where suspended material can be settled out or the water evaporates so that pollutants are separated from the water.

##### 3.1.4.2 Monitoring of Water Areas:

Monitoring of water areas affected by construction activities shall be the responsibility of the Contractor. All water areas affected by construction activities shall be monitored by the Contractor.

#### 3.1.5 Fish and Wildlife Resources

The Contractor shall keep construction activities under surveillance, management and control to minimize interference with, disturbance to and damage of fish and wildlife. Species that require specific attention along with measures for their protection will be listed by the Contractor prior to beginning of construction operations.

#### 3.1.6 Air Resources

The Contractor shall keep construction activities under surveillance, management and control to minimize pollution of air resources. All activities, equipment, processes, and work operated or performed by the Contractor in accomplishing the specified construction shall be in strict accordance with HIDOH, Chapter 59, HIDOH, Chapter 60, and all Federal emission and performance laws and standards. Ambient Air Quality Standards set by the Environmental Protection Agency shall be maintained for those construction operations and activities specified in this section. Special management techniques as set out below shall be implemented to control air

pollution by the construction activities which are included in the contract.

#### 3.1.6.1 Particulates

- a. Dust particles, aerosols, and gaseous by-products from all construction activities, 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.
- b. The Contractor shall maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards mentioned in paragraph Air Resources, herein before, to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated at such intervals as to keep the disturbed area damp at all times. The Contractor must have sufficient competent equipment available to accomplish this task. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

#### 3.1.6.2 Hydrocarbons and Carbon Monoxide

Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

#### 3.1.6.3 Odors

Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

#### 3.1.6.4 Monitoring of Air Quality

Monitoring of air quality shall be the responsibility of the Contractor. All air areas affected by the construction activities shall be monitored by the Contractor.

#### 3.1.7 Sound Intrusions

The Contractor shall keep construction activities under surveillance, and control to minimize damage to the environment by noise. The Contractor shall comply with the provisions of HIDOH, Chapter 43.

#### 3.2 POST CONSTRUCTION CLEANUP

The Contractor shall clean up area(s) used for construction.

### 3.3 RESTORATION OF LANDSCAPE DAMAGE

The Contractor shall restore all landscape features damaged or destroyed during construction operations outside the limits of the approved work areas. Such restoration shall be in accordance with the plan submitted for approval by the Contracting Officer. This work will be accomplished at the Contractor's expense.

### 3.4 MAINTENANCE OF POLLUTION CONTROL FACILITIES

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

### 3.5 TRAINING OF CONTRACTOR PERSONNEL IN POLLUTION CONTROL

The Contractor shall train his personnel in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of facilities (vegetative covers, and instruments required for monitoring purposes) to ensure adequate and continuous environmental pollution control.

-- End of Section --

# **Water Quality Monitoring Plan Kaumalapau Harbor Breakwater Repair Island of Lana`i, Hawaii**

Department of the Army  
U.S. Army Engineer District, Honolulu  
November 2001

## **1. PROJECT LOCATION AND GENERAL DESCRIPTION**

Kaumalapau Harbor is a small barge harbor located in a natural embayment on the southwest coast of Lana`i. The harbor has a 10-acre berthing area, and water depths between 20 and 60 feet. Shoreside facilities along the north side of the embayment consist of a 400-foot-long wharf, a cargo shed and barge loading and unloading equipment. A breakwater extending to the south from the northwestern side of the embayment protects the wharf area. The existing breakwater has been badly damaged by storm waves, and in its deteriorated condition allows increased wave energy to enter the harbor. The Kaumalapau Harbor breakwater repair project will rebuild the damaged breakwater in order to provide improved berthing conditions at the wharf for cargo and fuel delivery to the island. Repairs will consist of re-shaping the existing breakwater to provide a core for the new structure, and placement of an underlayer of 3 to 4 ton stone and an armor layer of 35-ton concrete armor units. In-water work is estimated to take approximately 18 months.

## **2. GENERAL SCOPE OF WORK**

The purpose of the work is to conduct marine water sampling and analysis in the vicinity of the proposed Kaumalapau Harbor breakwater repair project. The water sampling and testing will be performed by the construction contractor (Contractor) to monitor specific water quality parameters pre, during, and, if necessary, post construction. The decision whether post-construction monitoring is required will be made by the Contracting Officer based on the results of during construction water quality monitoring. The number of samples to be collected, frequency of collection, and the specific analyses to be performed shall be in accordance with the State of Hawaii, Department of Health, "General Monitoring Guideline for Section 401 Water Quality Certification Projects" (WQC Matrix) (Attachment 1 and Reference 4). The water quality sampling and testing results, and the Contractor's evaluation of compliance with State water quality standards for each sampling day during construction, shall be transmitted in the form of a brief written laboratory report to the Government Contracting Officer and the State Department of Health, Clean Water Branch (DOH/CWB) as soon as they become available. All field data and laboratory analysis shall be fully described and evaluated in a final summary report by the Contractor to the Contracting Officer which can be used to document compliance or non-compliance with State water quality standards (Reference 1).

Major work tasks include the following:

- a. coordinate with the Contracting Officer,
- b. establish appropriate quality control and quality assurance procedures,
- c. collect samples and associated field data,
- d. analyze samples for specified parameters, and
- e. prepare and submit reports.

The intent of the Water Quality Monitoring Plan is: 1) to ascertain that the Best Management Practices (BMP's) for the project are adequate to comply with State Water Quality Standards; 2) in the event that the BMP's prove inadequate, to promptly determine such, so that modifications of the BMP's can be implemented in a timely manner to bring the activity into compliance; and 3) to serve as a basis for self-compliance, so that activities associated with the proposed action can proceed within the parameters required by State water quality standards.

### 3. WORK TASK DETAILS

a. Coordinate with the Contracting Officer. The Contractor shall coordinate with the Contracting Officer to gather project information, provide schedules and points of contact, resolve contract difficulties, attend conferences, provide work status reports, and to assure timely and appropriate scheduling and completion of each of the sampling phases (pre-construction, during construction and post-construction).

b. Establish Appropriate Quality Control (QC) and Quality Assurance (QA) Procedures. The Contractor shall establish appropriate QC and QA procedures for this work. The QC/QA shall cover sample collection, preparation and transport, lab analysis and reporting of data. The QC/QA procedures shall be described in a written plan, which shall be submitted in writing to the Contracting Officer for approval and DOH/CWB for review and acceptance prior to the initiation of sampling.

c. Collect Samples and Associated Field Data. A set of water samples shall be collected by the Contractor at the five (5) stations shown on Figure 1, at the frequency specified in the WQC Matrix (Attachment 1). The samples shall be taken at the approximate mid-water depth at each station. The location of each sampling station shall be located and mapped. The collection of samples at each station shall be performed consistently with respect to location and depth, so that individual samples and sample sets represent replicates suitable for statistical analysis. Tide stage, weather conditions, wave action, wind direction and construction activity during collection of the water samples shall be recorded. Sample containers, preservation, and maximum holding times shall be as specified in 40 CFR Part 136 (Reference 2). Samples shall be collected during daylight hours, during hours of work, and at least three hours after work has commenced for the day. Sampling shall also be conducted on random days without prior notification in order to be representative so far as practicable of typical construction activities. In addition to the five regular sampling stations, a water sample shall be taken immediately outside of any silt curtains deployed around areas of active construction. The sample

shall be taken down-drift of wind or current induced water movement, within 3 feet of the outboard side of the silt curtain, and within 1-foot of the water surface.

d. Analyze Samples for Specified Parameters. The Contractor shall analyze all field samples for pH, turbidity and total suspended solids (TSS). Analyses shall be done in accord with the methods specified in Federal regulations at 40 CFR Part 136 (Reference 2), or, where this is lacking in information, then according to the methods contained in "Standard Methods for the Examination of Water and Wastewater" (Reference 3). Analysis shall include any necessary instrument calibration, analysis of laboratory blanks, quality control samples, or other mandates of the specified methods. All samples must be analyzed within the relevant maximum holding times stated in Table II of 40 CFR Part 136. The Contractor may substitute other methods only with prior approval of the Contracting Officer. In addition to the basic water quality parameters, during periods of excavation and reshaping of the existing breakwater, excavation of the toe trench, or tremie concrete placement in the water, the Contractor shall measure dissolved oxygen, salinity and temperature at each regular and silt screen sampling station.

e. Prepare and Submit Reports. The Contractor shall provide (1) preliminary laboratory reports (when requested by the Contracting Officer), (2) written laboratory reports, and (3) a final written summary report.

- (1) Preliminary laboratory reports may be requested by the Contracting Officer. These shall be furnished at no additional charge, and may be given verbally (via telephone) or by facsimile transmission. Preliminary reports are acknowledged to be tentative, subject to confirmation or change.
- (2) A brief (approximately 1-2 pages) written laboratory report shall be prepared for each sample day. Each of these reports shall list the project name, the date of sample collection, the date of analysis, the name of the laboratory/person performing the analysis, a brief statement concerning the observed degree of compliance or noncompliance with State water quality standards (Reference 1) as indicated by the analysis results and associated field data (and the apparent reason(s), if known, for any observed violations), the date of the report, and the signature of the preparer. The analysis results for each sample shall be tabulated and shall include project name, sample number, station number, subsurface depth of sample, time of collection, analyzed amount and unit of measure, and any relevant associated data or observations. In reaching conclusions concerning the degree of compliance with the State water quality standards and cause(s) of apparent violations, the Contractor shall conduct and consider the results of appropriate quantitative comparisons between the current field data obtained from project site monitoring stations and from control stations, and between the current data and baseline data provided by the Contracting Officer. The methods to be used in conducting such comparisons shall include generally accepted statistical methods or other methods selected by the investigator to be those which in his professional

judgment are most appropriate for the purpose of ascertaining degree of compliance with the water quality standards. The method(s) used and results considered shall be described. Reports including during construction sampling results shall be sent to the Contracting Officer and DOH/CWB within 24 hours of completion of laboratory analysis.

- (3) A written final summary report shall be prepared which fully describes the results of sampling and analysis. This report shall, at the least, contain the following information.
- a) An introduction, which includes a statement of purpose and objectives and a brief description of the study design, including a figure or figures to show the project location and the location of the sampling stations, relative to existing features and the construction project site.
  - b) A description of the methods employed in collecting, transporting, and analyzing the water samples.
  - c) Copies of all analysis reports (these may be placed in an appendix of the summary report).
  - d) A discussion summarizing results of the sampling and analysis. Presentation of the results shall include tabular and graphical presentations of the data, including statistical analysis where appropriate.
  - e) Summary conclusions regarding the degree of compliance or noncompliance with State water quality standards (Reference 1), and the probable cause(s) of any violations.

One unbound original of the final written summary report, on standard-size (8.5x11 inch) paper and suitable for photocopying, and 4 bound copies of the report shall be submitted to the Contracting Officer within 30 days of the completion of the analysis of the last water samples taken.

#### 4. SPECIAL CONDITIONS

- a. The Contractor shall designate a specific water quality principal investigator (PI) who can demonstrate training and knowledge in the sampling and analysis methodology which will be used in the conduct of this work. The PI, as well as the sampling and analysis methodology to be used, shall be submitted to the Contracting Officer for approval prior to the initiation of water quality monitoring. The PI and the methodology shall also be acceptable to the State of Hawaii, Department of Health. Any change in the PI must be approved by the Contracting Officer.
- b. The Contractor shall be responsible for the accuracy and validity of the data obtained in accomplishing this work. The Contractor, without additional cost or fee to the Government, shall correct errors or deficiencies in performance.

- c. The Contractor shall make his sample storage and analysis facilities, as well as all records relating to this work, available for inspection by the Contracting Officer upon request.
- d. In the event the Contracting Officer has need for expert written opinion or testimony on data or reports furnished under this contract in conjunction with administrative or judicial proceedings, the Contractor shall furnish experts to provide such testimony, or attend meetings/conferences in this regard. If so required, modification to this contract will be negotiated to include appropriate terms and conditions.
- e. All monitoring work shall be undertaken in accordance with OSHA standards and applicable federal, state and county regulations, and the safety provisions of Department of the Army Manual EM385-1-1.
- f. All materials, transportation, and equipment used in the conduct of this work shall be furnished by the Contractor.
- g. Any conflicts detected in any of the information furnished shall be brought to the attention of the Contracting Officer for resolution before proceeding with the work.
- h. The information developed, gathered and assembled in fulfillment of the contract requirements shall not be released, except to the DOH/CWB, by the Contractor, his consultants or subcontractors, without prior approval by the Contracting Officer. The information shall become the property of the Government and shall, therefore, not be used by the Contractor for any purpose at any time without the written consent of the Contracting Officer.

## 5. REFERENCES

1. Hawaii Administrative Rules, Title 11, Department of Health, Chapter 54, Water Quality Standards
2. Code of Federal Regulations (CFR), Title 40, Chapter 1 (EPA), Part 136 – Guidelines Establishing Test Procedures for the Analysis of Pollutants.
3. American Public Health Association. 1989. Standard Methods for the Examination of Water and Wastewater, 20<sup>th</sup> Edition.
4. State of Hawaii, Department of Health. April 7, 2000. General Monitoring Guideline for Section 401 Water Quality Certification Projects.

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## SECTION 01451

## CONTRACTOR QUALITY CONTROL

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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 E 329 (1995b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

## 1.2 DEFINITION

The Contractor is responsible for quality control and shall establish and maintain an effective quality control program in compliance with the Contract Clause titled "Inspection of Construction." The quality control program shall consist of plans, procedures, and organization necessary to produce an end product that complies with the contract requirements. The program shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control Plan; G.

## 1.4 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

The 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 quality requirements specified in the contract. The project superintendent in this context shall mean the individual with the responsibility for the overall management of the project including quality and production.

## 3.2 QUALITY CONTROL PLAN

## 3.2.1 General

The Contractor shall furnish for review by the Government, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Government will consider an interim plan for the first 90 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.

## 3.2.2 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. Technicians responsible for sampling and testing of concrete shall be certified by the American Concrete Institute (ACI) or the Concrete Technicians Association of Hawaii (CTAH). Proof of certification shall be included in the CQC Plan. Personnel qualifications may be furnished incrementally as the work progresses, but in no case, less than fourteen (14) calendar days before personnel are required on the job.
- 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.
- f. For all proposed QC materials testing laboratories, the contractor must submit a current HED or MTC letter of validation.
- g. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentataion.
- h. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.
- i. Reporting procedures, including proposed reporting formats.
- j. 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.

### 3.2.3 Acceptance of Plan

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

### 3.2.4 Notification of Changes

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

### 3.3 COORDINATION MEETING

After the 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. The CQC Plan shall be submitted for review a minimum of 7 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, 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 General

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure 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 par of the CQC organization. The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer.

The Contractor shall provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Complete records of all letters, material submittals, shop drawing submittals, schedules and all other project documentation shall be promptly furnished to the CQC organization by the Contractor. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

#### 3.4.2 CQC System Manager

The 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 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 requirement for the alternate shall be the same as for the designated CQC Systems Manager.

#### 3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel to assist the CQC System Manager. If it is subsequently determined by the Contracting Officer that the minimum contract CQC requirements are not being met, the Contractor may be required to provide additional staff personnel to the CQC organization at no cost to the Government.

#### 3.4.4 Additional Requirement

The CQC System Manager shall have completed the course entitled "Construction Quality Management For Contractors" within the past 5 years. This course is periodically offered at the General Contractors Association of Hawaii.

#### 3.4.5 Organizational Changes

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

#### 3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 15950A, Heating, Ventilating and Air Conditioning (HVAC) Control Systems; Section 15951A, Direct Digital Control for HVAC; Section 15990A, Testing, Adjusting, and Balancing of HVAC Systems; or Section 15995A, Commissioning of HVAC Systems, are included in the contract, the submittals required by those sections shall be coordinated with Section 01330, Submittal Procedures, to ensure adequate time is allowed for each type of submittal required.

#### 3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of

control shall be conducted by the CQC System Manager for each definable feature of 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.
- 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 7 days 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 7 days 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 that 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 3.7.2.1 Validation Requirements

Any laboratory used by the Contractor for testing aggregate, concrete, bituminous materials, soils, rock, and other construction materials must possess a current validation letter prior to performance of testing by that laboratory. Validation shall be obtained through the Corps of Engineers Materials Testing Center (MTC) in Vicksburg, MS. Validation may be initiated by completing an Inspection Request Form and questionnaire that are available directly from the MTC or from the MTC website, <http://www.wes.army.mil/SL/MTC/inspection.htm>.

The MTC also maintains a website listing validated laboratories at: <http://www.wes.army.mil/SL/MTC/ValStatesTbl.htm>.

#### 3.7.2.2 Exception

The validation letters already obtained from HED in 2001 and 2002 will be considered acceptable proof of validation through its expiration date. Upon expiration, laboratories must be revalidated by the MTC, as required above. The validation status of laboratories in Hawaii may be found at: <http://www.poh.usace.army.mil/Construction/LabValidation/labvalidation.html>.

### 3.7.2.3 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.

### 3.7.2.4 Capability Recheck

If the selected laboratory fails the capability check, the Contractor shall 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 a testing laboratory on the Island of Oahu, State of Hawaii, designated by the Contracting Officer. Coordination for each specific test, exact delivery location, and dates will be made through the Government field office.

## 3.8 COMPLETION INSPECTION

### 3.8.1 Punch-Out Inspection

Near the completion of all work or any increment thereof established by a completion time stated in the Special Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the CQC System Manager shall conduct an inspection of the work and develop a punch list of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and 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 this inspection to verify that the facility is complete and ready to be occupied. The QC Manager shall develop a punch

list of items which do not conform to the contract documents. The Government will review the punch list and add to or correct the items listed. The QC Manager shall incorporate Government comments and provide a Pre-Final Punch List. 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 thereof 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 this 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 prepared using government-provided software, QCS (see Section 01312), 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 should be identified (Preparatory, Initial, Follow-up). List 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 reviewed, with contract reference, by whom, and action taken.
- g. Off-site 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. Unless otherwise directed by the Contracting Officer 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 --

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## SECTION 01780

## CLOSEOUT SUBMITTALS

## PART 1 GENERAL

## 1.1 SUBMITTALS

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

Drawings showing final as-built conditions of the project. The final CADD as-built drawings shall consist of three sets of electronic CADD drawing files in the specified format, one set of original drawings, three sets of prints of the originals, and one set of the Government accepted working as-built drawings.

## SD-03 Product Data

## As-Built Record of Equipment and Materials.

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

## Warranty Management Plan.

One set of the warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. The Contractor shall furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

## Warranty Tags.

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

## Final Clean-Up.

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 maintain 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 daily 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. At the final inspection or upon beneficial occupancy of the facility by the user, whichever comes first. The Contractor shall provide one of the two sets of working as-built drawings to the COR for turnover with the facility. This set will serve as an advance/interim working set for the occupant of the completed facility; until such time that the final as-built drawings are furnished to them. Final as-built drawings shall be prepared after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked drawings 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 is 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 drawings.
- 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 Government accepted working as-built drawings, and adding such additional drawings as may be necessary. These working as-built marked drawings shall be neat, legible and accurate. These drawings are part of the permanent records of this project and shall be returned by the Contractor to the Contracting Officer after final acceptance 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 microstation 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 CADD files and pentable. 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. All changes to the contract drawing files shall be made on the 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.

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 10 days after Government acceptance 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/black-line prints of these drawings for Government review. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days 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 10 days 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 three sets of electronic files on compact disc, read-only memory (CD-ROM), one set of originals, three sets of prints and one set of the Government annotated and accepted 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 acceptance. Failure to submit final as-built drawing files or working as-built marked drawings as specified shall be cause for withholding any payment due the Contractor under this contract. 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 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<br>Section | Manufacturer<br>and Catalog,<br>Model, and | Composition<br>and Size | Where<br>Used |
|-------------|--------------------------|--|-------------------------|---------------|
|-------------|--------------------------|--|-------------------------|---------------|

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA  
Serial Number

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 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 10 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. 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, in accordance with the Contract Clause, WARRANTY OF CONSTRUCTION. 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 in effect throughout the construction period, and during the life of any guaranty required under the Contract Performance Bond, Standard Form 25.

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. After completion of the construction warranty work, charges will be made to the remaining construction warranty funds of expenses which the Government incurred while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government, at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

#### 1.3.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor shall furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, shall be continuously available, and shall be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

#### 1.3.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. The Contractor shall submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframes specified, the Government will perform the work and backcharge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Air Conditioning Systems

- (1) Recreational support.
- (2) Air conditioning leak in part of building, if causing damage.
- (3) Air conditioning system not cooling properly.

## Code 1-Doors

- (1) Overhead doors not operational, causing a security, fire, or safety problem.
- (2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

## Code 3-Doors

- (1) Overhead doors not operational.
- (2) Interior/exterior personnel doors or hardware not functioning properly.

## Code 1-Electrical

- (1) Power failure (entire area or any building operational after 1600 hours).
- (2) Security lights
- (3) Smoke detectors

## Code 2-Electrical

- (1) Power failure (no power to a room or part of building).
- (2) Receptacle and lights (in a room or part of building).

## Code 3-Electrical

Street lights.

## Code 1-Gas

- (1) Leaks and breaks.
- (2) No gas to family housing unit or cantonment area.

## Code 1-Heat

- (1) Area power failure affecting heat.
- (2) Heater in unit not working.

## Code 2-Kitchen Equipment

- (1) Dishwasher not operating properly.
- (2) All other equipment hampering preparation of a meal.

## Code 1-Plumbing

- (1) Hot water heater failure.
- (2) Leaking water supply pipes.

## Code 2-Plumbing

- (1) Flush valves not operating properly.
- (2) Fixture drain, supply line to commode, or any water pipe leaking.
- (3) Commode leaking at base.

## Code 3 -Plumbing

Leaky faucets.

## Code 3-Interior

- (1) Floors damaged.
- (2) Paint chipping or peeling.
- (3) Casework.

Code 1-Roof Leaks

Temporary repairs will be made where major damage to property is occurring.

Code 2-Roof Leaks

Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2-Water (Exterior)

No water to facility.

Code 2-Water (Hot)

No hot water in portion of building listed.

Code 3-All other work not listed above.

1.3.5 Warranty Tags

At the time of installation, each warranted item shall be tagged with a durable, oil and water resistant tag approved by the Contracting Officer. Each tag shall be attached with a copper wire and shall be sprayed with a silicone waterproof coating. The date of acceptance and the QC signature shall remain blank until project is accepted for beneficial occupancy. The tag shall show the following information.

- a. Type of product/material\_\_\_\_\_.
- b. Model number\_\_\_\_\_.
- c. Serial number\_\_\_\_\_.
- d. Contract number\_\_\_\_\_.
- e. Warranty period\_\_\_\_\_from\_\_\_\_\_to\_\_\_\_\_.
- f. Inspector's signature\_\_\_\_\_.
- g. Construction Contractor\_\_\_\_\_.
- Address\_\_\_\_\_.
- Telephone number\_\_\_\_\_.
- h. Warranty contact\_\_\_\_\_.
- Address\_\_\_\_\_.
- Telephone number\_\_\_\_\_.
- i. Warranty response time priority code\_\_\_\_\_.

j. WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

#### 1.4 MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING

Prior to final inspection and transfer of the completed facility; all reports, statements, certificates, and completed checklists for testing, adjusting, balancing, and commissioning of mechanical systems shall be submitted to and approved by the Contracting Officer as specified in applicable technical specification sections.

#### 1.5 OPERATION AND MAINTENANCE MANUALS

Operation manuals and maintenance manuals shall be submitted as specified. Operation manuals and maintenance manuals provided in a common volume shall be clearly differentiated and shall be separately indexed.

#### 1.6 FINAL CLEANING

The premises shall be left broom clean. Stains, foreign substances, and temporary labels shall be removed from surfaces. Carpet and soft surfaces shall be vacuumed. Equipment and fixtures shall be cleaned to a sanitary condition. Filters of operating equipment shall be cleaned. Debris shall be removed from roofs, drainage systems, gutters, and downspouts. Paved areas shall be swept and landscaped areas shall be raked clean. The site shall have waste, surplus materials, and rubbish removed. The project area shall have temporary structures, barricades, project signs, and construction facilities removed. A list of completed clean-up items shall be submitted on the day of final inspection.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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SECTION 01900

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PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

## SECTION 01900

## MISCELLANEOUS PROVISIONS

## 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-01 Preconstruction Submittals

## Progress Chart; G.

The Contractor shall prepare and submit for approval by the Contracting Officer a progress chart in accordance with the CONTRACT CLAUSE entitled "SCHEDULE FOR CONSTRUCTION CONTRACTS" twenty-one (21) calendar days prior to initiation of any work. Any material change to the progress chart must be approved in writing in advance by the Contracting Officer.

Any proposed changes to the approved schedule shall be requested by the Contractor in writing a minimum of fourteen (14) calendar days prior to the proposed start of work.

## SD-02 Shop Drawings

## As-Built Drawings

## SD-06 Test Reports

## Inspection of Existing Conditions

A written report with color photographs noting the condition of the existing facilities at the time of the inspection. One copy of the report including photographs shall be submitted to the Contracting Officer, prior to construction.

## Dive Plan; G.

The Contractor shall submit a Dive Plan in accordance with the requirements of US Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, Section 30, Contract Diving Operations. The Dive Plan shall be submitted a minimum of fourteen (14) calendar days prior to the start of any diving work.

Dust Control; G

Method(s) of dust control.

Condition of Contractor's Operation or Storage Area

The Contractor shall submit to the Contracting Officer photographs and/or videos depicting the condition of the Contractor's Operation or Storage Area.

#### 1.2 CONTRACTOR QUALITY CONTROL

To assure compliance with contract requirements, the Contractor shall establish and maintain quality control for materials and work covered by all sections of the TECHNICAL REQUIREMENTS in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Records shall be maintained for all operations including sampling and testing.

#### 1.3 AS-BUILT DRAWINGS

As-built drawings shall be in accordance with Section 01780 CLOSEOUT SUBMITTALS.

#### 1.4 DUST CONTROL

The amount of dust resulting from the Contractor's work shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as flooding and pollution. Measures shall also be taken for dust control along haul routes and equipment parking areas.

#### 1.5 PROTECTION

The Contractor shall take all necessary precautions to insure that no damages to private or public property will result from his operations. Any such damages shall be repaired or property replaced by the Contractor in accordance with the CONTRACT CLAUSES entitled "PERMITS AND RESPONSIBILITIES" and "PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS", without delay, and at no cost to the Government.

##### 1.5.1 Warning Signs and Barricades

The Contractor shall be responsible for posting warning signs or erecting temporary barricades to provide for safe conduct of work and protection of property.

##### 1.5.2 Protection of Grassed and Landscaped Areas

The Contractor's vehicles shall be restricted to paved roadways and driveways. Vehicles shall not be driven or parked on grassed and/or landscaped areas except when absolutely necessary for the performance of

the work and approved in advance by the Contracting Officer. Grassed or landscaped areas damaged by the Contractor shall be restored to their original condition without delay and at no cost to the Government.

#### 1.5.3 Protection of Trees and Plants

Where necessary, tree branches and plants interfering with the work may be temporarily tied back by the Contractor to permit accomplishment of the work in a convenient manner, so long as they will not be permanently damaged thereby. If this is not feasible, they may be pruned, subject to written approval by the Contracting Officer.

#### 1.6 RESTORATION WORK

Existing conditions or areas damaged or disturbed by the Contractor's operations shall be restored to their original condition, or near original condition as possible, to the satisfaction of the Contracting Officer.

#### 1.7 REMOVAL AND DISPOSAL

The Contractor shall salvage or recycle waste to the maximum extent practical as it relates to the capabilities of local industries. A record of the quantity of salvaged or recycled materials shall be maintained by the Contractor during the length of the project and submitted to the Contracting Officer at acceptance of the project. Quantities shall be recorded in the unit of measure of the industry. Reuse of materials on the site shall be considered a form of recycling. An example of such reuse would be the use of acceptable excavated materials as breakwater core material.

##### 1.7.1 Rubbish and Debris

Rubbish and debris shall be removed from Government-controlled property daily unless otherwise directed, so as not to allow accumulation. Materials that cannot be removed daily shall be stored in areas designated by the Contracting Officer.

#### 1.8 INTERFERENCE WITH GOVERNMENT OPERATIONS

The Contractor shall establish work procedures and methods to prevent interference with existing operations within or adjacent to the construction areas. Harbor operations shall take precedence over construction activities. The existing barge wharf shall be kept clear for cargo and fuel barge use, as well as possible other vessel calls, during the entire contract period. The Contractor may utilize the wharf to load/unload material and equipment, except for periods of scheduled barge service and other scheduled vessel calls. Procedures and methods shall also provide for safe conduct of work and protection of property which is to remain undisturbed.

##### 1.8.1 Coordination

The Contractor shall coordinate all work with the Contracting Officer to minimize interruption and inconvenience to the harbor users or to the

Government. Scheduling and programming of work will be established during the pre-construction conference. The Contractor shall coordinate wharf use with the State of Hawaii, Department of Transportation, Harbors Division.

#### 1.8.2 Utilities and Facilities

All utilities and facilities within the area shall remain operable and shall not be affected by the Contractor's work, unless otherwise approved in writing in advance by the Contracting Officer.

#### 1.9 CONTRACTOR'S OPERATIONS OR STORAGE AREA

An open operations or storage area will be made available as shown on the drawings, the exact location and boundaries of which will be determined by the Government. The Contractor shall construct a boundary fence to completely enclose the Work and Storage Area. The Contractor shall be responsible for the security necessary for protection of his equipment and materials, and shall maintain the area free of debris. No rusty or unsightly materials shall be used for providing the secure measure and such measure shall be erected in a workmanlike manner. Before any construction commences on establishing the operation/storage area, Contractor shall take photographs and/or videos of the site in order to establish the original conditions of the site. A duplicate set shall be made and submitted to the Government for its files. Upon completion and prior to the final acceptance of the contract work, the Contractor shall restore the area to its original condition.

#### 1.10 GOVERNMENT PROJECT OFFICE

The Contractor shall provide, for use by Government supervisory and inspection personnel, a job-site office space with a floor area not less than 150 square feet. This office space may be within the Contractor's project office building if adjacent to the job site and if separated by a solid partition; otherwise a separate facility, adjacent to the job site, shall be provided with windows and screens, electricity, including a minimum of four (4) wall outlets and two (2) ceiling lights, a telephone, a desk with drawers, a layout table, two (2) chairs, a legal size five-drawer locking file cabinet, and a fire extinguisher. Potable drinking water and temporary toilet facilities shall be made available to Government personnel, not necessarily within the project office, but in close proximity thereof. The cost of utilities including telephone, and operation and maintenance costs of the Government project office shall be borne by the Contractor. The Government will be responsible for its long-distance calls. Upon completion of the project, the project office and furnishings shall be removed and disposed of by the Contractor. In addition to the project office, the Contractor shall provide a secured, totally enclosed, and weather protected storage area. Minimum dimension of storage area shall be 100 square feet. Requirements for storage area shall also include a \$150,000.00 liability insurance policy to cover any loss to contents stored within the storage area.

## 1.11 GOVERNMENT TRANSPORTATION

## 1.11.1 Vehicle

Contractor shall furnish a 4-wheel drive vehicle to be used exclusively for Government personnel during entire contract performance period. Maintenance of vehicle shall be the responsibility of the Contractor. The Government will be responsible for fuel.

## 1.11.2 Boat

Contractor shall furnish a boat and qualified boat operator to be used exclusively for Government personnel a minimum of 12 hours per week for the entire contract performance period. Maintenance and fueling of boat shall be the responsibility of the Contractor.

## 1.12 GOVERNMENT DIVING SUPPORT

The Contractor shall provide support for Government construction inspection diving activities. Support shall include a dive platform adjacent to the area to be inspected and use of the Contractor's approved construction diving air compressor system.

## 1.13 INSPECTION

## 1.13.1 Preliminary Inspection of Existing Conditions

A minimum of fourteen (14) calendar days prior to actual construction, the Contractor shall arrange to have the Contractor's Quality Control representative meet with the authorized Contracting Officer's representative to inspect the existing facilities, and all other pertinent items within the construction area. The inspection shall be conducted to establish the existing conditions of the facilities, so that it may subsequently be determined whether any damages to the facilities are the result of the construction activity.

## 1.13.2 Final Inspection and Acceptance

The Contractor shall give the Contracting Officer, a minimum of fourteen (14) calendar days advance notice prior to final inspection for the project works for acceptance by the Contracting Officer. All deficiencies found or final inspection shall be promptly and satisfactorily corrected by the Contractor upon notification by the Contracting Officer.

## 1.14 WORKING DIRECTIVES

## 1.14.1 Working Hours

All work shall be performed between the hours of 0700 to 1700 HST, Monday through Saturday. No work shall be accomplished on Sundays and all State of Hawaii and federal holidays without written permission from the Contracting Officer. Such written permission shall be available at the job

site at all times during construction.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

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DIVISION 02 - SITE CONSTRUCTION

SECTION 02215

GEOTEXTILE

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- 1.2 GENERAL
- 1.3 SUBMITTALS
- 1.4 SHIPMENT AND STORAGE

PART 2 PRODUCTS

- 2.1 GEOTEXTILE FILTER FABRIC
  - 2.1.1 Geotextile
  - 2.1.2 Seams

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- 3.1 INSTALLATION OF THE GEOTEXTILE

-- End of Section Table of Contents --

## SECTION 02215

## GEOTEXTILE

## 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 3786 | (1987) Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting |
| ASTM D 4354 | (1999) Practice for Sampling of Geosynthetics for Testing                                    |
| ASTM D 4439 | (2002) Terminology for Geosynthetics   |
| ASTM D 4491 | (1989) Water Permeability of Geotextiles by Permittivity                                     |
| ASTM D 4533 | (1985, R1990) Trapezoid Tearing Strength of Geotextiles                                      |
| ASTM D 4632 | (1996) Test Method for Grab Breaking Load and Elongation of Geotextiles                      |
| ASTM D 4751 | (1987) Determining Apparent Opening Size of a Geotextile                                     |
| ASTM D 4833 | (1988) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products          |

## 1.2 GENERAL

The work provided for herein consists of furnishing all plant, labor, material, and equipment and performing all operations required for furnishing, hauling, and placing the geotextile, complete, as specified herein and shown on the contract drawings, and maintaining the geotextile until placement of the overlying material is completed and accepted.

## 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-04 Samples

##### Geotextile

If requested by the Contracting Officer, the Contractor shall provide to the Government geotextile samples for testing to determine compliance with any or all of the requirements in this specification. Sampling of geotextile shall be in accordance with ASTM D 4354. When samples are to be provided, they shall be submitted a minimum of 60 days prior to the beginning of installation of the same geotextile. All samples provided shall be from the same production lot as, and shall be the full manufactured width of will be supplied for the contract the geotextile by at least 10 feet long, except that samples for seam strength may be a full width samples folded over and the edges stitched for a length of at least 5 feet. Samples submitted for testing shall be identified by manufacturers lot designation.

#### SD-07 Certificates

##### Mill Certificate or Affidavit

The Contractor shall furnish the Contracting Officer, in duplicate, a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the geotextile.

The mill certificate or affidavit shall attest that the geotextile meets the chemical physical and manufacturing requirements stated in this specification.

#### 1.4 SHIPMENT AND STORAGE

During all periods of shipment and storage, the geotextile shall be protected from direct sunlight, ultra-violet rays, temperature greater than 140 degrees Fahrenheit, mud, dirt, dust and debris. To the extent possible, the fabric shall be maintained wrapped in a heavy duty protective covering.

#### PART 2 PRODUCTS

##### 2.1 GEOTEXTILE FILTER FABRIC

###### 2.1.1 Geotextile

The geotextile shall be a woven or non-woven pervious sheet of plastic yarn as defined by ASTM D 4439. The geotextile shall meet the physical requirements listed in Table No. 1 of the specifications. Fibers used in the manufacturer of geotextiles and the threads used in joining geotextiles, shall consist of long chain synthetic polymers, composed of at least 95% by weight polyolefins or polyesters. They shall be formed into a stable network such that the filament or yarns retain their dimensional

stability relative to each other, including selvages and shall contain stabilizers and inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultra-violet and heat exposure. Woven slit film geotextiles (i.e., geotextiles made from yarns of a flat, tape-like character) will not be allowed. The edges of the geotextile shall be finished to prevent the outer fiber from pulling away from the geotextile.

#### 2.1.2 Seams

The seams of the geotextile shall be sewn with thread of a material meeting the chemical requirements given above from geotextile yarn or shall be bonded by cementing or by heat. The sheets of geotextile shall be attached at the factory or another approved location, if necessary, to form sections not less than 36 feet wide. Seams shall be tested in accordance with method ASTM D 4632, using 1-inch square jaws and 12 inches per minute constant rate of traverse. The strengths shall be not less than 90 percent of the required tensile strength (Table 1) of the unaged geotextile in any principal direction.

TABLE NO. 1 - PHYSICAL REQUIREMENTS FOR  
GEOTEXTILE FILTER FABRIC

| <u>Physical Property</u>                        | <u>Test Procedure</u> | <u>Acceptable Values</u> ++  |   |
|---|-----------------------|--|---|
|   |                       | <u>Woven</u>   | <u>Non-Woven</u>  |
| Grab Tensile Strength (unaged geotextile)+      | ASTM D 4632           | 315 pound minimum in any principal direction   | 205 pound minimum in any principal direction  |
| Grab Elongation (unaged geotextile)+            | ASTM D 4632           | 20 percent minimum in any principal direction  | 20 percent minimum in any principal direction   |
| Puncture Strength (unaged geotextile)+          | ASTM D 4833           | 115 pounds per square inch minimum   | 80 pounds per square inch minimum   |
| Apparent Opening Size (AOS)                     | ASTM D 4751           | No finer than the U.S. Standard Sieve No. 100 and no coarser than the U.S. Standard Sieve No. 50 | No finer than the U.S. Standard Sieve No. 70 and no coarser than the U.S. Standard Sieve No. 30 |
| Trapezoidal Tear Strength & Principal Direction | ASTM D 4533           | 115 lbs minimum in any principal direction   | 80 lbs minimum in any principal direction   |

TABLE NO. 1 - PHYSICAL REQUIREMENTS FOR  
GEOTEXTILE FILTER FABRIC

|                                 |             |  |  |
|---------------------------------|-------------|--|--|
| Mullen Burst Strength           | ASTM D 3786 | 510 lbs<br>sq inch   | 255 lbs<br>sq inch   |
| Geotextile<br>Permeability (kg) | ASTM D 4491 | The<br>permeability<br>of the<br>geotextile<br>shall be<br>greater than<br>0.10 cm per<br>second | The<br>permeability<br>of the<br>geotextile<br>shall be<br>greater than<br>0.10 cm per<br>second |
| Sewn Seam Strength              | ASTM D 4632 | 270 lbs<br>minimum   | 185 lbs<br>minimum   |

+ Unaged geotextile is defined as geotextile in the condition received from the manufacturer or distributor.

++ All numerical values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the minimum in the table).

### PART 3 EXECUTION

#### 3.1 INSTALLATION OF THE GEOTEXTILE

The geotextile shall be placed in the manner and at the locations shown on the drawings. At the time of installation, the geotextile shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation or storage. The surface to receive the geotextile shall be prepared to a relatively smooth condition free of obstructions, depressions, debris and soft or low density pockets of material. Erosion features such as rills, gullies, etc., must be graded out of the surface before geotextile placement. The geotextile shall be placed with the long dimension parallel to the shoreline and laid smooth and free of tension, stress, folds, wrinkles, or creases. The strips shall be placed to provide a minimum width of 36 inches of overlap for each joint. Temporary pinning of the textile to help hold it in place until the overlying material is placed shall be allowed. The temporary pins shall be removed as the overlying material is placed to relieve high tensile stress which may occur during placement of material on the geotextile. The placement procedure requires that the length of the geotextile be 15 percent greater than the slope length. The Contractor shall adjust the actual length of the geotextile used based on initial installation experience. The geotextile shall be protected at all times during construction from contamination by surface runoff and any geotextile so contaminated shall be removed and replaced with uncontaminated geotextile. Any damage to the geotextile during its installation or during placement of overlying materials shall be replaced by the Contractor at no cost to the Government. The work shall be scheduled so that the covering of the

geotextile with a layer of the specified material is accomplished within one (1) day after placement of the geotextile. Failure to comply shall require replacement of geotextile. The geotextile shall be protected from damage prior to and during the placement of overlying materials. This may be accomplished by limiting the height of drop to less than 1 foot, by placing a cushioning layer of sand or gravel on top of the geotextile before placing the material, or other methods deemed necessary. Before placement of overlying materials, the Contractor shall demonstrate that the placement technique will prevent damage to the geotextile. In no case shall any type of equipment be allowed on the unprotected geotextile.

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SECTION 02390

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## SECTION 02390

## PLACING CORE-LOC ARMOR UNITS

## 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-04 Samples

## Physical Model; G

At the same time as the submittal of the Work Plan for the Test Section, the Contractor shall submit a Physical Scaled Model of the completed breakwater. The model shall be constructed with substantial material. The Model shall have at least one layer of simulated underlayer stone. The Crest and toe details shall be modeled as shown on the Drawings. The plans for the Model shall be submitted to the Contracting Officer and CLS for approval prior to construction of the Model. The Contracting Officer will supply 800 scaled Core-Loc units for the Model. The units supplied will have C dimension of 2.125 inches and be formed from dense plastic.

The approved model shall be installed in the Contractors facilities on site, and be used in training and verification of Core-Loc placement. Upon completion of construction the physical model shall be delivered to the Contracting Officer and become the property of the Government.

## SD-05 Design Data

## Equipment, Method of Transportation and Placement - Execution Proposal; G

The Contractor shall provide a detailed plan (Execution Proposal) describing the equipment and techniques he intends to use in shaping the breakwater and placing the Core-Loc units as shown on the drawings. This shall include methods and equipment intended to lift, set in place, and reposition the Core-Loc units.

If units are to be cast off site, equipment and methods intended for transporting Core-Loc units to the Kaumalapau Harbor staging area or project site shall also be submitted to the Contracting Officer. The proposal shall have been reviewed by the Core-Loc Specialist (CLS) in advance of the submittal, and the CLS comments

shall accompany the submittal. Submittal shall include a review and approval certification statement from the CLS. This proposal shall be submitted to the Contracting Officer for approval, at least 30 days prior to the commencement of Mobilization. Mobilization may not commence until the Contracting Officer approves the submittal. Approval will be based upon the Contractor demonstrating a well planned, feasible and technically sound approach to the project with equipment and staff that are possible to accomplish the work. Approval does not constitute any acknowledgement or representation by the Government that the Contractor's proposal will be sufficient to accomplish the work. The Contracting Officer's approval of the Contractor's proposal shall not relieve the Contractor of the responsibility for proper execution of the works. If the Contractor elects to change the plan, a revised proposal, reviewed and approved by the CLS, shall be submitted to the Contracting Officer ten (10) days in advance of any such change.

#### Grid Diagram; G

The Contractor shall develop a Grid Diagram, based upon the Drawings, showing placement of each individual unit. The diagram shall be designed based on a Packing Density of 0.57, and conform to the recommendations of the CLS. The Grid Diagram will be adjusted as necessary, by the results of the required test section and or the results of excavation of the toe trench or other changes as authorized by the COR. The Contractor shall have computer, plotting and software capacity on site to adjust the Grid Diagram, if required, as well as update the placing diagram for the weekly report. The Contractor shall have email services and internet access at the site for exchanging data. The Grid Diagram shall be submitted to the Contracting Officer 30 days prior to placement of any units. Submittal shall include a review and approval certification statement from the CLS. If modifications are required, the Contracting Officer shall have ten (10) days to review and approve such submittals prior to any placement of Core-Loc.

#### SD-06 Test Reports

##### Test Sections; G

The Contractor shall submit a work plan with drawings showing the method of construction for the required Test Section. Submittal shall include a review and approval certification statement from the CLS.

#### SD-09 Manufacturer's Field Reports

##### Weekly Report

The Contractor shall submit, weekly, the list of Core-Loc units to be placed in the coming week with their fabrication dates. The report shall also contain the number of units placed to date

compared to the theoretical number shown on the Grid Diagram for the same area, and a plan view and detailed digital listing of the X, Y positions of each Core-Loc placed to date. Each weekly report shall have a provision for comments by the CLS, and shall be reviewed by the CLS prior to submittal.

## 1.2 GENERAL DESCRIPTION OF WORK

The work consists of furnishing all plant, labor, equipment and material required for the placement of the Core-Loc units as shown on the plans.

## PART 2 PRODUCTS

### 2.1 CORE-LOCS

Manufacturing of Core-Loc is specified under Section 03310 CONCRETE FOR CORE-LOC, Section 03110 FORMWORK FOR CONCRETE, CORE-LOC.

### 2.2 CORE-LOC SPECIALIST (CLS)

#### 2.2.1 Scope

The Contractor shall retain a Core-Loc Specialist to advise on the preparation of the Execution proposal, Test Section, revisions that may become necessary to the Grid Diagram, Quality Control and training of personnel. The CLS shall undertake a scope of work to assist the Contractor in meeting the requirements of this section. The CLS shall be on-site at a minimum as follows:

- a. During the initial casting trials
- b. During the test section
- c. During placement of the first 50 units on the main trunk of the structure
- d. During the rock toe trench development and tremie operation
- e. During placement of the first 100 units on the head
- f. During placement of the first crest units
- g. At a minimum of four (4) additional times as deemed necessary by the COR to meet the requirements of this section

#### 2.2.2 Qualifications

The CLS shall have on its staff as a minimum:

- a. One (1) Registered Professional Engineer in the United States or equivalent with experience on a minimum of two (2) successfully completed Core-Loc projects totaling not less than 5,000 cubic meters of concrete constructed as Core-Loc.**

- b. One (1) marine construction specialist with a minimum of 20 years experience in marine construction particularly rock structures

### 2.2.3 Reporting

The CLS shall prepare written reports of all observations and recommendations to the Contractor with respect to the requirements of this section and general practice using Core-Loc units. Reports shall be copied directly to the Contracting Officer and COR. The COR shall be informed of each site visit performed by the CLS.

## PART 3 EXECUTION

### 3.1 HANDLING AND TRANSPORTING CORE-LOC UNITS

The Contractor shall exercise extreme caution in the loading, transportation, and unloading of new Core-Loc units, whether in the designated work area or in transportation of the Core-Loc units from the casting/storage location to the designated placement area. Core-Loc units shall not be handled until the concrete has reached a compressive strength of 4,000 psi as determined by concrete test cylinder breaks. New Core-Loc units shall not be transported for placement until the concrete reaches the specified 28-day flexural strength indicated in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. A suitable cradle shall be used in transportation to avoid movement of the Core-Loc units in transit. Equipment and methods used for handling and transporting of Core-Loc shall be designed to avoid damage to the units. Use of lifting eyes or any other insertions cast in the new Core-Loc units will not be permitted. New Core-Loc units that have any fractures at any time during casting, curing, handling, transporting, or placement, prior to final acceptance in place will be considered defective and will be removed and replaced at no cost to the government. Disposal of defective Core-Loc units is the responsibility of the Contractor.

#### 3.1.1 Delivery

Deliver Core-Loc units to the project site in a manner to preclude damage to the concrete units. During transport to the site, units shall be secured to avoid rocking and unit to unit contact.

#### 3.1.2 Storage

Store Core-Loc units at the plant or on the project site to avoid cracking, distortion, staining or other physical damage.

### 3.2 PLACEMENT OF CORE-LOC

#### 3.2.1 General

The Contractor shall be responsible for the control of his operations in accordance with Section 01451 CONTRACTOR QUALITY CONTROL to assure that Core-Loc units are placed in accordance with the contract requirements. No Core-Loc unit shall be placed on the structure until the method of

placement has been approved by the Contracting Officer's Representative and the CLS. Improperly placed Core-Loc units shall be relocated, as required and at the direction of the Contracting Officer, at no additional cost to the Government. Replacement of the damaged Core-Loc shall be the responsibility of the Contractor. Any given section of Core-Loc repair shall be built from the toe up to the crest. Core-Loc elements shall not be placed on the structure until the Underlayer Stone foundation has been properly installed, and accepted.

### 3.2.2 Test Section Placement

The Contractor shall build a test section of the Core-Loc placement on land. The section shall include the Toe Trench and Toe Buttress. The Contractor shall carry out a full handling test to ensure the placing crew has fully understood the principle of unit attitude variation. This test will help to determine appropriate lengths of sling sets to be used. The CLS must be present on site for these tests. The section shall be graded on a 1.5 to 1 slope and constructed in the method depicted on the drawings. It is anticipated the Test Section will involve the placement and replacement of approximately 20 to 25 Core-Loc units and be approximately 75 feet long.

The test section is intended to establish an in-the-field standard built to the Grid Diagram. The test section will demonstrate the Contractor's ability to place the Core-Loc units in the Grid Pattern to achieve the appropriate interlocking and packing density. Based on the test section, the Contractor shall make whatever modifications are necessary to the placement procedure, equipment, or techniques to reach the placement requirements.

The Contractor will construct the test section to represent the neat lines and grades shown on the drawings using stone and Core-Loc units from the stockpiles that will ultimately be used for construction. The Contractor shall notify the COR at least one week before the start of construction. The Contractor shall create test section drawings depicting the test, layout the work, provide survey control, construction surveys, and verification surveys in accordance with the Specifications and to the dimensions shown on the Drawings. The Test Section Core-Loc grid pattern shall be predetermined with the assistance of the CLS, and the units placed using the GPS positioning methodology as outlined in paragraph Position Control and Data Collection. The Contractor shall make every effort to place the core, underlayer, and toe buttress and toe backfill to the lines, grades and thicknesses shown on the Drawings. The Contractor shall account for the approximate stone tonnage placed in the test section. The Contractor shall make every effort to place the Core-Loc units in the test section in the Grid Pattern approved by the Contracting Officer. If the units have not been placed according to the specified Packing Density, or sufficient interlocking is not achieved, the Contracting Officer will reject the test section and another test section shall be built at no additional cost to the Government.

The Contracting Officer's approval of the Contractor's test section shall not relieve the Contractor of the responsibility for proper execution of the works, including but not limited, to placing of the Core-Loc units.

The Test Section shall remain in place until 50% of the Core-Loc units have been placed on the breakwater.

### 3.2.3 Placement of Core-Loc Toe Units

Core-Loc Toe units may be placed in a random attitude in the locations shown on the Grid Diagram. This pattern shall be verified in the test section. The maximum distance between adjacent units shall be as shown on the Grid Pattern. Toe Core-Loc Units shall be placed in a single layer and lowered to rest before being released. Toe Core-Loc Units shall rest firmly on the prepared Underlayer Stone grade. Divers shall check the final placement of all units for correctness and unit keying. The second row of Core-Loc units shall also be placed with the toe units, forming a two row toe in advance of the placement of units on the remainder of the slope. Special placement shall be made along the toe in the excavated rock trench. The trench shall be excavated into competent rock as shown on the drawings. The trench shall be backfilled with Tremie concrete meeting the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The Contractor shall provide a detailed placing plan for this area, approved by the CLS, for approval by the Contracting Officer. The Contractor may build a temporary breakwater to enable toe construction.

### 3.2.4 Placement of Core-Loc Slope and Crest Units

Core-Loc slope and crest units shall be placed in a single Random Packed layer. Every slope and crest Core-Loc unit shall be resting on the prepared Underlayer Stone surface. The Contractor shall insure that the specified Packing Density of 9.26 core-Loc units per 1000 square feet of slope surface area is strictly maintained during construction to assure proper interlocking. The Packing Density shall be verified for all Grid Diagrams by the CLS, and the calculations submitted to the Contracting Officer. The Core-Loc units shall be placed at the locations shown on the approved Grid Diagram. The actual location of the centroid of each unit shall be within 15 inches of the theoretical location shown on the Grid Diagram. Units shall be placed randomly, with adjacent units having different attitudes. No two units in the same horizontal row should be in contact. Each unit must be keyed into two units on the row below. Less than one-third of the units shall have an H-member parallel to the slope. Units with this attitude must be distributed throughout the slope and shall not be found in groups. Divers shall check the final placement of all units for correctness and unit keying. No unit shall be released into position until the optimum position is verified by the diver. (Note - All diving shall be done in accordance with the requirements of EM 385-1-1, U.S. Army Corps of Engineers, Safety and Health Requirements Manual.)

### 3.2.5 Position Control and Data Collection

The Core-Loc placing crane shall be equipped with a real time differential GPS equipment to determine and confirm the placement of the individual units. The system shall be equipped such that each days planned work can be entered into the data collector, and a targeting system used to guide the crane boom to the theoretical position for for each unit placed. Planning for each day shall consider satellite availability and operational windows necessary to achieve real time accuracy of better than +/-0.5 feet

at a one second refresh rate and a stationary accuracy of better than +/- 0.05 feet. As a unit is lifted to be placed into the work, the unique number of the Core-Loc assigned at casting shall be associated with the unique placement position. Once the unit is lowered into its final position, but prior to release of the lifting cable, the actual coordinates shall be recorded into the data collection system. At the end of each work day, that day's placing information shall be electronically recorded, and printed in hard copy as a backup. For each weekly report, the data shall be merged into an Excel spreadsheet that shows the grid location number, the theoretical coordinates, the actual coordinates, the deviation, the unique Core-Loc number placed in that position, the date of the Core-Loc casting, the date of placement, and the age at placement. The reporting requirements shall be developed by the CLS for the Contractor. The positioning and data recording system shall be approved by the Contracting Officer.

### 3.3 INSPECTION

The COR will check the Contractor's daily record of work. However, the presence of the COR shall not relieve the Contractor of the responsibility for the proper execution of the work. The Contractor will be required, without additional compensation, to furnish the COR with all necessary labor and equipment, including boats and diving equipment that may be necessary for inspecting the work.

As soon as practical after the completion of the Core-Loc unit placement, the work will be examined by the COR and the Contractor. During these examinations, the Contractor shall perform an alignment survey to be used to prepare a final drawing showing all dimensions, elevations, and cross sections of the "as-built" conditions of the breakwater. The Contractor will be required to remove excess materials or place additional materials, as directed by the COR, in order to comply with the Contract Documents. Sections will be examined thoroughly by soundings and topographical surveys as specified in Section 02486 STONE PLACEMENT AND CONSTRUCTION.

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## SECTION 02485

## STONE MATERIALS

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 127 (1988; R 1993) Specific Gravity and Absorption of Coarse Aggregate

## 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-02 Shop Drawings

Selection of borrow sources and detailed plans for quarry operations; G.

## SD-04 Samples

Samples of stone; G.

## 1.3 SOURCES OF STONE

Stone may be quarried or obtained from other sources as approved. All stones shall meet the requirements specified herein. Development of stone source and improvements of any access to the site shall be at the Contractor's responsibility and expense. The sources from which the Contractor proposes to obtain the material shall be selected well in advance of the time when the stones will be needed in the work. Approval of a source or sources of stone shall not be construed as approval of all material from that source or sources. The right is reserved to reject materials produced from localized areas, zones, or strata when such materials are unsuitable as determined by the Contracting Officer.

#### 1.4 SAMPLING AND FIELD TESTING OF STONE

##### 1.4.1 Sampling

Samples of stones from sources proposed by the Contractor shall be taken at locations designated by the Contracting Officer. The samples will be used as standards of the rock quality to be furnished by the Contractor. Duplicate sets of samples shall be taken, numbered, referenced and identified. One set shall remain at the Contractor's quarry (source) for later comparison with actual pieces of rock to be furnished for the project. The second set of samples shall be delivered, at the Contractor's expense, to an independent testing laboratory on Oahu to be designated by the Contracting Officer, no later than 30 days in advance of the time when placing of stone is expected to begin. Sampling, identification, preparation and transportation of samples shall be in accordance with ASTM D 75.

##### 1.4.2 Field Testing of Stones

Prior to removal from the source, the Contractor shall field test representative rock pieces selected by the Contracting Officer by dropping from a vertical height of 10 feet on a solid rock surface or on a bed of comparable size rock proposed for the project. Broken, cracked, or otherwise damaged stone found by dropping will not be acceptable and shall be disposed of by the Contractor at his expense.

#### 1.5 QUARRY AND BORROW OPERATIONS

##### 1.5.1 Quarry and Borrow Areas

The Contractor shall be responsible for obtaining all rights-of-way required in connection with his borrowing and quarrying operations. The Contractor shall obtain from the owners the right to procure materials, pay all charges involved, and bear all expenses of developing the sources, including rights-of-way for hauling. Necessary plant, labor, and materials for clearing, scraping, disposal, loading, hauling, and all other operations required to obtain the stones and borrow materials shall be provided by the Contractor at no additional cost to the Government. The Contractor shall, at his own expense, maintain all haul roads required for access from the quarry areas to the site of work and provide additional haul roads as required. The Contractor shall maintain necessary warning signs, and place warning lights between sundown and sunup along roads subject to public traffic. The Contractor shall be responsible for trespassing upon or injury to private lands adjacent to right-of-way resulting from his actions or those of his employees.

##### 1.5.2 Operation Requirements

The Contractor shall submit to the Contracting Officer, within 15 days after receipt of notice to proceed and 30 days before any work in the borrow and quarry areas, plan for the Contractor's borrow and quarry operations. Plans of operation shall include the following:

- a. Selection of quarry-borrow sources.

b. Detailed plans for quarry operation including:

(1) Maps, descriptions, and plans of proposed road to quarry and borrow sources.

(2) Method(s) of excavation.

(3) Plans for drainage and restoration after completion of work.  
All operations shall be subject to the approval of the Contracting Officer.

## PART 2 PRODUCTS

### 2.1 STONE

#### 2.1.1 General

All stones shall be dense, durable, and of a suitable quality to ensure permanence in the structure and in the climate in which it is to be used. Stones shall be free from cracks, seams, and other defects that would tend to increase unduly its deterioration from natural causes.

#### 2.1.2 Physical Requirements

Physical properties of the stones shall conform to the following requirements when tested in accordance with the respective ASTM Standards. Acceptance tests shall be performed on individual stone piece 10 to 30 pounds in weight in lieu of the sizes specified in ASTM C 127. Test apparatus shall be improvised to accommodate the above stone sizes. All acceptance tests shall be made by and at the expense of the Contractor. Samples of stone shall be furnished as specified in paragraph SAMPLING AND FIELD TESTING OF STONE.

|            |  |
|------------|--|
| ASTM C 127 | Bulk Specific Gravity (Saturated Surface Dry) Not Less than 2.5. |
|------------|--|

|            |                                       |
|------------|---------------------------------------|
| ASTM C 127 | Absorption - Not More than 4 percent. |
|------------|---------------------------------------|

## PART 3 EXECUTION

### 3.1 UNDERLAYER STONE

#### 3.1.1 General

Underlayer stone shall be of the sizes shown on the drawings and shall conform to the requirements of paragraph entitled "STONE".

#### 3.1.2 Placement

Underlayer stones shall be placed to the lines, grades, and thicknesses indicated. Underlayer stone shall be placed to its full layer thickness in one operation and in such a manner to avoid displacing the underlying material. A tolerance of plus or minus 3 inches will be permitted. The

desired distribution of sizes of stones throughout the mass may be obtained by selective loading, controlled dumping of successive loads during placing or by a combination of these methods. Placing stones into chutes or by similar methods likely to cause segregation of the various sizes will not be permitted. Placement shall be accomplished without displacement to the underlying material. The placement of underlayer stone shall proceed as soon as practicable after placing the geotextile filter fabric to prevent wave action from displacing the geotextile filter fabric.

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## SECTION 02486

## STONE PLACEMENT AND CONSTRUCTION

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ENGINEER MANUAL (EM)

EM 1110-2-1003 (1994) Hydrographic Surveying

## 1.2 SUBMITTALS

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

## SD-01 Preconstruction Submittals

## Equipment Data and Execution Plan; G

Prior to starting work, a list of all equipment, tools, machines, including their sizes, capacities and operating speeds, to be used in the performance of the work shall be submitted. All the plant shall be maintained in satisfactory working condition at all times. The Contractor shall provide a detailed proposal describing the equipment and techniques he intends to use in placing the stone as shown on the drawings. This shall include methods and equipment intended to transport, excavate, lift, set in place, and reposition stone as require. This proposal shall be submitted to the Contracting Officer for approval in conjunction with the Execution Plan specified in Section 02390, Placing of Core-Loc.

## Check Survey Data; G

A copy of the record of each check survey shall be submitted within one (1) workday after the survey.

## Work Plan

The Contractor shall provide a Work Plan detailing the procedures proposed for the accomplishment of the work. The

procedures shall provide for safe conduct of the work, use of proper equipment per type of material for excavation, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and disconnection of utilities. The Work Plan shall include the details of the intended stone placement approach and sequencing of the work. The construction sequence shall provide for protection of the harbor to at least the same level of protection existing at the harbor prior to commencement of construction. Excavation and shaping of the existing rubblemound shall be done in such a manner that wave protection afforded by the existing structure is maintained.

#### Recycling Plan

The Contractor shall provide a recycling plan prior to commencement of work. The recycling plan will describe the operation including the type of equipment used, method of operation, types of existing materials removed for processing, and the processing location. The plan will also include but is not limited to the following:

- a. Material Processing.
- b. Material Handling.
- c. Material Storage, Pre- and Post-Processing.

### 1.3 MATERIALS

The work covered by this section consists of furnishing all plant, labor, and equipment for performing all operations in connection with the placement of underlayer stone, toe bedding stone, buttress toe stone, core stone and toe trench backfill for the breakwater reconstruction as shown on the drawings and in accordance with these specifications and conditions of the contract. Also, included is all excavation and grading necessary to meet the lines and grades shown on the drawings.

#### 1.3.1 Core Stone

The Core Stone shall be excavated and graded or placed to the lines and grades shown on the drawings.

#### 1.3.2 Toe Bedding

The toe bedding stone, placed over geotextile filter fabric, shall be used when the new breakwater toe is constructed on sand and sediment native bottom material.

#### 1.3.3 Underlayer and Toe Buttress Stone

Underlayer and Toe Buttress Stone shall be furnished and placed on the prepared core stone and as toe buttress stone in the locations shown on the drawings.

#### 1.3.4 Toe Trench Backfill

The Toe Trench Backfill shall be placed in the toe trench to the lines and grades shown on the drawings.

### PART 2 PRODUCTS

#### 2.1 STONE MATERIALS

All stone necessary to complete the project shall be provided by the Contractor as specified in Section 02485 STONE MATERIALS.

### PART 3 EXECUTION

#### 3.1 GENERAL

The Contractor shall place stone materials for the structure as shown on the drawings. All materials shall be placed uniformly within the slope lines and grades indicated on the drawings or as directed by the Contracting Officer's Representative. Material shall be placed by equipment capable of handling materials of the size specified.

#### 3.2 DEBRIS

Any timbers, unsatisfactory material and debris within the area of construction shall be removed except as otherwise directed by the Contracting Officer's Representative, and upon removal shall become the property of the Contractor. All materials shall be properly disposed of in conformance with the requirements of the Section 01430 ENVIRONMENTAL PROTECTION, including any applicable local requirements. There will be no additional payments for materials to be disposed.

#### 3.3 TURBIDITY CONTROLS

The Contractor shall control the placement of stone materials in a manner that minimizes the turbidity of ocean waters. The Contractors' operations shall comply with Section 01430 ENVIRONMENTAL PROTECTION.

#### 3.4 EXCAVATION

##### 3.4.1 General

General excavation shall consist of removal of materials encountered in preparing the foundations to the lines, grades, and elevations indicated on the drawings as specified herein, or as directed by the Contracting Officer. Care shall be exercised by the Contractor not to excavate below the grades shown on the drawings or as directed by the Contracting Officer.

Grading shall be in conformity with the typical sections shown on the drawings and the tolerances specified in Paragraph GRADE TOLERANCES. Any excessive excavation, as determined by the Contracting Officer, due to the fault or negligence of the Contractor, shall be backfilled with specified material to grades shown on the drawings. Corrective measures shall be done by and at the expense of the Contractor. No separate measurements or

payment shall be made for excavation.

#### 3.4.2 General Excavation

Excavation shall consist of removal of existing rubblemound material as indicated on the drawings or as directed by the Contracting Officer, except hard solid rock.

#### 3.4.3 Hard Rock Excavation

The hard rock in the toe trench shall be excavated as shown on the drawings. Blasting shall not be allowed. The toe trench shall be backfilled to the limits shown on the drawings after placement of the Core-Loc units with tremie concrete.

#### 3.4.4 Disposition of Satisfactory Materials

Excavated materials which are suitable and approved by the Contracting Officer for incorporation into the finished work shall be placed directly therein or stockpiled for future use within the limits of the work, as directed by the Contracting Officer. Excess stone material shall be stockpiled as shown on the drawings.

### 3.5 STONE PLACEMENT

#### 3.5.1 Underlayer, Toe Buttress, Toe Bedding, Core and Toe Trench Backfill Placement

The existing rubblemound breakwater shall be excavated to the lines and grades shown on the drawings to permit placement of the Underlayer and Toe Buttress Stone to the thicknesses and lines and grades shown on the drawings. The thicknesses of the underlayer and toe buttress stone shall not deviate from the contract drawings.

Excavation or reworking of material for placement of underlayer, toe buttress stone and core-loc blocks shall be considered incidental to stone and core-loc placement.

##### 3.5.1.1 Underlayer and Toe Buttress Stone

Underlayer and buttress stone shall be placed to the lines and grades shown on the drawings. The stone shall be placed to a full zone thickness in one operation in a manner to avoid displacing the underlying or bedding material or placing undue impact force on underlying materials and supporting subsoils. Underlayer and Toe Buttress Stone shall be placed in a manner to produce a resultant graded mass of stone with minimum voids. Rearranging of individual stones may be required to achieve this result. Placement by any method which is likely to cause segregation will not be permitted. Placement shall begin at the bottom of the slope and proceed upward. Casting or dropping of stone over two (2) feet or moving by drifting and manipulating down the slope shall not be permitted. final finished slope shall be achieved as the material is placed.

### 3.5.1.2 Toe Bedding Stone

Toe bedding stone shall be placed to the lines and grades shown on the drawings. The toe bedding stone shall be placed in a manner to produce a resultant graded mass of stone with a minimum of voids. The stone shall be lowered by bucket to within 2 feet of the bottom before it is released.

### 3.5.1.3 Core Stone

Core stone may be supplied from an approved quarry or salvaged excess rubblemound stone from the breakwater. The core stone slope shall be excavated to the lines and grades shown on the drawings. The excavated stone or quarried rock shall be placed in the breakwater to the lines and grades shown on the drawings.

### 3.5.1.4 Toe Trench Backfill

Toe trench backfill shall be supplied from an approved quarry or salvaged excess rubblemound stone and meet the gradation specified. The backfill shall be lowered in a bucket to the toe buttress berm and moved into position over the toe trench prior to release. Casting or dropping of stone over two (2) feet shall not be permitted. Proper placement of the toe trench backfill shall be confirmed by diver inspection. Damage to a core-loc unit will require replacement of the core-loc unit at the Contractor's expense.

## 3.6 GRADE TOLERANCES

The finished surface and stone layer thickness shall not deviate from the lines and grades shown on the contract drawings by more than the tolerances listed below. Tolerances are measured perpendicular to the indicated neat lines. The average of the deviations ascertained for three (3) consecutive profiles separated by 25 feet shall be less than 1.3 feet. Averages for underlayer on the slope and toe buttress stone shall be calculated separately. Extreme limits of the tolerances given shall not be continuous in any direction for more than five (5) times the nominal stone dimension nor for an area greater than 100 square feet of the structure surface.

### NEATLINE TOLERANCES

| Stone               | Above Neatline<br>(Inches) | Below Neatline<br>(Inches) |
|---------------------|----------------------------|----------------------------|
| Underlayer on Slope | 12                         | 12                         |
| Toe Buttress Stone  | 12                         | 6                          |
| Underlayer on Crest | 9                          | 6                          |
| Toe Bedding Stone   | 12                         | 6                          |
| Core                | 12                         | 12                         |

In addition to the vertical tolerances above, the horizontal alignment for the finished stone courses shall be +/-2 feet from that shown on the drawings provided the lines, arcs, and curves are smooth and continuous without visible bends, deflections and kinks.

The intention is that the work will 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's Representative. Excess material permitted to remain in place by the Contracting Officer's Representative will not be paid for.

### 3.7 QUALITY CONTROL

#### 3.7.1 General

The Contractor shall establish and maintain quality control for all work performed at the quarry or quarries and the job site under this section to assure compliance with contract requirements. It shall maintain records of its quality control tests, inspections and corrective actions. Quality control measures shall cover all materials, equipment, tests and construction operations including but not limited to the following:

- a. Placement of all materials to the slope and grade lines shown on the contract drawings and in accordance with this Section of the specifications.
- b. Conducting all operations in compliance with the requirements of Section 01430 ENVIRONMENTAL PROTECTION.
- c. Observance of safety regulations.

#### 3.7.2 Records

A copy of the waste manifests, receipts, records of inspections and tests, as well as records of any corrective action taken, shall be furnished to the Contracting Officer's Representative in accordance with Section 01451 CONTRACTOR QUALITY CONTROL.

#### 3.7.3 Check Surveys

Surveys made by the Contractor will be required on each material placed for determining that the materials are acceptably placed in the work. The Contractor shall perform verification surveys as the work progresses to verify that lines, grades, and thicknesses for the completed work are within the specified tolerances. Verification surveys shall be performed with a total station survey instrument and range pole-mounted prism; surveyor's level, range pole and surveyor's tape; tag line and sounding basket; or other methods that are consistent with the requirements of this section, in accordance with EM 1110-2-1003, subject to the approval of the COR. Range poles, if used, shall be fitted with a flat, durable, 12 inch diameter base. Electronic depth recorder will not be allowed for checking stone courses after stone placement or excavation to grade of existing rubblemound. The Contractor shall provide all boats, personnel and other equipment necessary to adequately and safely perform verification surveys.

##### 3.7.3.1 Scope

The Contractor shall survey the harbor bottom and existing rubblemound

breakwater prior to placement of stone materials and excavation of the existing rubblemound material. Bottom survey and existing rubblemound profiles shall be performed at 25 foot stations along the Survey Control Line (SCL). The SCL shall be established parallel to the long axis of the structure. Profiles shall run perpendicular to the SCL and structure alignments, and shall extend at least 25 feet beyond the structure limits.

Verification surveys for each stone course shall consist of cross sections of the structures performed by the Contractor at intervals of 25 feet along the SCL. Verification surveys of the stone courses shall be performed at the same stations along the SCL as the bottom surveys. Take elevation readings (soundings) every 5 feet, and at every break in grade, to a distance not less than 25 feet beyond the limits of the stone course being surveyed. Take additional elevation readings as directed by the COR. Verification surveys shall also be taken of the core stone layer prior to placement of succeeding layers.

#### 3.7.3.2 Execution

Above water surveys shall be accomplished using conventional land surveying methods. For surveys below water, the Contractor shall move into position for each reading using a boat or platform, as required, to provide complete coverage of the section from the water line to the harbor bottom. All verification surveys shall be referenced to the SCL and Mean Lower Low Water Datum. Verification surveys shall be conducted in the presence of the COR unless waived by the COR. For each verification survey performed, the Contractor shall transmit a verification survey record containing the following information to the COR:

- a. Structure and stone type surveyed.
- b. Verification survey location (station along the SCL).
- c. Date and time of survey.
- d. Weather conditions.
- e. Staff gauge reading at time of survey.
- f. Name of participants.
- g. Field notes.
- h. A plot on cross section paper showing the SCL, neat lines, and individual elevation readings.

The exact format of the verification survey record will be agreed upon by the COR and the Contractor.

Before any stone placement over a previously placed stone type, existing harbor bottom or excavated grade, survey of the previously placed stone, existing harbor bottom or excavated grade must be verified by the COR.

## 3.8 LIMITATIONS OF PLACEMENT PROCEDURES

Stone construction in advance of completed permanent protection shall be at the Contractor's risk. The Contractor shall keep the Contracting Officer's Representative advised as to any and all situations that may result in a possible interruption of work. The Contractor is responsible for the structures until completed and accepted by the Contracting Officer.

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## SECTION 03110

## FORMWORK FOR CONCRETE CORE-LOC

## 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 CONCRETE INSTITUTE (ACI)

ACI 347R (1994) Guide for Formwork for Concrete

## 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 03310 CONCRETE FOR CORE-LOC, Paragraph Construction Tolerances. 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. 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.

## 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-02 Shop Drawings

Formwork; G

Drawings and design computations for all formwork required shall be submitted at least 14 days either before fabrication on site or before delivery of prefabricated forms. All submittals shall be

approved by the CLS prior to submission to the Government (refer to Section 02390 PLACING CORE-LOC ARMOR UNITS for definition of CLS). The CLS review comments shall be included with the drawings.

If restoring is permitted, the method, including location, order, and time of erection and removal shall also be submitted for review.

#### SD-03 Product Data

##### Materials

Manufacturer's literature shall be submitted for all form materials, plywood, concrete form hard board, form accessories, prefabricated forms, form coating.

#### SD-09 Manufacturer's Field Reports

##### Inspection

The Contractor shall submit field inspection reports for concrete forms.

### 1.4 FORM DESIGN

The forms shall be designed by a person regularly engaged in the design and manufacture of concrete forms. The shape of the Core-Loc structural elements is a patented shape. That patent is held by the U.S. Army Corps of Engineers and no patent royalties will be required for execution of this project.

### 1.5 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 for a Class "B" Finish. This class of finish shall apply to all surfaces. The form facing material shall be composed of tongue-and-groove or shiplap lumber, plywood conforming to DOC PS 1, Grade B-B concrete form, tempered concrete form hardboard or steel. Steel lining on wood sheathing will not be permitted.

### 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

No through ties or through fasteners of any type will be allowed. All control, fasteners, connectors, and form stabilizers will be external to the completed core-lot elements.

## 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 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. 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. All corners shall be smooth and free of burrs, holes, gaps or roughness that may damage the concrete surface upon removal of the form.

#### 3.1.3 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

#### 3.2.1 General

Forms shall not be removed without approval, and all removal shall be accomplished in a manner which will prevent injury to concrete. Forms shall not be removed before the expiration of the minimum time indicated below, except as otherwise directed or specifically authorized. 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 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.

#### 3.2.2 Formwork

Removal of the forms shall be in a manner to insure complete safety of the structure. Supporting-forms shall not be removed until structural members have acquired sufficient strength support safely their own weight and any construction and/or storage load to which they may be subjected. Forms shall not be removed before the expiration of the minimum time indicated hereafter, except as otherwise directed or specifically authorized:

|                      |          |
|----------------------|----------|
| Non-Supporting Forms | 24 hours |
| Supporting Forms     | 72 hours |

The Contractor may elect to remove the forms at a period less than the time specified herein. The Contractor may remove the forms, both supported and unsupported, after 16 hours provided the following conditions are met. The Contractor will do a structural analysis of the members to insure that strengths suitable for form removal have been reached. This analysis will be performed by a licensed structural engineer and will include the results of short term compressive and flexural strength tests. Test results and analysis will indicate that the concrete in the forms has compressive and flexural strength sufficiently higher than the minimum required for form removal. Any early removal of the form shall not relieve the Contractor from the requirement for supplying core-locs free of cracks. The core-locs will be protected to insure they are not subjected to any loads, either during construction or storage, which may damage them. When conditions on the work are such as to justify the requirement, forms will be required to remain in place for longer periods.

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.

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## SECTION 03300

## CAST-IN-PLACE STRUCTURAL CONCRETE

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ACI INTERNATIONAL (ACI)

|              |   |
|--------------|---|
| ACI 117/117R | (1990; Errata) Standard Tolerances for Concrete Construction and Materials                    |
| ACI 211.1    | (1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete |
| ACI 214.3R   | (1988) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results |
| ACI 305R     | (1991) Hot Weather Concreting   |
| ACI 318/318R | (1995) Building Code Requirements for Reinforced Concrete and Commentary                      |

## AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

|              |   |
|--------------|---|
| AASHTO M 182 | (1991) Burlap Cloth Made From Jute or Kenaf |
|--------------|---|

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|           |  |
|-----------|--|
| ASTM C 31 | (1991) Making and Curing Concrete Test Specimens in the Field          |
| ASTM C 33 | (1993) Concrete Aggregate  |
| ASTM C 39 | (1994) Compressive Strength of Cylindrical Concrete Specimens          |
| ASTM C 42 | (1994) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete |
| ASTM C 78 | (1994) Flexural Strength of Concrete                                   |

|             |  |
|-------------|--|
|             | (Using Simple Beam With Third-Point Loading)   |
| ASTM C 94   | (1996) Ready-Mixed Concrete  |
| ASTM C 136  | (1995a) Sieve Analysis of Fine and Coarse Aggregates   |
| ASTM C 143  | (1990a) Slump of Hydraulic Cement Concrete   |
| ASTM C 150  | (1995) Portland Cement   |
| ASTM C 171  | (1995) Sheet Materials for Curing Concrete   |
| ASTM C 172  | (1990) Sampling Freshly Mixed Concrete   |
| ASTM C 192  | (1990a) Making and Curing Concrete Test Specimens in the Laboratory  |
| ASTM C 494  | (1992) Chemical Admixtures for Concrete  |
| ASTM C 881  | (1990) Epoxy-Resin-Base Bonding Systems for Concrete   |
| ASTM C 940  | (1989) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory                     |
| ASTM C 1017 | (1992) Chemical Admixtures for Use in Producing Flowing Concrete   |
| ASTM C 1059 | (1991) Latex Agents for Bonding Fresh to Hardened Concrete   |
| ASTM C 1064 | (1986; R 1993) Temperature of Freshly Mixed Portland Cement Concrete   |
| ASTM C 1077 | (1995b) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation |
| ASTM C 1116 | (1991) Fiber-Reinforced Concrete and Shotcrete   |
| ASTM D 75   | (1987; R 1992) Sampling Aggregates   |

## CORPS OF ENGINEERS (COE)

|               |   |
|---------------|---|
| COE CRD-C 104 | (1980) Method of Calculation of the Fineness Modulus of Aggregate |
| COE CRD-C 400 | (1963) Requirements for Water for Use in                          |

## Mixing or Curing Concrete

COE CRD-C 521 (1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete

## NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44 (1995) NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices

## NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA TMMB-01 (1992) Truck Mixer Agitator and Front Discharge Concrete Carrier Standards of the Truck Mixer Manufacturers Bureau

NRMCA CPMB 100 (1990) Concrete Plant Standards

NRMCA QC 3 (1984) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

## 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-03 Product Data

Synthetic Reinforcing Fiber

## SD-06 Test Reports

Testing and Inspection for Contractor Quality Control

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

## SD-07 Certificates

Mixture Proportions

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of

each strength or class of concrete including underwater concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

#### Qualifications

Written documentation for Contractor Quality Control personnel.

#### Work Plan

The Contractor shall provide a Work Plan detailing the procedures proposed for the accomplishment of the Underwater Toe Trench Tremie Concrete Operation. Work plan shall also include the Contractor's proposed system for the flexible forming system. The procedures shall provide for safe conduct of the work, use of proper equipment and materials, and techniques for toe and tremie concrete placement at the work site exposed to ocean waves and currents. The Contractor is responsible for providing barriers required to protect the underwater concrete from washout or segregation or damage by wave action and/or underwater currents.

### 1.2 QUALIFICATIONS

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

Concrete Field Testing Technician, Grade I  
Concrete Laboratory Testing Technician, Grade I or II  
Concrete Construction Inspector, Level II

The foreman or lead journeyman of the flatwork finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation.

### 1.3 GENERAL REQUIREMENTS

#### 1.3.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R.

## 1.3.2 Strength Requirements and w/c Ratio

## 1.3.2.1 Strength Requirements

Specified compressive strength (f'c) shall be as follows:

| <u>Compressive Strength</u> | <u>Structure or Portion of Structure</u> |
|-----------------------------|--|
| 4,000 psi at 28 days        | Concrete Crest Cap                       |
| 3,000 psi at 28 days        | Underwater Toe Trench Tremie Concrete    |

Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength for concrete made with Type I or II portland cement. Compressive strength shall be determined in accordance with ASTM C 39.

- a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (6 by 12 inch cylinders) shall be fabricated by the Contractor 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 than 500 psi. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.
- b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 500 psi or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. 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 strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.
- c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of

the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318/318R. Concrete work evaluated by structural analysis or by results of a load test as being under strength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

#### 1.3.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be as follows:

| WATER-CEMENT RATIO, BY WEIGHT | STRUCTURE OR PORTION OF STRUCTURE |
|-------------------------------|-----------------------------------|
| 0.45                          | Concrete Crest Cap                |
| 0.5                           | Underwater Toe Trench Tremie      |

Underwater Toe Trench Tremie concrete shall have minimum 7 sacks of cement per cubic yards of concrete. These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan and silica fume, by the weight equivalency method as described in ACI 211.1. In the case where silica fume is used, the weight of the silica fume shall be included in the equations of ACI 211.1 for the term P which is used to denote the weight of pozzolan.

#### 1.3.3 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143.

| Structural Element  | Slump<br>Minimum | Maximum |
|---|------------------|---------|
| Cast-In-Place Concrete<br>unless noted otherwise              | 2 in.            | 4 in.   |
| Any structural concrete approved<br>for placement by pumping: |                  |         |
| At pump   | 2 in.            | 6 in.   |
| At discharge of line  | 1 in.            | 4 in.   |
| Underwater Toe Trench Tremie                                  | 3.5 in.          | 4.5 in. |

Contractor is permitted to use a plasticizing admixture conforming to ASTM

C 1017 or when a Type D or G high range water reducing admixture conforming to ASTM C 494 is permitted to increase slump of concrete. Contractor will submit his proposed method to the Contracting Officer for review and acceptance before placing tremie concrete (to include identification of any proposed admixtures).

#### 1.3.4 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 90 degrees F.

#### 1.3.5 Size of Coarse Aggregate

The largest feasible Nominal Maximum Size Aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

#### 1.3.6 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

### 1.4 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

#### 1.4.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192 and tested in accordance with ASTM C 39. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in the paragraph Maximum Allowable w/c Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and Ground Granulated Blast Furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1.

Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

#### 1.4.2 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength ( $f'_{cr}$ ) exceeding the specified compressive strength ( $f'_c$ ) by the amount indicated below. This required average compressive strength,  $f'_{cr}$ , will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below  $f'_{cr}$  during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day  $f'_{cr}$ , the mixture shall be adjusted, as approved, to bring the daily average back up to  $f'_{cr}$ . During production, the required  $f'_{cr}$  shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

##### 1.4.2.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths ( $f'_c$ ) within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength  $f'_{cr}$  used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

$$f'_{cr} = f'_c + 1.345 \text{ where units are in MPa}$$

$$f'_{cr} = f'_c + \text{where units are in psi}$$

$$f'_{cr} = f'_c + 2.335 - 3.45 \text{ where units are in MPa}$$

$f'_{cr} = f'_c + 2.33S - 500$  where units are in psi

Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

| NUMBER OF TESTS | MODIFICATION FACTOR<br>FOR STANDARD DEVIATION |
|-----------------|---|
| 15              | 1.16  |
| 20              | 1.08  |
| 25              | 1.03  |
| 30 or more      | 1.00  |

#### 1.4.2.2 Computations Without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength  $f'_{cr}$  shall be determined as follows:

#### 1.5 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

#### 1.6 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

##### 1.6.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the

specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

#### 1.6.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

#### 1.6.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

#### 1.6.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

### PART 2 PRODUCTS

#### 2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement, and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

##### 2.1.1 Portland Cement

ASTM C 150, Type II.

#### 2.2 AGGREGATES

Aggregates shall conform to the following.

##### 2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.

##### 2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S, Size Designation 67.

## 2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

### 2.3.1 Water-Reducing or Retarding Admixture

ASTM C 494, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

### 2.3.2 High-Range Water Reducer

ASTM C 494, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

### 2.3.3 Anti-Washout Admixture

Anti-washout admixture shall be used in underwater toe tremic concrete. Anti-washout admixture shall have no retarding effect on the concrete setting time. Washout resistance per Army Corps of Engineers CRD-C61, "Test Method for Determining the Resistance of Freshly Mixed Concrete to Washing Out in Water." Placed concrete shall be cohesive and homogenous throughout, resisting segregation. Dosage of anti-washout admixture shall be as determined by admixture manufacturer. Other admixtures used in the underwater toe concrete mix shall be compatible with the anti-washout admixture. As a compatible accelerator admixture may be used to better project the concrete from wash out by wave action and under currents.

### 2.3.4 Other Chemical Admixtures

Chemical admixtures for use in producing flowing concrete, including underwater application for tremie concrete, shall comply with ASTM C 1017, Type I or II. These admixtures shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

## 2.4 CURING MATERIALS

### 2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

### 2.4.2 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

## 2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

## 2.6 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to ASTM C 1059.

## 2.7 EPOXY RESIN

Epoxy resins for use in repairs shall conform to ASTM C 881, Type IV, Grade 2. Class as appropriate to the existing ambient and surface temperatures.

## 2.8 FLEXIBLE FORMING SYSTEM

Flexible forming system shall be capable of containing concrete during placement. Flexible formwork shall be used to form concrete cap that abuts against the top-most layer of core-loc units. When required, additional supports shall be installed to reinforce the forming system.

## 2.9 Fiber-Reinforced Concrete

In addition to the requirements specified above, fiber reinforced concrete shall be provided in accordance with ASTM C 1116 Type III, synthetic fiber reinforced concrete, and as follows. Synthetic reinforcing fibers shall be 100 percent virgin polypropylene fibrillated fibers containing no reprocessed olefin materials. Fibers shall have a specific gravity of 0.9, a minimum tensile strength of 70 ksi, graded per manufacturer, and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement. A minimum of 1.5 pounds of fibers per cubic yard of concrete shall be used. Fibers shall be added at the batch plant. Fiber reinforced concrete shall be used in areas indicated on the drawings.

# PART 3 EXECUTION

## 3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section 03110 FORMWORK FOR CONCRETE CORE-LOC. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

### 3.1.1 Foundations

#### 3.1.1.1 Preparation of Rock

Rock surfaces upon which concrete is to be placed shall be free from oil, standing or running water, mud, drummy rock, coating, debris, and loose, semidetached or unsound fragments. Joints in rock shall be cleaned to a satisfactory depth, and may be filled with clean gravel as determined by the Contracting Officer, and to firm rock on the sides. Immediately before the concrete is placed, rock surfaces shall be cleaned thoroughly by the use of air-water jets or sandblasting as specified below for Previously Placed Concrete. Rock surfaces shall be kept continuously moist for at least 24 hours immediately prior to placing concrete thereon. All horizontal and approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar proportioned similar to that in the concrete mixture. Concrete shall be placed before the mortar stiffens.

### 3.2 CONCRETE PRODUCTION

#### 3.2.1 Batching, Mixing, and Transporting Concrete

Concrete shall either be batched and mixed onsite or shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB-01. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete. Site-mixed concrete shall conform to the following subparagraphs.

##### 3.2.1.1 General

The batching plant shall be located on site in the general area indicated on the drawings or off site close to the project. The batching plant shall conform to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required.

##### 3.2.1.2 Batching Equipment

The batching controls shall be semiautomatic or automatic, as defined in NRMCA CPMB 100. A 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 accurate recorder or recorders that meet the requirements of NRMCA CPMB 100. The weight of water and admixtures shall be recorded if batched by weight. Separate bins or compartments shall be provided for each size group of aggregate and type of cementitious material, to prevent intermingling at any time. Aggregates shall be weighed either in separate weigh batchers with individual scales or, provided the smallest size is batched first, cumulatively in one weigh batcher on one scale. Aggregate shall not be weighed in the same batcher with cementitious material. If both portland cement and other cementitious

material are used, they may be batched cumulatively, provided that the portland cement is batched first. Water may be measured by weight or volume. Water shall not be weighed or measured cumulatively with another ingredient. Filling and discharging valves for the water metering or batching system shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. Piping for water and for admixtures shall be free from leaks and shall be properly valved to prevent backflow or siphoning. Admixtures shall be furnished as a liquid of suitable concentration for easy control of dispensing. An adjustable, accurate, mechanical device for measuring and dispensing each admixture shall be provided. Each admixture dispenser shall be interlocked with the batching and discharging operation of the water so that each admixture is separately batched and individually discharged automatically in a manner to obtain uniform distribution throughout the water as it is added to the batch in the specified mixing period. When use of truck mixers makes this requirement impractical, the admixture dispensers shall be interlocked with the sand batchers. Different admixtures shall not be combined prior to introduction in water and shall not be allowed to intermingle until in contact with the cement. Admixture dispensers shall have suitable devices to detect and indicate flow during dispensing or have a means for visual observation. 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, and for sampling and calibrating the dispensing of cementitious material, water, and admixtures. Filling ports for cementitious materials bins or silos shall be clearly marked with a permanent sign stating the contents.

#### 3.2.1.3 Scales

The weighing equipment shall conform to the applicable requirements of CPMB Concrete Plant Standard, and 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. The tests shall be made at the specified frequency in the presence of a Government inspector. The weighing equipment shall be arranged so that the plant operator can conveniently observe all dials or indicators.

#### 3.2.1.4 Batching Tolerances

##### (A) Tolerances with Weighing Equipment

| <b>MATERIAL</b>        | <b>PERCENT OF REQUIRED<br/>WEIGHT</b> |
|------------------------|---------------------------------------|
| Cementitious materials | 0 to plus 2                           |
| Aggregate              | plus or minus 2                       |
| Water                  | plus or minus 1                       |
| Chemical admixture     | 0 to plus 6                           |

##### (B) Tolerances with Volumetric Equipment

For volumetric batching equipment used for water and admixtures, the following tolerances shall apply to the required volume of material being batched:

| <b>MATERIAL</b>      | <b>PERCENT OF REQUIRED MATERIAL</b> |
|----------------------|-------------------------------------|
| Water:               | plus or minus 1 percent             |
| Chemical admixtures: | 0 to plus 6 percent                 |

#### 3.2.1.5 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched.

#### 3.2.1.6 Concrete Mixers

Mixers shall be stationary mixers or truck mixers. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The 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.

#### 3.2.1.7 Stationary Mixers

Concrete plant mixers shall be drum-type mixers of tilting, nontilting, horizontal-shaft, or vertical-shaft type, or shall be pug mill type 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 applicable to central-mixed concrete.

#### 3.2.1.8 Truck Mixers

Truck mixers, the mixing of concrete therein, and concrete uniformity shall conform to the requirements of ASTM C 94. 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 is possible to determine the number of revolutions at mixing speed and the number of revolutions at agitating speed. Water shall not be added at the placing site unless specifically approved; and in no case shall it exceed the specified w/c. Any such water shall be injected at the base of the mixer, not at the discharge end.

### 3.3 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in truck mixers, agitators, nonagitating transporting equipment conforming to NRMCA TMMB-01 or by approved pumping equipment conveyors.

### 3.4 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

#### 3.4.1 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 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 2 square feet. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 2 cubic yards shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

#### 3.4.2 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 shall 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.

#### 3.4.3 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. Nonagitating equipment shall be used only for transporting plant-mixed concrete over a smooth road and 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.

#### 3.4.4 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

#### 3.4.5 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, such as discharge baffle or hopper, for preventing segregation of the concrete at the transfer points and the point of placing. Belt conveyors shall be constructed such that the idler spacing shall not exceed 36 inches. The belt speed shall be a minimum of 300 feet per minute and a maximum of 750 feet per minute. If concrete is to be placed through installed horizontal or sloping reinforcing bars, the conveyor shall discharge concrete into a pipe or elephant truck that is long enough to extend through the reinforcing bars.

#### 3.4.6 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 4 inches. Aluminum pipe shall not be used.

### 3.5 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

#### 3.5.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns

and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

### 3.5.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.025 inch, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segregation or flotation of coarse aggregate shall be prevented. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

### 3.5.3 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 85 degrees F, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

### Maximum Allowable Concrete Placing Temperature

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| Relative Humidity, Percent,<br>During Time of<br>Concrete Placement | Maximum Allowable Concrete<br>Temperature<br>Degrees |
|---|--|
| Greater than 60   | 90 F   |
| 40-60   | 85 F   |
| Less than 40  | 80 F   |

#### 3.5.4 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

#### 3.5.5 Placing Flowable Concrete

If a plasticizing admixture conforming to ASTM C 1017 is used or if a Type F or G high range water reducing admixture is permitted to increase the slump, the concrete shall meet all requirements of paragraph GENERAL REQUIREMENTS. Extreme care shall be used in conveying and placing the concrete to avoid segregation. Consolidation and finishing shall meet all requirements of paragraphs Placing Concrete, Finishing Formed Surfaces, and Finishing Unformed Surfaces. No relaxation of requirements to accommodate flowable concrete will be permitted.

#### 3.5.6 Placing Concrete Underwater

Concrete shall be deposited in water by a tremie or concrete pump. The methods and equipment used shall be submitted to the Government for information only. Concrete buckets shall not be used 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 concrete shall be deposited so that it enters the mass of the previously placed concrete from within, displacing water with a minimum disturbance to the surface of the concrete. The discharge end of the pump line or tremie shaft shall be kept continuously submerged in the concrete. The underwater seal at start of placing shall 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 of concrete will be limited to 5 m.

### 3.6 FINISHING FORMED SURFACES

Finishing of formed surfaces shall be as specified herein. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/117R. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract. Repairs not meeting these requirements will be rejected and shall be replaced.

#### 3.6.1 Class C and Class D Finish

Fins, ravelings, and loose material shall be removed, and, FORMWORK, holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 1/2 inch deep or more than 2 inches in diameter shall be repaired. Defects more than 2 inches in diameter shall be cut back to sound concrete, but in all cases at least 1 inch.

### 3.7 REPAIRS

#### 3.7.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 4 inches shall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the No. 16 mesh sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be

completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

### 3.7.2 Repair of Major Defects

Major defects will be considered to be those more than 1/2 inch deep or, for Class D finish, more than 2 inches in diameter. Also included are any defects of any kind whose depth is over 4 inches or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

#### 3.7.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 2 inches on all sides. All such defective areas greater than 12 square inches shall be outlined by saw cuts at least 1 inch. Defective areas less than 12 square inches shall be outlined by a 1 inch deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

### 3.7.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 6 inches deep and also have an average diameter at the surface more than 18 inches or that are otherwise so identified by the Project Office. Such defects shall be repaired as specified herein or directed, except that defects which affect the strength of the structure shall not be repaired and that portion of the structure shall be completely removed and replaced. Deep and large defects shall be repaired by procedures approved in advance including forming and placing special concrete using applied pressure during hardening. Preparation of the repair area shall be as specified for surface application of mortar. In addition, the top edge (surface) of the repair area shall be sloped at approximately 20 degrees from the horizontal, upward toward the side from which concrete will be placed. The special concrete shall be a concrete mixture with low water content and low slump, and shall be allowed to age 30 to 60 minutes before use. Concrete containing a specified expanding admixture may be used in lieu of the above mixture; the paste portion of such concrete mixture shall be designed to have an expansion between 2.0 and 4.0 percent when tested in accordance with ASTM C 940. A full width "chimney" shall be provided at the top of the form on the placing side to ensure filling to the top of the opening. A pressure cap shall be used on the concrete in the chimney with simultaneous tightening and revibrating the form during hardening to ensure a tight fit for the repair. The form shall be removed after 24 hours and immediately the chimney shall be carefully chipped away to avoid breaking concrete out of the repair; the surface of the repair concrete shall be dressed as required.

### 3.8 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in PART 1, when tested as specified herein.

#### 3.8.1 General

In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tempers or "jitterbugs" shall not be used for any surfaces. The dusting surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any surfaces with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied

in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

### 3.8.2 Broomed

The top surface of the concrete cap shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a coarse fiber push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab. After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

## 3.9 CURING AND PROTECTION

### 3.9.1 General

Concrete shall be cured by an approved method for the period of time given below:

|              |        |
|--------------|--------|
| All Concrete | 7 days |
|--------------|--------|

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except for plastic coated burlap, impervious sheeting alone shall not be used for curing.

### 3.9.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, non-supporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

### 3.9.3 Impervious Sheeting

The following concrete surfaces may be cured using impervious sheets: Ribs. However, except for plastic coated burlap, impervious sheeting alone

shall not be used for curing. Impervious-sheet curing shall only be used on horizontal or nearly horizontal surfaces. Surfaces shall be thoroughly wetted and be completely covered with the sheeting. Sheeting shall be at least 18 inches wider than the concrete surface to be covered. Covering shall be laid with light-colored side up. Covering shall be lapped not less than 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.

#### 3.9.4 Ponding or Immersion

Concrete shall continually immerse throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete.

#### 3.10 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with ASTM C 1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations.

##### 3.10.1 Grading and Corrective Action

###### 3.10.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fitness modulus determination in accordance with ASTM C 136 and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall immediately reported to the Contracting Officer, concreting shall be stopped, and immediate steps taken to correct the grading.

###### 3.10.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C 136 for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production

control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and shall be reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

#### 3.10.2 Quality of Aggregates

Thirty (30) days prior to the start of concrete placement, the Contractor shall perform all tests for aggregate quality required by ASTM C 33. In addition, after the start of concrete placement, the Contractor shall perform tests for aggregate quality at least every three months, and when the source of aggregate or aggregate quality changes. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

#### 3.10.3 Scales, Batching and Recording

The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every three months. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, the Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

#### 3.10.4 Batch-Plant Control

The measurement of concrete materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate weights and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic yard, amount of water weights per cubic yard for each class of concrete batched during each day's plant operation.

## 3.10.5 Concrete Mixture

a. 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 for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Limits shall be set on separate control charts for slump and the chart for range, and for determining need for any remedial action. Limits shall be set on separate control charts for slump for each type of mixture. The upper warning limit shall be set at 1/2 inch below the maximum allowable slump specified in paragraph SLUMP in PART 1 for each type of concrete and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 2 inches. Samples for slump shall be taken at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

b. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an adjustment shall immediately be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, the concreting operation shall immediately be halted, and the Contractor shall take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.

c. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064. The temperature shall be reported along with the compressive strength data.

d. Strength Specimens. At least one set of test specimens shall be made, for compressive or flexural strength as appropriate, on each different concrete mixture placed during the day for each 500 cubic yards or portion thereof of that concrete mixture placed each day. Additional sets of test specimens shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A truly random (not haphazard) sampling plan shall be developed by the Contractor and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength per paragraph STRENGTH REQUIREMENTS in Part 1 shall consist of four specimens, two to be tested at 7 days and two at 28 days. A set of test specimens for concrete within a 90-day strength per the same paragraph shall consist of six specimens, two tested at 7 days, two at 28 days, and two at 90 days. Test specimens shall be molded and cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39 for test cylinders and ASTM C 78 for test beams. Results of all strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in paragraph STRENGTH REQUIREMENTS in Part 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in ACI 214.3R.

#### 3.10.6 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

#### 3.10.7 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to

meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

### 3.10.8 Vibrators

The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing. Any vibrator not meeting the requirements of paragraph CONSOLIDATION, shall be immediately removed from service and repaired or replaced.

### 3.10.9 Curing Inspection

- a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.
- b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by one (1) day.
- c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the Contractor shall estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, shall compute the rate of coverage in square feet per gallon, and shall not whether or not coverage is uniform.
- d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.
- e. Sheet Curing Inspection. At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.
- f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing

period for those areas shall be extended by one (1) day.

#### 3.10.10 Mixer Uniformity

a. Stationary Mixers. Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 75,000 cubic yards of concrete placed, whichever results in the shortest time interval, uniformity of concrete mixing shall be determined in accordance with ASTM C 94.

b. Truck Mixers. Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.

c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

#### 3.10.11 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. The Contracting Officer has the right to examine all contractor quality control records.

-- End of Section --

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## SECTION 03310

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## SECTION 03310

## CONCRETE FOR CORE-LOC

## 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 CONCRETE INSTITUTE (ACI)

|                |   |
|----------------|---|
| ACI 117/117R   | (1990; Errata) Standard Tolerances for Concrete Construction and Materials                    |
| ACI 211.1      | (1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete |
| ACI 214        | (1977; R 1989) Evaluation of Strength Test Results of Concrete                                |
| ACI 214.3R     | (1988) Evaluation of Strength Test Results of Concrete  |
| ACI 305R       | (1991) Hot Weather Concreting   |
| ACI 318/318R   | (1995) Building Code Requirements for Reinforced Concrete and Commentary                      |
| ACI 318M/318RM | (1992) Building Code Requirements for Reinforced Concrete (Metric)                            |

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|           |  |
|-----------|--|
| ASTM C 31 | (1991) Making and Curing Concrete Test Specimens in the Field                          |
| ASTM C 33 | (1993) Concrete Aggregates   |
| ASTM C 39 | (1994) Compressive Strength of Cylindrical Concrete Specimens                          |
| ASTM C 42 | (2003) Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete |

|             |   |
|-------------|---|
| ASTM C 78   | (1994) Flexural Strength of Concrete<br>(Using Simple Beam with Third-Point<br>Loading)   |
| ASTM C 94   | (1994) Ready-Mixed Concrete   |
| ASTM C 143  | (1990a) Slump of Hydraulic Cement Concrete  |
| ASTM C 150  | (1995) Portland Cement  |
| ASTM C 171  | (1992) Sheet Materials for Curing Concrete  |
| ASTM C 172  | (1990) Sampling Freshly Mixed Concrete  |
| ASTM C 186  | (1994) Standard Test for Heat of Hydration<br>of Hydraulic Cement   |
| ASTM C 192  | (1990a) Making and Curing Concrete Test<br>Specimens in the Laboratory  |
| ASTM C 289  | (1994) Potential Alkali-Silica Reactivity<br>of Aggregates (Chemical Method)  |
| ASTM C 309  | (1994) Liquid Membrane-Forming Compounds<br>for Curing Concrete   |
| ASTM C 494  | (1992) Chemical Admixtures for Concrete   |
| ASTM C 597  | (2002) Test Method for Pulse Velocity<br>Through Concrete   |
| ASTM C 618  | (2003) Specification for Coal Fly Ash and<br>Raw or Calcined Natural Pozzolan for Use<br>as a Mineral Admixture in Concrete                                 |
| ASTM C 803  | (2003) Test Method for Penetration<br>Resistance of Hardened Concrete   |
| ASTM C 805  | (1994) Rebound Number of Hardened Concrete  |
| ASTM C 881  | (1990) Epoxy-Resin-Base Bonding Systems<br>for Concrete   |
| ASTM C 1059 | (1999) Specification for Latex Agents for<br>Bonding Fresh to Hardened Concrete   |
| ASTM C 1064 | (1986; R 1993) Temperature of Freshly<br>Mixed Portland Cement Concrete   |
| ASTM C 1077 | (1995b) Standard Practice for Laboratories<br>Testing Concrete and Concrete Aggregates<br>for Use in Construction and Criteria for<br>Laboratory Evaluation |

|             |  |
|-------------|--|
| ASTM C 1107 | (1991a) Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)        |
| ASTM C 1116 | (2003) Specification for Fiber-Reinforced Concrete and Shotcrete |
| ASTM D 75   | (1987; R 1992) Sampling Aggregates                               |

## CORPS OF ENGINEERS (COE)

|               |   |
|---------------|---|
| COE CRD-C 318 | (1972) 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 | (2000) Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices |
|------------|--|

## NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

|                |                                 |
|----------------|---------------------------------|
| NRMCA CPMB 100 | (1990) Concrete Plant Standards |
|----------------|---------------------------------|

## 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-02 Shop Drawings

## Shop Drawings; G.

The Contractor shall submit to the Contracting Officer for approval shop drawings of the form proposed for use in the casting of core-loc of the size and dimension indicated on the drawings. Reasonable tolerance will be allowed in the specified dimensions of the core-loc forms. Shop drawings shall be submitted at least ten (10) days in advance of intended time of use to permit checking and approval by the Contracting Officer. No core-loc elements shall be cast until forms are approved. As a minimum, the shop drawings shall show dimensions of all form components, proposed fabrication information (including weld information, dimension and specifications of bolts or other fasteners), and assembly information. The shop drawings shall include all

relevant drawings, diagrams, layouts, schematics, descriptive literature, illustrations, and schedules. The shop drawings shall be industry standard, capable of being used to construct the forms by any competent form manufacturer.

#### SD-03 Product Data

##### Synthetic Reinforcing Fiber

##### Concrete Mixture Proportioning; G.

Concrete mixture proportions shall be determined by the Contractor, in accordance with the requirements in paragraph CONCRETE MIXTURE PROPORTIONING, and submitted for review. The concrete 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 shall be stated. Proportions shall indicate the mass of cement and pozzolan when used, 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 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

The Contractor shall submit batch plant data to the Contracting Officer for review for conformance with applicable specifications.

##### Concrete Mixers

The Contractor shall submit concrete mixer data which includes the make, type, and capacity of concrete mixers proposed for mixing concrete.

##### Placing Equipment and Methods

All placing equipment and methods shall be submitted for review by the Contracting Officer.

#### SD-06 Test Reports

##### Aggregate Quality

Aggregate quality tests shall be submitted at least 30 days prior to start of concrete placement, in accordance with paragraph AGGREGATES.

##### Tests and Inspections

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

#### SD-07 Certificates

Testing Technicians; G Concrete Construction Inspector; G.

The Contractor shall submit statements that the concrete testing technicians and the concrete inspectors meet the requirements of paragraph TESTS AND INSPECTIONS.

Curing and Protection; G

The curing medium and methods to be used shall be submitted for review and approval for conformance with paragraph CURING AND PROTECTION.

Hot-Weather Placing; G

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.

Cementitious Materials; G.

Cementitious materials, including cement and pozzolan, will be accepted on the basis of the manufacturer's certification of compliance.

Impervious-Sheet Curing Materials

Impervious-sheet curing materials shall be certified for compliance with all specification requirements.

Other Chemical Admixtures

Other chemical admixtures shall be certified for compliance with all specification requirements.

Membrane-Forming Curing Compound

Membrane-forming curing compound shall be certified for compliance with all specification requirements.

Epoxy Resin Latex Bonding Compound

Epoxy resin and latex bonding compound shall be certified for compliance with all specification requirements.

Non-Shrink Grout

Descriptive literature of the non-shrink 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.

### 1.3 GOVERNMENT TESTING AND SAMPLING

The Government may 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.

#### 1.3.1 Cementitious Materials, Admixtures, and Curing Compound

At least 30 days in advance of concrete placement, the Contractor shall notify the Contracting Officer of the sources for cementitious materials, admixtures, and curing compound, along with sampling location, brand name, type, and quantity to be used in the manufacture and/or curing of the concrete.

#### 1.3.2 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.

#### 1.3.3 Concrete Strength

The strength of the concrete will be considered acceptable when the moving average of every 5 sets of compressive strength at 28-day age are above the compressive strength as determined by correlation with 28-day compressive strength tests specified in paragraphs: Mixture Proportioning for 28-day Flexural Strength and Concrete Testing for CQC; and no individual set is more than 500 psi, below the determined compressive strength. Compressive strength test specimens will be made by the Contractor and cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39.

a. Investigation of Low-Strength Test Results: When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 3.5 MPa (500 psi) or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. Non-destructive 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 (3) 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 318M/318RM (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 Contracting 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.

#### 1.4 DESIGN REQUIREMENTS

##### 1.4.1 Concrete Properties

Specified flexural strength, when specimens are tested in accordance with ASTM C 78 shall be a minimum of 700 psi at 28 days. The maximum allowable water/cement ratio shall be a 0.40 by weight. The total air content shall not exceed 5%. At no time shall the temperature of the concrete be greater than 165 degrees F. The maximum temperature differential between the interior and exterior concrete shall not exceed 36 degrees F.

#### 1.5 CONSTRUCTION TOLERANCES

##### 1.5.1 General

The definitions of the terms used in the following tables shall be as defined in ACI 117/117R. Level and grade tolerance measurement 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.

#### **TOLERANCES FOR CORE-LOC STRUCTURAL ELEMENTS**

Cross-Sectional Dimensions for Members, such as Columns, Beams, and Slabs.

**TOLERANCES FOR CORE-LOC STRUCTURAL ELEMENTS**

More than 12 inches but not over 36 inches dimension ... +1/2 inch / -3/8 inch

Over 36 inches dimension ..... +1 inch / -3/4 inch

(2) ..... Structural Sections

(2.1) Vertical Alignment:

Formed surfaces slope with respect to the specified plane.

Vertical alignment of outside corners and joints exposed to view ..... 1/4 inch in 10 feet

(2.2) Abrupt Variation ..... 1/8 inch

(2.3) Gradual Variation:

Surface finish tolerances as measured by placing a freestanding (unleveled), 5 foot straightedge for plane surface curved template for curved surface anywhere on the surface and allowing it to rest upon two high spots within 72 hour after concrete placement. The gap at any point between the straightedge or template and the surface shall not exceed. .... 1/4 inch

1.5.2 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.

1.5.3 Identification

All core-loc units must be readily identifiable by means of a unique numbering system.

At the time of casting, the unique number shall be inscribed in the top of one of the flukes of the unit.

Upon stripping of the form, the unit identification number with fabrication data shall be painted on each unit in English lettering, block type, minimum 4 inches high and shall be black enamel finished with protective coating. The paint shall be safe, permanent, and durable when exposed to the elements; i.e., UV light, salt water, and other injurious elements.

Samples, along with manufacturer's literature shall be provided to the Contracting Officer, for approval, at least ten (10) days prior to the start of the works.

## PART 2 PRODUCTS

## 2.1 MATERIALS

## 2.1.1 Cementitious Materials

Cementitious materials shall be Portland cement, or Portland cement in combination with pozzolan and shall conform to appropriate specifications listed below. Use of cementitious materials in the elements shall be restricted to one color, one source, and one type.

## 2.1.1.1 Portland Cement

ASTM C 150, Type II, low alkali.

## 2.1.1.2 Pozzolan

Pozzolan shall be a fly ash conforming to requirements of ASTM C 618, Class F, with the loss on ignition to 6 percent.

## 2.1.2 Aggregates

Aggregates shall conform to the requirements of ASTM C 33. Aggregates to be used for production of concrete shall be considered innocuous when tested in accordance with ASTM C 289. Test results, used to validate this property for aggregate sources used, shall be no more than 60 days old at the time of the manufacture of concrete elements.

## 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 Accelerating Admixture

Accelerators shall meet the requirements of ASTM C 494, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

## 2.1.3.2 Water-Reducing or Retarding Admixture

a. Water-Reducing or Retarding Admixtures: ASTM C 494, 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, 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.

#### 2.1.4 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. The color of impervious-sheet curing materials will be white opaque.

##### 2.1.4.2 Membrane-Forming Curing Compound

The membrane-forming curing compound shall conform to ASTM C 309, Type 2.

##### 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, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400, and approved by the Contracting Officer.

##### 2.1.6 Non-Shrink Grout

Non-Shrink grout shall conform to ASTM C 1107 and shall be a commercial formulation suitable for the application proposed.

##### 2.1.7 Latex Bonding Compound

Latex bonding compound agents for bonding fresh to hardened concrete shall conform to ASTM C 1059.

##### 2.1.8 Epoxy Resin

Epoxy resins for use in repairs shall conform to ASTM C 881, Type III, Grade I or II.

##### 2.1.9 Fiber Reinforced Concrete

In addition to the requirements specified above, fiber reinforced concrete shall be provided in accordance with ASTM C 1116 Type III, synthetic fiber reinforced concrete, and as follows. Synthetic reinforcing fibers shall be 100 percent virgin polypropylene fibrillated fibers containing no reprocessed olefin materials. Fibers shall have a specific gravity of 0.9, a minimum tensile strength of 70 ksi, graded per manufacturer, and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement. A minimum of 1.5 pounds of fibers per cubic yard of concrete shall be used. Fibers shall be added at the batch plant.

## 2.2 CONCRETE MIXTURE PROPORTIONING

### 2.2.1 Quality of Mixture

Mixture proportions shall be selected so that the strength and W/C requirements listed in paragraph DESIGN REQUIREMENTS are met. Concrete shall be composed of cementitious material, water, fine and coarse aggregates, and admixtures. The cementitious material shall be Portland cement or portland cement in combination with pozzolan.

### 2.2.2 Nominal Maximum-Size Coarse Aggregate

Nominal maximum-size coarse aggregate shall be 1 inch.

### 2.2.3 Air Content

Air entrainment shall not exceed 5%.

### 2.2.4 Slump

The slump shall be determined in accordance with ASTM C 143 and shall be within the range of 1 inch to 4 inches.

### 2.2.5 Concrete Proportioning Studies

Trial design batches, mixture proportioning studies, and testing requirements shall be the responsibility of the Contractor. Mixture proportioning studies shall be performed by a commercial laboratory, inspected by the Government, and approved in writing. The laboratory performing the mixture proportioning shall conform with ASTM C 1077. Strength requirements during mixture proportioning studies shall be based on flexural strength as determined by test specimens fabricated in accordance with ASTM C 192 and tested in accordance with ASTM C 78. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use on the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportion is, slumps, and air content suitable for the work shall be based on methodology described in ACI 211.1, modified as necessary to accommodate flexural strength. Determine the heat of hydration in accordance with ASTM C 186 for each trial batch.

#### 2.2.5.1 Water-Cement Ratio

At least three (3) different water-cement ratios, which will produce a range of strength encompassing that required on the project, shall be used.

The maximum allowable water-cement ratio required in paragraph 1.4.1, Concrete Properties will be the equivalent water-cement ratio as determined by conversion from the mass ratio of water to cement plus pozzolan by the weight equivalent method as described in ACI 211.1. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by mass of the total cementitious material, and the maximum shall be 35 percent.

Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content.

#### 2.2.5.2 Trial Mixtures Studies

Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any placing method proposed which requires special properties.

The temperature of concrete in each trial batch shall be reported. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding. Concrete proportioning studies shall be performed using the following procedures:

#### 2.2.5.3 Mixture Proportioning for 28-Day Flexural Strength

The following step by step procedure shall be followed:

- a. Fabricate all beams and cylinders for each mixture from the same batch or blend of batches. fabricate and cure all beams and cylinders in accordance with ASTM C 192, using 6 inch x 6 inch beams and 6 inch x 12 inch cylinders.
- b. Test beams in accordance with ASTM C 78, cylinders in accordance with ASTM C 39.
- c. Fabricate and cure test beams from each mixture for 7-, 14-, and 28-day flexural tests; six (6) beams to be tested per age.
- d. Fabricate and cure test cylinders from each mixture for 7-, 14-, and 28-day compressive strength tests; six (6) cylinders to be tested per age.
- e. Using the average strength for each w/c at each age, plot all results from each of the three (3) mixtures on separate graphs for w/c versus:
  - 7-day flexural strength,
  - 14-day flexural strength,
  - 28-day flexural strength,
  - 7-day compressive strength,
  - 14-day compressive strength,
  - 28-day compressive strength.
- f. From these graphs select a w/c that will produce a mixture giving a 28-day flexural strength equal to the required strength determined in accordance with paragraph "CONCRETE PROPERITES".
- g. Using the above selected w/c, select from the graphs the expected 7-, 14-, and 28-day flexural strengths and the expected

7-, 14-, and 28-day compressive strengths for the mixture.

h. From the above expected strengths for the selected mixture the following Correlation Ratios:

(1) Ratio of the 28-day compressive strength of the selected mixture to the 28-day flexural strength of the mixture (for acceptance).

(2) Ratio of the 7-day compressive strength of the selected mixture to the 28-day flexural strength of the mixture (for CQC control).

i. If there is a change in materials, additional mixture design studies shall be made using the new materials and new Correlation Ratios shall be determined.

j. No concrete shall be placed until the Contracting Officer has approved the Contractor's mixture proportions.

#### 2.2.6 Average Flexural Strength Required for Mixtures

In order to ensure meeting, during production, the strength requirements specified in paragraph "CONCRETE PROPERTIES", the mixture proportions selected during mixture proportioning studies and used during construction shall produce a required average flexural strength exceeding the specified strength, R, by the amount indicated below. This required average flexural strength, Ra, will not be a required acceptance criteria during concrete production, but will be used for CQC operations as specified in paragraph TESTS AND INSPECTION. During production, the required Ra shall be adjusted (increased or decreased), as appropriate and as approved, based on the standard deviation of equivalent 28-day strengths being attained during placement.

##### 2.2.6.1 From Previous Test Records

Where a concrete production facility has previous test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected, shall represent concrete produced to meet a specified flexural strength or strengths within 70 psi of the 28-day flexural strength specified for the proposed work, and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two (2) specimens made from the same sample of concrete and tested at 28-days. Required average flexural strength, Ra, used as the basis for selection of concrete proportions shall be the value from the equation that follows, using the standard deviation as determined above:

$$R_a = R + 1.34S$$

Where: S = Standard Deviation  
 R = Specified Flexural Strength  
 Ra = Required Average Flexural Strength

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:

| <u>Number of Tests</u> | <u>Modification Factor<br/>for Standard Deviation</u> |
|------------------------|---|
| 15                     | 1.16  |
| 20                     | 1.08  |
| 25                     | 1.03  |
| 30 or more             | 1.00  |

#### 2.2.6.2 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,  $R_a$ , shall be determined by adding 15 percent to the specified flexural strength,  $R$ .

### PART 3 EXECUTION

#### 3.1 EQUIPMENT

##### 3.1.1 Batch Plant

Batching plant shall conform to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required. 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.

##### 3.1.1.1 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 in the presence of a Government inspector.

##### 3.1.1.2 Batching Tolerances

###### a. Weighing Tolerances:

| <u>Required Material</u> | <u>Percent of Mass</u> |
|--------------------------|------------------------|
| Cementitious Materials   | 0 to plus 2            |
| Aggregate                | plus or minus 2        |

|                    |                 |
|--------------------|-----------------|
| 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:

| <u>Required Material</u> | <u>Percent of Mass</u>  |
|--------------------------|-------------------------|
| Water                    | Plus or minus 1 percent |
| Chemical Admixtures      | 0 to plus 6 percent     |

#### 3.1.1.3 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.

#### 3.1.2 Concrete Mixing

Concrete will be mixed in accordance with the requirements of ASTM C 94.

#### 3.1.3 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:

| <b>Application<br/>(inches)</b> | <b>Head Diameter (inches)</b> | <b>Frequency VPM</b> | <b>Amplitude</b> |
|---------------------------------|-------------------------------|----------------------|------------------|
| General Constr.                 | 2 to 3.5                      | 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

Before placement of concrete, care shall be taken to insure that forms are properly aligned and in a condition to receive concrete. They will be cleaned to the satisfaction of the Contracting Officer's Representative. Any needed repairs will be completed and approved prior to delivery of concrete to the forms. All stabilizers, braces, clamps, and other necessary fixtures will be in place and properly fastened prior to the delivery of concrete. The Contractor will have sufficient manpower, vibrators, and materials for curing the concrete on site ready for use prior to delivery of concrete to the forms. Placement will be terminated at the direction of the COR at anytime in which the COR determines that unsatisfactory elements may be manufactured.

### 3.3 PLACING

#### 3.3.1 Preproduction Trial Core-Loc Units

Prior to full scale production of core-locs units, the Contractor shall cast three (3) preproduction units. The trial units shall be full scale. The trial units shall be cast in accordance with these specifications and the approved submittals, Section 03300 SUBMITTALS. The trial units shall be cast in the presence of the CLS and the COR. The trial core-loc units shall be tested in accordance with Section 03300. In addition, the Contractor shall install four (4) thermocouples in each trial unit. A thermocouple shall be located at the intersection of the axis of each H member and the cross member. A thermocouple shall also be located at the center of each H member, 3 inches from the top of the member. The thermocouples shall be attached to a data logger. Temperature readings shall be recorded from each thermocouple daily for 28 days. The Contractor shall submit a report containing the daily temperature readings for the first seven (7) days. The report shall be submitted within ten (10) days of casting the unit. Production unit casting shall not commence until the 28-day data has been submitted and approved by the Contracting Officer.

#### 3.3.2 General

Core-loc elements shall be cast with the vertical H-members upright. See the Core-loc casting details in the project plans.

#### 3.3.3 Placing Procedures

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 trunk 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.

#### 3.3.4 Time Interval Between Mixing and Placing

Concrete shall be placed within 30 minutes after discharge into non-agitating 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 delaying until the truck mixer is at or near the construction site.

#### 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.** 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 replacement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

#### 3.3.6 Consolidation

Immediately after placement, each layer of 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.

### 3.4 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 shall have a trowel finish. Finishing shall be as specified below. 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

A trowel finish shall be applied to all unformed surfaces. 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.

#### 3.4.2 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. Uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any structural element. 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. Forms shall not be reused if there is any evidence of surface wear or defects that would impair the quality of the surface.

#### 3.4.3 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. Surfaces 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. Core-loc units having defective areas larger than described shall be rejected.

The Contractor shall keep a record of all repair operations. All repaired units must be inspected and approved by the COR, who reserves the right to reject units repaired by this method if he deems them unsatisfactory.

#### 3.4.4 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. Metal tools shall not be used to finish permanently exposed surfaces. The repaired areas shall be cured for seven (7) days. The temperature of the in situ concrete, adjacent air, and replacement mortar shall be above 40 degrees F during placement, finishing, and curing. Other methods and materials for repair maybe 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

The length of the curing period shall be determined by the type of cementitious material, as specified below. Concrete shall be cured by an approved method.

|   |         |
|---|---------|
| Portland cement blended with 25 percent or less fly-ash   | 14 days |
| Portland cement blended with more than 25 percent fly-ash | 25 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 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 forms 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 non-staining 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. 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 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 and the second coat shall be applied perpendicular to the first coat. Concrete surfaces that have been subjected to rainfall within 3 hours curing compound has been applied shall be resprayed by the method and 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.

### 3.6 TESTS AND INSPECTIONS

Tests and inspections shall conform to the following requirements.

#### 3.6.1 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 requirements of ASTM C 1077. 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 Techniques, 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 Construction Inspector, Level II. 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.

#### 3.6.2 Testing and Inspection Requirements

##### 3.6.2.1 Aggregates

Aggregates for concrete production will be tested by the Contractor to insure conformance to the requirements of ASTM C 33. Aggregates shall be non-alkali silica reactive. Gradation tests, as a minimum will be performed on the first day of concrete production and at least once every other day while production continues. At any point in the placement when the Contracting Officer's Representative determines that the concrete's properties may be affected by the aggregate gradations additional tests will be performed, without cost to the Government, as directed.

##### 3.6.2.2 Scales

The accuracy of the scales have been certified by the state or other public agency responsible for weights and measures within a period of one year prior to the start of concrete.

##### 3.6.2.3 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. A report shall be prepared indicating type and source of cement used, type and source of pozzolan 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.

#### 3.6.2.4 Concrete Mixture

a. Slump Testing: In addition to slump tests which shall be made when test specimens are fabricated, at least one slump test shall be made on randomly selected batches in accordance with ASTM C 143 for each separate concrete mixture produced during each 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.

b. Temperature: The temperature of the concrete shall be measured when compressive strength specimens, as described in Section 03300, paragraph 3.6.2.4 are fabricated. Measurement shall be in accordance with ASTM C 1064. The temperature shall be reported along with the compressive strength data. The Contractor shall also record the air, aggregate, fresh concrete and mixing water temperature. Any significant difference, in the opinion of the COR, between these recorded temperatures and the temperatures recorded during the casting of the Trial Units, shall be cause to measure the interior and exterior concrete temperature of the core-loc units using thermocouples as described in Section 03310, paragraph 3.3.1.

c. Compressive-Strength Specimens: At least one set of test specimens shall be made each day on each different concrete mixture placed during the day. Additionally, the strength tests shall represent no more than 100 cubic yards of concrete. 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 per paragraph DESIGN REQUIREMENTS shall consist of five (5) cylinders, two (2) to be tested at 7 days and two (2) at 28 days and one (1) held in reserve. Test specimens shall be molded and cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39. All compressive-strength test results 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 used. The charts shall be similar to those found in ACI 214.

#### 3.6.2.5 Inspection Before Placing

Foundation or construction joints and forms 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.

#### 3.6.2.6 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.

#### 3.6.2.7 Vibrators

a. Vibrator Testing and Use: The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and 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 (2) measurements shall be taken, one (1) 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.

#### 3.6.2.8 Curing

a. Moist-Curing Inspections: At least once each shift, and once per day on non-work days an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.

b. Moist-Curing Corrective Action: When a daily inspection

report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for 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 non-work 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.

### 3.6.3 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. 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.

### 3.7 PROTECTION OF ELEMENTS

Great care shall be exercised in the operation of construction equipment adjacent to the core-loc elements.

-- End of Section --