

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>			1. CONTRACT ID CODE <b>J</b>	PAGE OF PAGES <b>1   2</b>
2. AMENDMENT/MODIFICATION NO. <b>0002</b>	3. EFFECTIVE DATE <b>09-Jun-2003</b>	4. REQUISITION/PURCHASE REQ. NO. W22W9K-3113-0591	5. PROJECT NO.(If applicable)	
6. ISSUED BY CODE <b>DACA27</b>  USA ENGINEER DISTRICT, LOUISVILLE ATTN: CELRL-CT 600 DR. MARTIN LUTHER KING PLACE ROOM 821 LOUISVILLE KY 40202		7. ADMINISTERED BY (If other than item 6) CODE  <b>See Item 6</b>		
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)			<input checked="" type="checkbox"/>	9A. AMENDMENT OF SOLICITATION NO. <b>DACA27-03-B-0005</b>
			<input checked="" type="checkbox"/>	9B. DATED (SEE ITEM 11) <b>07-May-2003</b>
				10A. MOD. OF CONTRACT/ORDER NO.
				10B. DATED (SEE ITEM 13)
CODE		FACILITY CODE		
<b>11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS</b>				
<input checked="" type="checkbox"/> The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer <input type="checkbox"/> is extended, <input checked="" type="checkbox"/> is not extended.				
Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning <u>1</u> copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.				
12. ACCOUNTING AND APPROPRIATION DATA (If required)				
<b>13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.</b>				
A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.				
B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).				
C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:				
D. OTHER (Specify type of modification and authority)				
E. IMPORTANT: Contractor <input type="checkbox"/> is not, <input type="checkbox"/> is required to sign this document and return _____ copies to the issuing office.				
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) Solicitation No. DACA27-03-B-0005, Upgrade Aircraft Parking/Ramp, Johnstown Air Reserve Station, Johnstown, PA, is amended to provide clarifications from Amdt. #0001.  -The "Unit Price Schedule" referenced in Amdt. #0001 is deleted in its entirety. The bidding Schedule in Amdt. #0001 entitled "Revised Bidding Schedule", Page 7 of 7, containing three items under the Primary Facilities & three items under the Supporting Facilities is the pricing information you are required to submit with your bid. -Section 00800 is being reissued to include Para 1.56, Variation in Estimated Quantities, Subdivided Items which was inadvertently omitted from Amdt. #0001. -Section 02714 was inadvertently omitted from Amdt. #0001 and is attached -Section 02753 is attached and being reissued to clarify the document. -Sheet C-301 Drainage Schedule, Line 3, Invert Elevations should read 683.59. -Bid Opening Date and Time of 17 JUN 2003 at 2:00 PM Louisville Time remains unchanged.				
Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.				
15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)		
		TEL: _____ EMAIL: _____		
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED	
_____ (Signature of person authorized to sign)		BY _____ (Signature of Contracting Officer)	09-Jun-2003	

SECTION 00800

SPECIAL CLAUSES

10/02

AMENDMENT 1

PART 1 GENERAL

1.1 REFERENCES - NOT USED

1.2 SUBMITTALS

Government approval/acceptance 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

Small Tool Usage Plan ;

Labor, Equipment and Material Reports ; G, RE,

Pollution Prevention Plan ;

Updated Network Analysis ; G, RE

Quality Control Plan ; G, RE,

SD-05 Design Data

Equipment-in-Place List ;

Maintenance and Parts Data ;

SF1413 ;

Local Agency Check ;

Aggregate Sources ; G, RE

Purchase Orders ;

Notice of Soil Treatment ;

Progress Photographs ;

Waste Test Results Manifest ;

Site Plan ; G, RE

Dirt and Dust Control Plan ; G, RE

Construction and Demolition (C&D) Waste Management Plan ; G, RE

Activity Environmental Analysis ;

SD-07 Certificates

Warranties ;

Insurance ;

Updated Network Analysis ; G, RE

DA Form 3337 ; G, RE

SD-11 Closeout Submittals

As-Built Drawings ; G, RE

Mechanical Room Layout ; G, RE

Preliminary Network Analysis ; G, RE

Complete Network Analysis ; G, RE

Updated Network Analysis ; G, RE

1.3 COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK (APR 1984) FAR 52.211-10.

2 Jan 96 \*1

The Contractor shall be required to commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, prosecute said work diligently, and complete the entire work ready for use not later than **480** calendar days after date of receipt of notice to proceed. The time stated for completion shall include as-built drawings, O&M manuals, operational tests/reports/training/instructions, equipment lists, and final cleanup of the premises. \*1

1.4 LIQUIDATED DAMAGES--CONSTRUCTION (SEP 2000) FAR 52.211-12.

Oct 00

a. If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of \$1,800.00 for each calendar day of delay until the work is completed or accepted.

b. If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

1.5 TIME EXTENSIONS (SEPT 2000) FAR 52.211-13

Oct 00

Time extensions for contract changes will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The change order granting the time extension may provide that the contract completion date will be extended only for those specific elements related to the changed work and that the remaining contract completion dates for all other portions of the work will not be altered. The change order also may provide for an equitable readjustment of liquidated damages under the new completion schedule.

1.6 NOT USED

24 Feb 92

1.7 CONTRACT DRAWINGS AND SPECIFICATIONS (AUG 2000) DFARS 252.236-7001

19 Sept 2000

(May 2002)

a. At award, the Government will furnish the Contractor a compact disk containing all technical contract documents. This disk will include a complete set of drawing files and technical specification files which have all amendments incorporated. The disk will contain drawing files in CALS Type 4 format and technical specifications in PDF format.

The CALS files and the PDF files are being provided for the Contractor's use in printing hard copies of contract documents.

In addition, native CADD files and Specsintact files are provided in accordance with "AS-BUILT DOCUMENTS" paragraph for the Contractor's use in developing as-built plans and specifications.

b. The Contractor shall--

- (1) Check all drawings furnished immediately upon receipt;
- (2) Compare all drawings and verify the figures before laying out the work;
- (3) Promptly notify the Contracting Officer of any discrepancies;
- (4) Be responsible for any errors which might have been avoided by complying with paragraph (b); and
- (5) Reproduce and print contract drawings and specifications as needed.

c. Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

d. The work shall conform to the specifications and the contract drawings identified on the following index of drawings:

TABLE OF DRAWINGS

Drawing Code F-115-13-01

Drawing No.	Title (followed by drawing code if different from that shown above)	Latest Rev. No. & Date
GENERAL		
G-100	Cover Sheet	
G-200	Abbreviations	
G-300	Legends and Reference Symbology	
G-400	Haul Route	
G-500	Construction Phasing Plan	
GEOTECHNICAL		
B-100	Boring Location Plan	
B-101	Geologic Notes	
B-102	Boring Logs and Notes	
B-103	Boring Logs and Notes	
B-104	Boring Logs and Notes	
B-105	Boring Logs and Notes	
B-106	Boring Logs and Notes	
B-107	Boring Logs and Notes	
CIVIL		
C-001	Existing Site Plan	
C-100	Demolition Plan	
C-101	Demolition Plan	
C-200	Geometric Plan	
C-201	Pavement Layout	
C-202	Layout Plan	
C-203	Layout Plan	
C-204	Pavement Marking Plan	
C-205	Pavement Marking Plan	
C-206	Overall Pavement Plan	
C-207	Pavement and Elevation Plan	
C-208	Pavement and Elevation Plan	
C-209	Pavement and Elevation Plan	
C-210	Pavement and Elevation Plan	
C-211	Pavement and Elevation Plan	
C-212	Pavement and Elevation Plan	
C-213	Pavement and Elevation Plan	
C-214	Pavement and Elevation Plan	
C-215	Pavement and Elevation Plan	
C-216	Pavement and Elevation Plan	
C-217	Pavement and Elevation Plan	
C-218	Geometric Plan for C-5 Aircraft	
C-219	Layout and Pavement Marking Plan for C-5 Aircraft	
C-300	Grade and Drain Plan	

	C-301	Grade and Drain Plan
#1	<b>C-302</b>	<b>Grade and Drain Plan</b>
	C-400	Sediment and Erosion Control Plan
	C-401	Sediment and Erosion Control Plan
	C-500	Sediment and Erosion Control Notes
	C-501	Sediment and Erosion Control Details
	C-502	Sediment and Erosion Control Details
	C-503	Pavement Details
	C-504	Pavement Details
	C-505	Pavement Details
	C-506	Pavement Details
	C-507	Pavement Details
	C-508	Pavement Details
#1	<b>C-509</b>	<b>Details</b>

#### ELECTRICAL

	ED101	Electrical Demolition Site Plan
	EA101	Electrical Site Plan
	EA102	Electrical Site Grounding Plan
	EA103	Electrical Site Lighting Design
	EA501	Electrical Details
	EA502	Electrical Details
	EA503	Electrical Details

## 1.8 AS-BUILT DOCUMENTS3 NOVEMBER 1998

### 1.8.1 General.

This section covers the completion of **as-built drawings** and as-built specifications, as a requirement of the contract.

#### 1.8.1.1 As-Built Drawings

An as-built drawing is a construction drawing revised to reflect the final as-built conditions of the project because of modifications, changes, corrections to the project design required during construction, submittals and extensions of design. The terms "drawings," "contract drawings," "drawing files," "working as-built drawings" and "final as-built drawings" refer to contract drawings that are revised to be used for the "RECORD DRAWING AS-BUILTS".

#### 1.8.1.2 As-Built Specifications:

As-built specifications are the construction specifications as modified by changes (contract mods, ACO approved variations from the construction specifications which did not result in contract mods).

### 1.8.2 Maintenance of Working As-Built Drawings

The Contractor shall revise 2 sets of paper prints by red-line process to show the as-built conditions during the prosecution of the project. These as-built marked prints shall be kept current on a weekly basis and 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. Changes must be reflected on all sheets affected by the change. The working as-built marked prints will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor before submission of each monthly pay estimate. The working as-built drawings shall show the following information, but not be limited thereto:

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. Additional as-built information that exceeds the detail shown on the Contract Drawings. These as-built conditions include those that reflect structural details, fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations and layouts, equipment, sizes, mechanical room layouts and other extensions of design, that were not shown in the original contract documents because the exact details were not known until after the time of approved shop drawings. It is recognized that these shop drawing submittals (revised showing as-built conditions) will serve as the as-built record without actual incorporation into the contract drawings. All such shop drawing submittals must include, along with the hard copy of the drawings, CADD files of the shop drawings in a commercially available digital format, compatible with the Using Agency System (see paragraph "Computer Aided Design and Drafting (CADD) Drawings"). All shop drawings which require submittal of CADD files are indicated in the submittal register located at the end of this section.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Changes or modifications which result from the final inspection.

g. Where contract drawings or specifications present options, only the option selected for construction shall be shown on the final as-built prints.

h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, the Contractor shall furnish a contour map of the final borrow pit/spoil area elevations.

i. If fire protection and fire detection related systems are included in this project, the as-built drawings will include detailed information for all aspects of the systems including wiring, piping, and equipment drawings.

The Contractor will be provided files at the beginning of construction for use during the construction phase which are to be maintained during construction and for the preparation of as-builts. The Contractor shall enter changes and corrections on blue line prints on a weekly basis in accordance with Paragraph "Maintenance of Working As-Built Drawings" and update the CADD as-built drawings on a weekly basis. Both paper and electronic documents shall be available at all times and shall be provided promptly to the Contracting Officer when requested. The Contractor shall be responsible for backup of electronic files during construction and for controlling release of information.

### 1.8.3 Retainage

The Contractor shall include in his schedule of values, the cost of as-built document preparation. This value shall include all requirements of this clause:

- Maintenance of working as-built drawings
- Maintenance of working as-built specifications
- Conversion of submittals and other miscellaneous documents into electronic files
- Creation of "Record As-Built Drawings & Specifications" (either by CADD dwgs and Specsintact specifications or by manually prepared documents as specified herein.)
- Creation of a CD containing all required files.
- Submittal of as-built documents in the required media forms and numbers of copies

If the Contractor fails to maintain the working as-built drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of bringing the as-built documents up to date. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of working as-built documents.

### 1.8.4 Preliminary Submittal

Six (6) weeks before occupancy of this facility by the Government, the Contractor shall submit one (1) set of the original working as-built drawings to the Contracting Officer for review and approval. These working as-built marked drawings shall be neat, legible and accurate. The review by Government personnel will be expedited to the maximum extent possible. Upon approval, the working as-built marked drawings will be returned to the Contractor for use in preparation of final as-built drawings. If upon review, the working as-built marked drawings are found to contain errors and/or omissions, they will be returned to the Contractor for corrections. The Contractor shall complete the corrections and return the working as-built marked drawings to the Contracting Officer within 10 calendar days.

### 1.8.5 Preparation of Final As-Built Drawings

Upon approval of the working as-built prints submittal, the Contractor will be furnished, by the Government, one set of contract drawings in CADD (if not previously provided) with all amendments incorporated, to be used for final as-built drawings. These contract drawings will be furnished in the format specified in paragraph "Computer Aided Design and Drafting" (CADD).

These drawings shall be modified as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with approved working as-built prints, adding such additional drawings as may be necessary. These drawings are part of the permanent records of this project and the Contractor shall be responsible for the protection and safety thereof until returned to the Contracting Officer. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at no expense to the Government.

In the event the Contractor accomplishes additional work which changes the as-built conditions of the facility, after submission and approval of the working as-built drawings, he shall be responsible for the addition of these changes to the working as-built drawings and also to the final as-built documents.

#### 1.8.6 Markings and Indicators

Changes shall be annotated with a triangle and sequential number at the following locations:

- a. bottom of the revised detail
- b. right hand and bottom border aligned with the revised detail
- c. the revision block of the title block.

Separate markings shall be made for each modification negotiated into the contract.

#### 1.8.7 Preparation of Final As-Built Specifications

Final as-built specifications shall be prepared in Specsintact and the electronic files shall be placed on the same CD-ROM that contains the as-built CADD files, if applicable. The front sheet of the specifications shall contain an identification which clearly labels the specifications as representing as-built conditions and shall be dated with the date of the submittal.

#### 1.8.8 Preparation of Other As-Built Documents

All other non-electronic documents which may include design analysis, catalog cuts, certification documents that are not available in native electronic format shall be scanned and provided in an organized manner in Adobe .pdf format.

#### 1.8.9 Submittal of Final As-Built Documents

At the time of Beneficial Occupancy of the project, Final As-Built documents shall be provided to the Contracting Officer in the formats described in paragraph "Computer Aided Design and Drafting (CADD)".

#### 1.8.10 Partial Occupancy

For projects where portions of construction are to be occupied or activated before overall project completion, including portions of utility systems, as-built drawings for those portions of the facility being occupied or activated shall be supplied at the time the facility is occupied or activated. This same as-built information previously furnished must also be shown on the final set of as-built drawings at project completion.

#1 1.8.11 Computer Aided Design and Drafting (CADD) Drawings

Only personnel proficient in the preparation of CADD drawings (**Microstation J**) 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 to that of the originals. Line work, line weights, lettering, layering conventions, and symbols shall be the same as the original line work, 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 guidance specified for original drawings. Three dimensional (3D) elements shall be placed in files in their proper locations when using 3D files with spatially correct elements. 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 media files supplied by the Government. All work by the Contractor shall be done on files in the format in which they are provided. Translation of files to a different format, for the purpose of As-Built production, and then retranslating back to the format originally provided, will not be acceptable. These contract drawings will already be compatible with the Using Agency's system when received by the Contractor. The Using Agency uses Microstation J CADD software system. The media files will be supplied by the Contractor to the COR on ISO 9660 Format 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 all required corrections, changes, additions, and deletions.

a. 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 5 mm 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.

b. Revision markers defined in paragraph "Markings and Indicators" shall be placed as follows:

(1) at the detail, placed in the design file where the revised graphics are located and the revision was placed

(2) right hand and bottom border in the drawing sheet file  
revision block of the title block in the drawing sheet file.

c. After receipt by the Contractor of the approved working as-built prints and the original contract drawings files the Contractor shall, within 30 calendar days, make the final as-built submittal. This submittal shall consist of 2 sets of completed final as-built drawings on separate media consisting of both CADD files (compatible with the Using Agency's system on electronic storage media identical to that supplied by the Government) and Mylars; 2 blue line prints of these drawings and the return of the approved marked working as-built prints. 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 its CADD system.

All paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final as-built drawing files and marked prints as specified shall be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final as-built drawings shall be accomplished before final payment is made to the Contractor.

1.8.12 NOT USED

1.8.13 Payment

No separate payment will be made for as-built drawings required under this contract, and all costs in conjunction therewith, shall be considered a subsidiary obligation of the Contractor.

1.9 NOT USED

1.10 EQUIPMENT DATA

15 June 1990

Real Property Equipment.

Contractor shall be required to make an **Equipment-in-Place list** of all installed equipment furnished under this contract. This list shall include all information usually listed on manufacturer's name plate. The form is part of SPECIAL CLAUSES and is included following the SPECIAL CLAUSES, so to positively identify the piece of property. The list shall also include the cost of each piece of installed property F.O.B. construction site. For each of the items which is specified herein to be guaranteed for a specified period from the date of acceptance thereof, the following information shall be given: The name, serial and model number address of equipment supplier, or manufacturer originating the guaranteed item. The Contractor's guarantee to the Government of these items will not be limited by the terms of any manufacturer's guarantee to the Contractor. Furnish the list as one (1) reproducible and three (3) copies to the Contracting Officer thirty (30) calendar days before completion of any segment of the contract work which has an incremental completion date.

**Maintenance and Parts Data.**

The Contractor will be required to furnish a brochure, catalog cut, parts list, manufacturer's data sheet or other publication which will show detailed parts data on all other equipment subject to repair and maintenance procedures not otherwise required in Operations and Maintenance Manuals specified elsewhere in this contract. Distribution of directives shall follow the same requirements as listed in paragraph above.

1.11 PHYSICAL DATA (APR 1984) FAR 52.236-4.

2 January 1996

Data and information furnished or referred to below is furnished for the Contractor's information. The Government will not be responsible for any interpretation or conclusion drawn from the data or information by the Contractor.

Physical Conditions indicated on the drawings and in the specifications are the result of site investigations by surveys, borings, test pits and probings.

Weather Conditions. The Contractor shall make his own investigations as to weather conditions at the site. Data may be obtained from various National Weather Service offices located generally at airports of principal cities, the nearest to this project being: Johnstown, PA.

Historical data for all areas may be obtained from:

U. S. Department of Commerce  
National Climatic Center  
Federal Building  
Asheville, N. C. 28801

Transportation Facilities. Roads and railroads in the general area are shown on the drawings. Access ways shall be investigated by the Contractor to satisfy himself as to their existence and allowable use.

1.12 UTILITIES (APR 1984) FAR 52.236-14 (PARA. 1.12.A.(1) & 1.12.A.(2) ONLY).

15 June 1990

a. Availability and Use of Utility Services

(1) The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

b. Alterations to Utilities

Where changes and relocations of utility lines are noted to be performed by others, the Contractor shall give the Contracting Officer at least thirty (30) days written notice in advance of the time that the change or relocation is required. In the event that, after the expiration of thirty (30) days after the receipt of such notice by the Contracting Officer, such utility lines have not been changed or relocated and delay is occasioned to the completion of the work under contract, the Contractor will be entitled to a time extension equal to the period of time lost by the Contractor after the expiration of said thirty (30) day period. Any modification to existing or relocated lines required as a result of the Contractor's method of operation shall be made wholly at the Contractor's expense and no additional time will be allowed for delays incurred by such modifications.

c. Interruptions of Utilities

(1) No utility services shall be interrupted by the Contractor to make connections, to relocate, or for any purpose without approval of the Contracting Officer.

(2) Request for Permission to shut down services shall be submitted in writing to the Contracting Officer not less than seventeen (17) days before

date of proposed interruption. The request shall give the following information:

- (a) Nature of Utility (Gas, L.P. or H.P., Water, etc.)
- (b) Size of line and location of shutoff;
- (c) Buildings and services affected.
- (d) Hours and date of shutoff.
- (e) Estimated length of time services will be interrupted.

(3) Services shall not be shutoff until receipt of approval of the proposed hours and date from the Contracting Officer.

(4) Shutoffs which will cause interruption of Government work operations as determined by the Contracting Officer shall be accomplished during regular non-work hours or on non-work days of the Using Agency without any additional cost to the Government.

(5) Operation of valves on water mains will be by Government personnel. Where shutoff of water lines interrupts service to fire hydrants or fire sprinkler systems, the Contractor shall arrange his operations and have sufficient material and personnel available to complete the work without undue delay or to restore service without delay in event of emergency.

(6) Flow in gas mains which have been shut off shall not be restored until the Government inspector has determined that all items serviced by the gas line have been shut off.

1.13 NOT USED

1.14 NOT USED

1.15 LINES, GRADES AND LIMITS

15 June 1990

The Contractor shall be responsible for all layout required to properly control the work under this contract as determined by the Contracting Officer. The Contractor shall also furnish at his own expense, all string line, nails, and materials and labor as may be required in laying out the work.

20 Feb 2002

1.16 PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984) FAR 52.236-1

15 June 1990

Within 7 days after the award of any subcontract, either by himself or a subcontractor, the Contractor shall deliver to the Contracting Officer a completed SF 1413, "Statement and Acknowledgment." The form shall include the subcontractor's acknowledgement of the inclusion in his subcontract of the clauses of this contract entitled "Davis-Bacon Act," "Contract Work Hours and Safety Standards Act-Overtime Compensation," "Apprentices and Trainees," "Compliance with Copeland Regulations," "Withholding of Funds,"

"Subcontracts," "Contract Termination-Debarment," and "Payrolls and Basic Records." Nothing contained in this contract shall create any contractual relation between the subcontractor and the Government

#### 1.17 SUPERINTENDENCE OF SUBCONTRACTORS

24 February 1992

a. The Contractor shall be required to furnish the following, in addition to the superintendence required by CONTRACT CLAUSE: SUPERINTENDENCE BY THE CONTRACTOR.

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

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

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

#### 1.18 IDENTIFICATION OF EMPLOYEES.

15 June 1990

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

b. The Contractor is required to provide a **Local Agency Check** for each individual that will be working on this contract. See Paragraph "COMPLIANCE WITH POST/BASE REGULATIONS" for instructions.

#### 1.19 CONTRACTOR-PREPARED NETWORK ANALYSIS SYSTEM

24 February 1992

The progress chart to be prepared by the Contractor pursuant to the clause entitled "Schedules for Construction Contracts," shall consist of a network analysis system as described below. In preparing this system the scheduling of construction is the responsibility of the Contractor. The requirement for the system is included to assure adequate planning and execution of the work and to assist the Contracting Officer in appraising the reasonableness of the proposed schedule and evaluating progress of the work.

The system shall consist of diagrams and accompanying mathematical analyses. The diagrams shall show elements of the project in detail and the entire project in summary.

(1) Diagrams shall show the order and interdependence of activities and the sequence in which the work is to be accomplished as planned by the Contractor. The basic concept of a network analysis diagram will be followed to show how the start of a given activity is dependent on the completion of preceding activities and its completion restricts the start of following activities.

(2) Detailed network activities shown on a detailed or sub-network diagram shall include, in addition to construction activities, the submittal and approval of samples of materials and shop drawings, the procurement of critical materials and equipment, fabrication of special material and equipment and their installation and testing. All activities of the Government that affect progress and contract required dates for completion of all or parts of the work will be shown. The detail of information shall be such that duration times of activities will range from three (3) to thirty (30) days with not over two percent (2%) of the activities exceeding these limits. The activities which comprise the following separate buildings and features shall be separately identifiable by coding or use of sub-networks or both:

Building or feature .....

Minimum number of activities .....

The selection and number of activities shall be subject to the Contracting Officer's approval. Detailed networks, when summary networks are also furnished, need not be time scaled but shall be drafted to show a continuous flow from left to right with no arrows from right to left. The following information shall be shown on the diagrams for each activity: preceding and following event numbers, description of the activity, cost, and activity duration.

(3) Summary Network. If the project is of such size that the entire network cannot be readily shown on a single sheet, a summary network diagram shall be provided. The summary network diagram shall consist of a minimum of fifty activities and a maximum of one hundred and fifty activities, and shall be based on and supported by detailed diagrams. Related activities shall be grouped on the network. The critical path shall be plotted generally along the center of the sheet with channels with increasing float placed towards the top or bottom. The summary network shall be time scaled using units of approximately one-half inch equals one week or other suitable scale approved by the Contracting Officer. Weekends and holidays shall be indicated. Where slack exists, the activities shall be shown at the time when they are scheduled to be accomplished.

(4) The mathematical analysis of the network diagram shall include a tabulation of each activity shown on the detailed network diagrams. The following information will be furnished as a minimum for each activity:

(i) predecessor and successor activity identification (numbers shall be selected and assigned so as to permit identification of the activities with bid items):

(ii) activity description;

- (iii) estimated duration of activities (the best estimate available at time of computation);
- (iv) earliest start date (by calendar date);
- (v) earliest finish date (by calendar date);
- (vi) scheduled or actual start date (by calendar date);
- (vii) scheduled or actual finish date (by calendar date);
- (viii) latest start date (by calendar date);
- (ix) latest finish date (by calendar date);
- (x) slack or float;
- (xi) monetary value of activity;
- (xii) responsibility for activity (Prime Contractor, subcontractors, suppliers, Government, etc.);
- (xiii) manpower required;
- (xiv) percentage of activity completed;
- (xv) Contractor's earnings based on portion of activity completed; and
- (xvi) bid items of which activity is a part.

(5) The program or means used in making the mathematical computation shall be capable of compiling the total value of completed and partially completed activities and subtotals from separate buildings or feature listed in paragraph (2) above.

(6) In addition to the tabulation of activities, the computation will include the following data:

- (i) identification of activities which are planned to be expedited by use of overtime or double shifts to be worked including Saturdays, Sundays and holidays;

- (ii) on-site manpower loading schedule;

- (iii) a description of the major items of construction equipment planned for operations of the project. (The description shall include the type, number of units and unit capacities. A schedule showing proposed time equipment will be on the job keyed to activities on which equipment will be used shall be provided); and

- (iv) where portions of the work are to be paid by unit costs, the estimated number of units in an activity which was used in developing the total activity cost.

(7) The analysis shall list the activities in sorts or groups as follows:

- (i) by the preceding event number from lowest to highest and then in the order of the following event number;

- (ii) by the amount of slack, then in order of preceding event number;

- (iii) by responsibility in order of earliest allowable start dates; and

- (iv) in order of latest allowable start dates, then in order of preceding event numbers, and then in order of succeeding event numbers.

Submission and approval of the system shall be as follows:

(1) A preliminary network analysis defining the Contractor's planned operations during the first sixty (60) calendar days after notice to proceed will be submitted within ten (10) days. The Contractor's general approach for the balance of the project shall be indicated. Cost of activities expected to be completed or partially completed before submission and approval of the whole schedule should be included.

(2) The complete network analysis consist of the detailed network mathematical analysis (on-site manpower loading schedule, equipment schedule) and network diagrams shall be submitted within forty (40) calendar days after receipt of notice to proceed.

The Contractor shall participate in a review and evaluation of the proposed network diagrams and analysis by the Contracting Officer. Any revisions necessary as a result of this review shall be resubmitted for approval of the Contracting Officer within ten (10) calendar days after the conference. The approved schedule shall then be the schedule to be used by the Contractor for planning, organizing and directing the work and for reporting progress. If the Contractor thereafter desires to make changes in his method of operating and scheduling he shall notify the Contracting Officer in writing stating the reasons for the change. If the Contracting Officer considers these changes to be of a major nature he may require the Contractor to revise and submit for approval, without additional cost to the Government, all or the affected portion of the detailed diagrams and mathematical analysis and the summary diagram to show the effect on the entire project. A change may be considered of major nature if the time estimated to be required or actually used for an activity or the logic of sequence of activities is varied from the original plan to a degree that there is a reasonable doubt as to the effect on the contract completion date or dates. Changes which affect activities with adequate slack time shall be considered as minor changes, except that an accumulation of minor changes may be considered a major change when their cumulative effect might affect the contract completion date.

The Contractor shall submit at intervals of fifteen (15) calendar days a report of the actual construction progress by updating the mathematical analyses. Revisions causing changes in the detailed network shall be noted on the summary network, or a revised issue of affected portions of the detailed network furnished. The summary network shall be revised as necessary for the sake of clarity. However, only the initial submission or complete revisions need be time scaled. Subsequent minor revisions need not be time scaled.

The report shall show the activities or portions of activities completed during the reporting period and their total value as basis for the Contractor's periodic request for payment. Payment made pursuant to the General Provision entitled "Payments to Contractor" will be based on the total value of such activities completed or partially completed after verification by the Contracting Officer. The report will state the percentage of the work actually completed and scheduled as of the report date and the progress along the critical path in terms of days ahead or behind the allowable dates. If the project is behind schedule, progress along other paths with negative slack shall also be reported. The Contractor shall also submit a narrative report with the updated network analysis which shall include but not be limited to a description of the problem areas, current and anticipated, delaying factors and their impact, and an explanation of corrective actions taken or proposed.

Sheet size of diagrams shall be 30 by 42 inches. Each updated copy shall show a date of the latest revision.

Initial submittal and complete revisions shall be submitted in six (6) copies.

Periodic reports shall be submitted in four (4) copies.

1.20 WARRANTY OF CONSTRUCTION (MAR 1994) ALTERNATE 1 (APR 1984) FAR 52.246-211.

15 January 1998

a. General Requirements

(1) In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph 1.20.a.(10) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

(a) Warranty Payment: Warranty work is a subsidiary portion of the contract work, and has a value to the Government approximating 1% of the contract award amount. The Contractor will assign a value of that amount in the breakdown for progress payments mentioned in the Contract Clause: Payments Under Fixed-Price Construction Contracts. If the Contractor fails to respond to warranty items as provided in paragraph 1.20.5, the Government may elect to acquire warranty repairs through other sources and, if so, shall backcharge the Contractor for the cost of such repairs. Such backcharges shall be accomplished under the Changes Clauses of the contract through a credit modification(s).

(2) This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(3) The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

(a) The Contractor's failure to conform to contract requirements;

or

(b) Any defect of equipment, material, workmanship, or design furnished.

(4) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

(5) The Contracting Officer shall notify the Contractor, in writing, (see para. 1.20.b.(3) and 1.20.e) within a reasonable time after the discovery of any failure, defect, or damage.

(6) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, (see para. 1.20.5) the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(7) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(a) Obtain all warranties that would be given in normal commercial practice;

(b) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(c) Provide names, addresses, and telephone numbers of all subcontractors, equipment suppliers, or manufacturers with specific designation of their area of responsibilities if they are to be contacted directly on warranty corrections; and

(d) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

(8) In the event the Contractor's warranty under paragraph of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

(9) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

(10) This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

(11) Defects in design or manufacture of equipment specified by the Government on a "brand name and model" basis, shall not be included in this warranty. In this event, the Contractor shall require any subcontractors, manufacturers, or suppliers thereof to execute their warranties, in writing, directly to the Government.

b. Performance Bond

(1) The Contractor's Performance Bond will remain effective throughout the construction warranty period and warranty extensions.

(2) In the event the Contractor or his designated representative(s) fails to commence and diligently pursue any work required under this clause, and in a manner pursuant to the requirements thereof, the Contracting Officer shall have a right to demand that said work be performed under the Performance Bond by making written notice on the surety. If the surety fails or refuses to perform the obligation it assumed under the Performance Bond, the Contracting Officer shall have the work performed by others, and after completion of the work, may make demand for reimbursement of any or

all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

(3) Following oral or written notification of required warranty repair work, the Contractor will respond as dictated by para. 1.20.e. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor as outlined in the paragraph 1.20.b.(2) above.

c. 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 clause. Communication procedures for Contractor notification of 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 will furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warrantied construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of his responsibilities in connection with other portions of this provision.

d. Equipment Warranty Identification Tags

(1) The Contractor shall provide warranty identification tags on all Contractor and Government furnished equipment which he has installed.

(a) The tags shall be similar in format and size to the exhibits provided by this specification, they shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and they shall be installed in a position that is easily (or most easily) noticeable. Contractor furnished equipment that has differing warranties on its components will have each component tagged.

(b) Sample tags shall be submitted for Government review and approval. These tags shall be filled out representative of how the Contractor will complete all other tags.

(c) Tags for Warrantied Equipment: The tag for this equipment shall be similar to the following. Exact format and size will be as approved.

---

EQUIPMENT WARRANTY  
CONTRACTOR FURNISHED EQUIPMENT

MFG

MODEL NO.

SERIAL NO.

CONTRACT NO.

CONTRACTOR NAME

CONTRACTOR WARRANTY EXPIRES

MFG WARRANTY(IES) EXPIRE

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EQUIPMENT WARRANTY  
GOVERNMENT FURNISHED EQUIPMENT

MFG MODEL NO.

SERIAL NO.

CONTRACT NO.

DATE EQUIP PLACED IN SERVICE

MFG WARRANTY(IES) EXPIRE

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(d) If the manufacturer's name (MFG), model number and serial number are on the manufacturer's equipment data plate and this data plate is easily found and fully legible, this information need not be duplicated on the equipment warranty tag. The Contractor warranty expires (warranty expiration date) and the final manufacturer's warranty expiration date will be determined as specified by para. 1.20.1.

(2) Execution. The Contractor will complete the required information on each tag and install these tags on the equipment by the time of and as a condition of final acceptance of the equipment.

(3) Payment. The work outlined above is a subsidiary portion of the contract work, and has a value to the Government approximating 5% of the value of the Contractor furnished equipment. The Contractor will assign a value of that amount in the breakdown for progress payments mentioned in the Contract Clause: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS.

(4) Equipment Warranty Tag Replacement. As stated in para. 1.20.1.4, the Contractor's warranty with respect to work repaired or replaced shall run for one year from the date of repair or replacement. Such activity shall include an updated warranty identification tag on the repaired or replaced equipment. The tag shall be furnished and installed by the Contractor, and shall be identical to the original tag, except that the Contractor's warranty expiration date will be one year from the date of acceptance of the repair or replacement.

e. Contractor's Response to Warranty Service Requirements. Following oral or written notification by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, the Contractor shall respond to warranty service requirements in

accordance with the "Warranty Service Priority List" and the three categories of priorities listed below.

First Priority Code 1 Perform on site inspection to evaluate situation, determine course of action, initiate work within 24 hours and work continuously to completion or relief.

Second Priority Code 2 Perform on site inspection to evaluate situation, determine course of action, initiate work within 48 hours and work continuously to completion or relief.

Third Priority Code 3 All other work to be initiated within 5 work days and work continuously to completion or relief.

The "Warranty Service Priority List" is as follows:

Code 1 Air Traffic Control and Air Navigation Systems and Equipment.

Code 1 Doors  
a. Overhead doors not operational.

Code 1 Electrical  
a. Power failure (entire area or any building operational after 1600 hours).  
b. Traffic control devices.  
c. Security lights.

Code 2 Electrical  
a. Power failure (no power to a room or part of building).  
b. Receptacle and lights.  
c. Fire alarm systems.

Code 1 Gas  
a. Leaks and breaks.

Code 1 Heat  
d. Area power failure affecting heat.

Code 1 Intrusion Detection Systems  
Finance, PX and Commissary, and high security areas.

Code 2 Intrusion Detection Systems  
Systems other than those listed under Code 1.

Code 2 Water (Exterior)  
No water to facility.

(1) Should parts be required to complete the work and the parts are not immediately available, the Contractor shall have a maximum of 12 hours after arrival at the job site to provide the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, with firm written proposals for emergency alternatives and temporary repairs for Government participation with the Contractor to provide emergency relief until the required parts are available on site for the Contractor to perform permanent warranty repair. The Contractors proposals shall include a firm date and time that the required parts shall be available on site to complete the permanent warranty repair. The

Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, will evaluate the proposed alternatives and negotiate the alternative considered to be in the best interest of the Government to reduce the impact of the emergency condition. Alternatives considered by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer will include the alternative for the Contractor to "Do Nothing" while waiting until the required parts are available to perform permanent warranty repair. Negotiating a proposal which will require Government participation and the expenditure of Government funds shall constitute a separate procurement action by the using service.

1.21 NOT USED

1.22 NOT USED

1.23 SALVAGE MATERIALS AND EQUIPMENT.

24 February 1992

The Contractor shall maintain adequate property control records for all materials or equipment specified in Section 02220 to be salvaged. These records may be in accordance with the Contractor's system of property control, if approved by the property administrator. The Contractor shall be responsible for the adequate storage and protection of all salvaged materials and equipment and shall replace, at no cost to the Government, all salvage materials and equipment which are broken or damaged during salvage operations as the result of his negligence, or while in his care.

1.24 NOT USED

1.25 NOT USED

1.26 PROJECT SIGN

1 August 1996

General. The Contractor shall furnish and erect at the location directed one project sign.

Exact placement location will be designated by the Contracting Officer. The panel sizes and graphic formats have been standardized for visual consistency throughout all Corps operations.

Panels are fabricated using HDO plywood with dimensional lumber uprights and bracing.

All legends are to be painted in the sizes and styles as specified by the graphic formats shown at the end of this section. The signs (including back and edges), posts and braces shall be given two coats of Benjamin Moore No. 120-60 poly-silicone enamel or approved equal before lettering. The 4' x 4' right section of the project sign shall be white with black lettering. The upper 2' x 2' left section of the project sign shall be communication red (CR) with white lettering. The lower 2' x 2' left section of the project sign shall be black with white lettering (matching local sponsor's colors). Paint colors shall be as follow:

Black -	Federal Standard 595a	Color Number 27038
White -	Federal Standard 595a	Color Number 27875

Red - PANTONE 032

An example of the sign including mounting and fabrication details are also provided at the end of this section.

Name of the project shall be as follows:

Upgrade Aircraft Parking/Ramp  
Johnstown, PA

Name of the designer shall be as follows:

The Mason & Hanger Group, Inc.  
300 West Vine Street  
Suite 1300  
Lexington, KY 40507

Name of local sponsor shall be as follows:

99th RSC  
99 Soldiers Lane  
Coroapolis, PA

Erection and Maintenance.

a. The signs shall be erected at the designated location(s). Signs shall be plumb and backfill of post holes shall be well tamped to properly support the signs in position throughout the life of the contract. The signs shall be maintained in good condition until completion of the contract, shall remain the property of the Contractor, and shall be removed from the site upon completion of work under the contract.

b. The Corps of Engineers logo and the local sponsor's logo will be provided by the Contracting Officer.

Payment. No separate payment will be made for furnishing and erecting the project signs as specified and costs thereof shall be considered a subsidiary obligation of the Contractor.

#### 1.27 NOT USED

#### 1.28 WAGE RATES

1 February 1995

The decision of the Secretary of Labor, covering rates of wages, including fringe benefits to be paid laborers and mechanics performing work under this contract, is attached hereto. The payment for all classes of laborers and mechanics actually employed to perform work under the contract will be specified in the following contract clauses: DAVIS-BACON ACT, CONTRACT WORK HOURS AND SAFETY STANDARDS ACT, and THE COPELAND ACT.

Wage decisions included are: PA020004

### 1.29 PURCHASE ORDERS

15 June 1990

Five copies of all purchase orders, for items requiring shop inspection, showing firm names and addresses, shall be submitted to the Contracting Officer when orders for materials are placed. Orders shall be so worded or marked that each item, piece or member can be definitely identified on the drawings. Purchase prices are not necessary and may be obliterated from the copies of the purchase orders furnished.

### 1.30 INTERFERENCE WITH TRAFFIC AND PUBLIC AND PRIVATE PROPERTY.

15 June 1990

a. The Contractor at all times shall dispose his plant and conduct the work in such manner as to cause as little interference as possible with private and public travel. Damage (other than that resulting from normal wear and tear) to roads, shall be repaired to as good a condition as they were prior to the beginning of work and to the satisfaction of the Contracting Officer.

b. The Contractor shall provide and maintain as may be required by the State of Pennsylvania, Department of Transportation, proper barricades, fences, danger signals and lights, provide a sufficient number of watchmen, and take such other precautions as may be necessary to protect life, property and structures, and shall be liable for and hold the Government free and harmless from all damages occasioned in any way by his act or neglect, or that of his agents, employees, or workmen.

### 1.31 SEQUENCE OF WORK.

15 September 1995

SCHEDULING OR WORK DURING THE PERIOD 18 DECEMBER THROUGH 1 JANUARY MUST BE APPROVED BY OCCUPANTS. THE GOVERNMENT GIVES NO ASSURANCE OF SMOOTH WORK FLOW DURING THIS TIME. THERE ARE SIGNIFICANT NUMBERS OF OCCUPANTS ON LEAVE AND AWAY FROM QUARTERS AND OTHERS WHO WISH TO NOT BE DISTURBED DURING THIS PERIOD DUE TO FAMILY OBLIGATIONS. ANY ATTEMPT TO SCHEDULE WORK DURING THIS PERIOD IS AT THE CONTRACTOR'S RISK.1.32 GOVERNMENT FIELD OFFICE FACILITIES AND SERVICES.

1 August 1996

#### 1.32.1 Resident Engineer's Office

The Contractor shall provide the Government Resident Engineer with an office, approximately 18.58 sm in floor area, located where directed, and providing space heat, air conditioning, electric light and power, toilet facilities consisting of one lavatory and one water closet complete with connections to water and sewer mains. A mail slot shall be provided in the door, or an apartment-type lockable mail box mounted on the surface of the door. At completion of the project, the office shall remain the property of the Contractor and shall be removed from the site. All utility connections shall be connected and disconnected in accordance with local codes and to the satisfaction of the Contracting Officer. If a window style air conditioner is used then the refrigerant shall be one of the fluorocarbon gases that is in accordance with FS BB-F-1421 and has an Ozone Depletion Potential (ODP) of less than or equal to 0.05. Provide air conditioning, drawing rack, drawing table, conference table, 2 desks or desk spaces, chairs, one legal size four drawer filing cabinet, plain paper fax (access to Contractor's is acceptable),

copier with duplex (access to Contractor's is acceptable), phone service (2 lines including local and long distance service), drinking water cooler with service, weekly janitorial service.1.32.2 Trailer-Type Mobile Office (Contractor's Option)

In lieu of constructing, maintaining and, at end of construction period, removing a temporary type field office, the Contractor may, at his option, furnish and maintain a trailer-type mobile office acceptable to the Contracting Officer and providing as a minimum the facilities specified above. The trailer shall be securely anchored to the ground at all four corners to guard against movement during high winds.

### 1.33 COMPLIANCE WITH POST/BASE REGULATIONS.

1 August 1996

a. The site of the work is on a military reservation and all rules and regulations issued by the Commanding Officer covering general safety, security, sanitary requirements, pollution control and traffic regulations, shall be observed by the Contractor. Information regarding these requirements may be obtained by contacting the Contracting Officer, who will provide such information or assist in obtaining same from appropriate authorities.

b. Contractor personnel shall park only in areas authorized by the Contracting Officer.

### 1.34 EQUIPMENT AND OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995)

EFAR 52.231-5000.

20 March 1997

a. This does not apply to terminations. See 52.249-5000, Basis for Settlement of Proposals and FAR Part 49.

b. Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region I. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the Contracting Officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time of negotiations shall apply.

c. Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under

common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

d. When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the Contracting Officer shall request the Contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Cover Sheet.

e. Whenever a modification or equitable adjustment of contract price is required, the contractor's cost proposals for equipment ownership and operating expenses shall be determined in accordance with the requirements of SPECIAL CONTRACT REQUIREMENT: EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE. A copy of EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule" is available for review at the office of the District Engineer, Room 821, 600 Dr. Martin Luther King, Jr. Place, Louisville, Kentucky, or a copy may be ordered from the Government Printing Office at a cost of \$11.00 by calling telephone no. (301) 953-7974.

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### 1.35 LABOR, EQUIPMENT, AND MATERIAL REPORTS

15 June 1990

Daily Equipment Report. The Contractor shall submit a daily report of all Contractor-owned or rented equipment at the jobsite. A similar report is required for all subcontractor equipment. The subcontractor's report may be separate or included with the Contractor's report provided the equipment is adequately identified as to ownership. The required equipment report shall include each item of equipment (hand-operated small tools or equipment excluded) on the job and shall specifically identify each item as to whether it is Contractor-owned or rented, shifts, hours of usage, down time for repairs, and standby time. Identification of the equipment shall include make, model and plant number of all items. Separate identification by a key sheet providing these data may be utilized with the daily report indicating the type of equipment and the equipment plant numbers. The format of the Daily Equipment Report will be as approved by the Government in the field.

Labor, Equipment & Material Reports for Extra Work/Cost. A Report shall also be submitted by the Contractor listing any labor, equipment and materials expended on and/or impacted by any change order directed by the Government and for which total price/time agreement has not been reached. These requirements also apply to subcontractors at any tier. The same Report is required at any time the Contractor claims or intends to claim for extra costs whether or not there is Government recognition (constructive changes). This requirement is in addition to any Contractor "Notice" or "Reservation of Rights". Submittal of such a report will not be construed as satisfying the "Notice" required under the "Changes" clause or any other clause. But, absence of such Reports submitted to the Government contemporaneously with the alleged extra work/cost will be considered as evidence that no such extra work/cost occurred that are chargeable to the Government.

The Report shall be detailed to the degree required by the Government in the field and shall contain the following as a minimum:

- a. The cause of the extra labor, equipment or materials costs.
- b. For extra labor - Indicate crew, craft, hours, location and cost. Describe nature or type of extra costs, i.e, extra work, overtime, acceleration, interference, reassignment, mobilizations and demobilizations, supervision, overhead, type of inefficiency, etc.
- c. For extra equipment - Indicate type and description, hours, location, cost; whether working, idle, standby, under repair, extra work involved, etc.
- d. For extra materials - Indicate type and description, where used, whether consumed, installed or multi-use, quantity, cost, extra work involved, etc.
- e. Affected activities - Relate to Contract Schedule (Network Analysis); demonstrate whether delay or suspension is involved.
- f. Segregate all entries by prime and each subcontractor.
- g. Summarize costs daily and by cumulative subtotal or with frequency required by the Government.

This report will not be considered as evidence that any of the alleged extra costs actually occurred. The report will be used to check against over obligation of funds for change orders directed prior to price/time agreement and to track alleged extra costs the Contractor considers otherwise chargeable against the Government. The Government may respond at any interval to either challenge, amend or confirm the report. Absence of a Government response is not to be considered acquiescence or denial. The Government may order work stoppage if deemed necessary to avoid overobligation of funds. The frequency of the report shall be daily or as otherwise approved by the Government representative in writing.

1.36 NOT USED

1.37 NOT USED

1.38 NOT USED

1.39 PROGRESS PHOTOGRAPHS

18 Nov 1999)

The Contractor shall, during the progress of the work, furnish the Contracting Officer digital photos (furnished on CD-ROM) depicting construction progress. The photographic work furnished shall be commercial quality as determined by the Contracting Officer. The photography shall be performed between the first and fifth of each month and the photographs, delivered to the Contracting Officer not later than the 15th of each month taken. A maximum of six views from different positions shall be taken as directed to show, inasmuch as possible, work accomplished during the previous month. At least one set of photographs will be made at completion of the contract, after final inspection by the Contracting Officer. Each photograph shall be identified on the face of the picture or the border of the slide giving date made, contract title and number, location of work, as well as a brief description of work depicted. No separate payment will be made for these services and all costs in connection thereto shall be considered a subsidiary obligation of the Contractor.

1.40 NOT USED

1.41 INSURANCE --WORK ON A GOVERNMENT INSTALLATION (SEP 1989) FAR 52.228-5.

17 July 1992

The Contractor shall, at its own expense, provide and maintain during the entire performance of this contract at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

(1) Coverage complying with State laws governing insurance requirements, such as those requirements pertaining to Workman's Compensation and Occupational Disease Insurance. Employer's Liability Insurance shall be furnished in limits of not less than \$100,000.00 except in states with exclusive or monopolistic funds.

(2) Comprehensive General Liability Insurance for bodily injury coverage shall be furnished in limits of not less than \$500,000 per occurrence.

(3) Comprehensive Automobile Liability Insurance for both bodily injury and property damage, shall be furnished in limits of not less than \$200,000.00 per person, \$500,000.00 per accident for bodily injury, and \$20,000.00 per accident for property damage. When the Financial Responsibility or Compulsory Insurance Law of the State, requires higher limits, the policy shall provide for coverage of at least those higher limits.

Before commencing work under this contract, the Contractor shall submit to the Contracting Officer in writing that the required insurance certification has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribe, or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

The Contractor shall insert the substance of this clause, including this paragraph, in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

1.42 IMPLEMENTATION OF GOVERNMENT RESIDENT MANAGEMENT SYSTEM

March 2002

RMS shall be maintained in accordance with Section 01312A QUALITY CONTROL SYSTEM (QCS).

1.43 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER. ER 415-1-15

(31 OCT 89)

2 January 1991

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

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

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

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

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY  
WORK DAYS BASED ON (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
(16)	(13)	(08)	(06)	(05)	(04)	(04)	(04)	(04)	(04)	(07)	(13)

Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated listed above, the

Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract clause entitled "Default (Fixed Price Construction)".

1.44 USE OF INCLINOMETER FOR LONG BED DUMP TRUCKS (DACF BULLETIN 25 MARCH 1993)

4 June 1993

The recommendation of EM 385-1-1, Section 16.B.15, is mandatory for this project.

1.45 AVAILABILITY OF SAFETY AND HEALTH REQUIREMENTS MANUAL (EM 385-1-1).

17 May 2000

As covered by CONTRACT CLAUSE "ACCIDENT PREVENTION", compliance with EM 385-1-1 is a requirement for this contract. Copies may be purchased for \$31.00 each at the following address:

United States Government Bookstore  
Room 118, Federal Building  
1000 Liberty Avenue  
Pittsburgh, PA 15222-4003  
Telephone: (412) 395-5021 FAX: (412) 395-4547

Or downloaded from the following website:

<http://www.usace.army.mil/inet/usace-docs/eng-manuals/em385-1-1/toc.htm>

1.46 FIRE PROTECTION DURING CONSTRUCTION (MIL-HDBK-1008C PARA. 1.6)

15 April 1991

The Contractor is alerted to the requirements of Contract Clause "CLEANING UP" and more specifically to the requirements for fire protection during construction spelled out in EM 385-1-1 and NFPA No. 241 Building Construction and Demolition Operations. This item must be covered in the submittal required under Contract Clause "ACCIDENT PREVENTION".

1.47 HAUL ROADS

2 Jan 1996

Whenever practical, one-way haul roads shall be used on this contract. Haul roads built and maintained for this work shall comply with the following:

a. One-way haul roads for off-the road equipment; e.g., belly dumps, scrapers, and off-the-road trucks shall have a minimum usable width of 25 ft. One-way haul roads for over-the-road haulage equipment only (e.g., dump trucks, etc.) may be reduced to a usable width of 15 ft. When the Contracting Officer determines that it is impractical to obtain the required width for one-way haul roads (e.g., a road on top of a levee), a usable width of not less than 10 ft. may be approved by the Contracting Officer, provided a positive means of traffic control is implemented. Such positive means shall be signs, signals, and/or signalman and an effective means of speed control.

b. Two-way haul roads for off-the-road haulage equipment shall have a usable width of 60 ft. Two-way haul roads for over-the-road haulage equipment only may be reduced to a usable width of 30 ft.

c. Haul roads shall be graded and otherwise maintained to keep the surface free from potholes, ruts, and similar conditions that could result in unsafe operation.

d. Grades and curves shall allow a minimum sight distance of 200 ft. for one-way roads and 300 ft. for two-way roads. Sight distance is defined as the centerline distance an equipment operator (4.5 ft. above the road surface) can see an object 4.5 ft. above the road surface. When conditions make it impractical to obtain the required sight distance (e.g., ramps over levees), a positive means of traffic control shall be implemented.

e. Dust abatement shall permit observation of objects on the roadway at a minimum distance of 300 ft.

f. Haul roads shall have the edges of the usable portion marked with posts at intervals of 50 ft. on curves and 200 ft. maximum elsewhere. Such markers shall extend 6 ft. above the road surface and, for nighttime haulage, be provided with reflectors in both directions.

1.48 NOT USED

1.49 NOT USED

#### 1.50 CONSTRUCTION HAZARD COMMUNICATION

1 November 1991

The Contractor is required to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1926.59). This standard is designed to inform workers of safe and appropriate methods of working with hazardous substances in the workplace. The standard has five requirements, and every hazardous or potentially hazardous substance used or stored in the work area is subject to all five. They are:

(1) Hazard Evaluation. Any company which produces or imports a chemical or compound must conduct a hazard evaluation of the substance to determine its potential health or physical hazard. The hazard evaluation consists of an investigation of all the available scientific evidence about the substance. The Contractor is required to assure that all producers (manufacturer/distributors) have performed these evaluations and transmit the required information with any hazardous materials being used or stored on the project site. From the hazard evaluation, a substance may be classified as a health hazard, or a physical hazard. These classifications are then further broken down according to type:

##### Health Hazards

Carcinogens  
Irritants  
Sensitizers  
Corrosives  
Toxic substances  
Highly toxic  
substances

##### Physical Hazards

Combustible liquids  
Compressed gases  
Explosives  
Flammables  
Organic peroxides  
Unstable substances  
Water-reactive

Substances harmful to specific organs or parts of the body substances

(2) Warning Labels. If a chemical is hazardous or potentially hazardous, the producer or importer must affix a warning label to every container of that chemical before it leaves his facility. The Contractor must assure these labels are attached and legible. The label must identify the chemical, state the hazard, and give the name and address of the producer or importer. If the hazardous substance is transferred to another container, that container must then be labeled, tagged, or marked with the name of the chemical and the appropriate hazard warning. Warning labels should be replaced immediately if they are defaced or removed.

(3) Material Safety Data Sheets. The producer or importer must also supply a material safety data sheet (MSDS). The Contractor must keep these available in the work area where the substance is used, so that the people using the substance can easily review important safety and health information, such as:

The hazard possible from misuse of the substance  
Precautions necessary for use, handling, and storage  
Emergency procedures for leaks, spills, fire and first aid  
Useful facts about the substance's physical or chemical properties

(4) Work Area Specific Training. Because of hazardous substance may react differently depending on how it is used or the environment of the work area, the Contractor must conduct work area specific training; special training which takes the Contractor's operations, environment, and work policies into consideration. Work area training presents:

The hazardous substances which are present in the work place and the hazards they pose

Ways to protect against those hazards, such as protective equipment, emergency procedures, and safe handling

Where the MSDS's are kept, and an explanation of the labeling system  
Where the Contractor's written Hazard Communication Program is located

(5) The Written Hazard Communication Program. In accordance with OSHA requirements, the Contractor must prepare a written Hazard Communication Program. This document will be included in the Contractor's Accident Prevention Plan. This document states how the Contractor plans to ensure that hazardous materials are appropriately labeled, how and where MSDS's will be maintained, and how employees will be provided with specific information and training.

1.51 NOT USED

1.52 NOT USED

1.53 RIGHTS IN TECHNICAL DATA--NONCOMMERCIAL ITEMS (NOV 1995)  
252.227-7013 (JUN 1995).  
20 March 1997

(a) Definitions. As used in this clause:

(1) "Computer data base" means a collection of data recorded in a form capable of being processed by a computer. The term does not include computer software.

(2) "Computer program" means a set of instructions, rules, or routines recorded in a form that is capable of causing a computer to perform a specific operation or series of operations.

(3) "Computer software" means computer programs, source code, source code listings, object code listings, design details, algorithms, processes, flow charts, formulae and related material that would enable the software to be reproduced, recreated, or recompiled. Computer software does not include computer data bases or computer software documentation.

(4) "Computer software documentation" means owner's manuals, user's manuals, installation instructions, operating instructions, and other similar items, regardless of storage medium, that explain the capabilities of the computer software or provide instructions for using the software.

(5) "Detailed manufacturing or process data" means technical data that describe the steps, sequences, and conditions of manufacturing, processing or assembly used by the manufacturer to produce an item or component or to perform a process.

(6) "Developed" means that an item, component, or process exists and is workable. Thus, the item or component must have been constructed or the process practiced. Workability is generally established when the item, component, or process has been analyzed or tested sufficiently to demonstrate to reasonable people skilled in the applicable art that there is a high probability that it will operate as intended. Whether, how much, and what type of analysis or testing is required to establish workability depends on the nature of the item, component, or process, and the state of the art. To be considered "developed," the item, component, or process need not be at the stage where it could be offered for sale or sold on the commercial market, nor must the item, component, or process be actually reduced to practice within the meaning of Title 35 of the United States Code.

(7) "Developed exclusively at private expense" means development was accomplished entirely with costs charged to indirect cost pools, costs not allocated to a government contract, or any combination thereof.

(i) Private expense determinations should be made at the lowest practicable level.

(ii) Under fixed-priced contracts, when total costs are greater than the firm-fixed-price or ceiling price of the contract, the additional development costs necessary to complete development shall not be considered when determining whether development was at government, private, or mixed expense.

(8) "Developed exclusively with government funds" means development was not accomplished exclusively or partially at private expense.

(9) "Developed with mixed funding" means development was accomplished partially with costs charged to indirect cost pools and/or costs not allocated to a government contract, and partially with costs charged directly to a government contract.

(10) "Form, fit, and function data" means technical data that describes the required overall physical, functional, and performance characteristics (along with the qualification requirements, if applicable) of an item, component, or process to the extent necessary to permit identification of physically and functionally interchangeable items.

(11) "Government purpose" means any activity in which the United States Government is a party, including cooperative agreements with international or multi-national defense organizations, or sales or transfers by the United States Government to foreign governments or international organizations. Government purposes include competitive procurement, but do not include the rights to use, modify, reproduce, release, perform, display, or disclose technical data for commercial purposes or authorize others to do so.

(12) "Government purpose rights" means the right to--

(i) Use, modify, reproduce, release, perform, display, or disclose technical data within the Government without restrictions; and

(ii) Release or disclose technical data outside the Government and authorize persons to whom release or disclosure has been made to use, modify, reproduce, release, perform, display, or disclose that data for United States government purposes.

(13) "Limited rights" means the rights to use, modify, reproduce, release, perform, display, or disclose technical data, in whole or in part, within the Government. The Government may not, without the written permission of the party asserting limited rights, release or disclose the technical data outside the Government, use the technical data for manufacture, or authorize the technical data to be used by another part, except that the Government may reproduce, release or disclose such data or authorize the use or reproduction of the data by persons outside the Government if reproduction, release, disclosure, or use is--

(i) Necessary for emergency repair and overhaul; or

(ii) A release or disclosure of technical data (other than detailed manufacturing or process data) to, or use of such data by, a foreign government that is in the interest of the Government and is required for evaluational or informational purposes;

(iii) Subject to a prohibition on the further reproduction, release, disclosure, or use of the technical data; and

(iv) The contractor or subcontractor asserting the restriction is notified of such reproduction, release, disclosure, or use.

(14) "Technical data" means recorded information, regardless of the form or method of the recording, of a scientific or technical nature (including computer software documentation). The term does not include

computer software or data incidental to contract administration, such a financial and/or management information.

(15) "Unlimited rights" means rights to use, modify, reproduce, perform, display, release, or disclose technical data in whole or in part, in any manner, and for any purpose whatsoever, and to have or authorize others to do so.

(b) Rights in technical data.

The Contractor grants or shall obtain for the Government the following royalty free, world-wide, nonexclusive, irrevocable license rights in technical data other than computer software documentation (see Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation clause of this contract for rights in computer software documentations):

(1) Unlimited rights.

The Government shall have unlimited rights in technical data that are--

(i) Data pertaining to an item, component, or process which has been or will be developed exclusively with Government funds;

(ii) Studies, analyses, test data, or similar data produced for this contract, when the study, analysis, test, or similar work was specified as an element of performance;

(iii) Created exclusively with Government funds in the performance of a contract that does not require the development, manufacture, construction, or production of items, components, or processes;

(iv) Form, fit, and function data;

(v) Necessary for installation, operation, maintenance, or training purposes (other than detailed manufacturing or process data);

(vi) Corrections or changes to technical data furnished to the Contractor by the Government;

(vii) Otherwise publicly available or have been released or disclosed by the Contractor or subcontractor without restrictions on further use, release or disclosure, other than a release or disclosure resulting from the sale, transfer, or other assignment of interest in the technical data to another party or the sale or transfer of some or all of a business entity or its assets to another party;

(viii) Data in which the Government has obtained unlimited rights under another Government contract or as a result of negotiations; or

(ix) Data furnished to the Government, under this or any other Government contract or subcontract thereunder, with--

(A) Government purpose license rights or limited rights and the restrictive condition(s) has/have expired; or

(B) Government purpose rights and the Contractor's exclusive right to use such data for commercial purposes has expired.

(2) Government purpose rights.

(i) The Government shall have government purpose rights for a five-year period, or such other period as may be negotiated, in technical data--

(A) That pertain to items, components, or processes developed with mixed funding except when the Government is entitled to unlimited rights in such data as provided in paragraphs (b)(ii) and (b)(iv) through (b)(ix) of this clause; or

(B) Created with mixed funding in the performance of a contract that does not require the development, manufacture, construction, or production of items, components, or processes.

(ii) The five-year period, or such other period as may have been negotiated, shall commence upon execution of the contract, subcontract, letter contract (or similar contractual instrument), contract modification, or option exercise that required development of the items, components, or processes or creation of the data described in paragraph (b)(2)(i)(B) of this clause. Upon expiration of the five-year or other negotiated period, the Government shall have unlimited rights in the technical data.

(iii) The Government shall not release or disclose technical data in which it has government purpose rights unless--

(A) Prior to release or disclosure, the intended recipient is subject to the non-disclosure agreement at 227.7103-7 of the Defense Federal Acquisition Regulation Supplement (DFARS); or

(B) The recipient is a Government contractor receiving access to the data for performance of a Government contract that contains the clause at DFARS 252.227-7025, Limitations on the Use or Disclosure of Government-Furnished Information Market with Restrictive Legends.

(iv) The Contractor has the exclusive right, including the right to license others, to use technical data in which the Government has obtained government purpose rights under this contract for any commercial purpose during the time period specified in the government purpose rights legend prescribed in paragraph (f)(2) of this clause.

(3) Limited rights.

(i) Except as provided in paragraphs (b)(1)(ii) and (b)(1)(iv) through (b)(1)(ix) of this clause, the Government shall have limited rights in technical data--

(A) Pertaining to items, components, or processes developed exclusively at private expense and marked with the limited rights legend prescribed in paragraph (f) of this clause; or

(B) Created exclusively at private expense in the performance of a contract that does not require the development, manufacture, construction, or production of items, components, or processes.

(ii) The Government shall require a recipient of limited rights data for emergency repair or overhaul to destroy the data and all copies in its possession promptly following completion of the emergency repair/overhaul and to notify the Contractor that the data have been destroyed.

(iii) The Contractor, its subcontractors, and suppliers are not required to provide the Government additional rights to use, modify, reproduce, release, perform, display, or disclose technical data furnished to the Government with limited rights. However, if the Government desires to obtain additional rights in technical data in which it has limited rights, the Contractor agrees to promptly enter into negotiations with the Contracting Officer to determine whether there are acceptable terms for transferring such rights. All technical data in which the Contractor has granted the Government additional rights shall be listed or described in a license agreement made part of the contract. The license shall enumerate the additional rights granted the Government in such data.

(4) Specifically negotiated license rights.

The standard license rights granted to the Government under paragraphs (b)(1) through (b)(3) of this clause, including the period during which the Government shall have government purpose rights in technical data, may be modified by mutual agreement to provide such rights as the parties consider appropriate but shall not provide the Government lesser rights than are enumerated in paragraph (a)(13) of this clause. Any rights so negotiated shall be identified in a license agreement made part of this contract.

(5) Prior government rights.

Technical data that will be delivered, furnished, or otherwise provided to the Government under this contract, in which the Government has previously obtained rights shall be delivered, furnished, or provided with the pre-existing rights, unless--

(i) The parties have agreed otherwise; or

(ii) Any restrictions on the Government's rights to use, modify, reproduce, release, perform, display, or disclose the data have expired or no longer apply.

(6) Release from liability.

The Contractor agrees to release the Government from liability for any release or disclosure of technical data made in accordance with paragraph (a)(13) or (b)(2)(iii) of this clause, in accordance with the terms of a license negotiated under paragraph (b)(4) of this clause, or by others to whom the recipient has released or disclosed the data and to seek relief solely from the party who has improperly used, modified, reproduced, released, performed, displayed, or disclosed Contractor data marked with restrictive legends.

(c) Contractor rights in technical data.

All rights not granted to the Government are retained by the Contractor.

(d) Third party copyrighted data.

The Contractor shall not, without the written approval of the Contracting Officer, incorporate any copyrighted data in the technical data to be delivered under this contract unless the Contractor is the copyright owner or has obtained for the Government the license rights necessary to perfect a license or licenses in the deliverable data of the appropriate scope set forth in paragraph (b) of this clause, and has affixed a statement of the license or licenses obtained on behalf of the Government and other persons to the data transmittal document.

(e) Identification and delivery of data to be furnished with restrictions on use, release, or disclosure.

(1) This paragraph does not apply to restrictions based solely on copyright.

(2) Except as provided in paragraph (e)(3) of the clause, technical data that the Contractor assets should be furnished to the Government with restrictions on use, release, or disclosure are identified in an attachment to this contract (see Attachment). The Contractor shall not deliver any data with restrictive markings unless the data are listed on the Attachment.

(3) In addition to the assertions made in the Attachment, other assertions may be identified after award when based on new information or inadvertent omissions unless the inadvertent omissions would have materially affected the source selection decision. Such identification and assertion shall be submitted to the Contracting Officer as soon as practicable prior to the scheduled date for delivery of the data, in the following format, and signed by an official authorized to contractually obligate the Contractor:

Identification and Assertion of Restrictions on the Government's Use, Release, or Disclosure of Technical Data.

The Contractor asserts for itself, or the persons identified below, that the Government's rights to use, release, or disclose the following technical data should be restricted--

Technical Data to be Furnished With Restrictions*	Asserted Basis for Assertion**	Name of Person Rights Category***	Asserting Restrictions****
(LIST)	(LIST)	(LIST)	(LIST)

\*If the assertion is applicable to items, components, or processes developed at private expense, identify both the data and each such item, component, or process.

\*\*Generally, the development of an item, component, or process at private expense, either exclusively or partially, is the only basis for asserting restrictions on the Government's rights to use, release, or disclose technical data pertaining to such terms, components, or processes. Indicate whether development was exclusively or partially at private expense. If development was not at private expense, enter the specific reason for asserting that the Government's right should be restricted.

\*\*\*Enter asserted rights category (e.g. government purpose license rights from a prior contract, rights in SBIR data generated under another contract, limited or government purpose rights under this or a prior contract, or specifically negotiated licenses).

\*\*\*\*Corporation, individual, or other person, as appropriate.

Date \_\_\_\_\_

Printed Name and Title \_\_\_\_\_

Signature \_\_\_\_\_

\_\_\_\_\_  
(End of identification and assertion)

(4) When requested by the Contracting Officer, the Contractor shall provide sufficient information to enable the Contracting Officer to evaluate the Contractor's assertions. The Contracting Officer reserves the right to add the Contractor's assertions to the Attachment and validate any listed assertion, at a later date, in accordance with the procedures of the Validation of Restrictive Markings on Technical Data clause of this contract.

(f) Marking requirements.

The Contractor, and its subcontractor or suppliers, may only assert restrictions on the Government's rights to use, modify, reproduce, release, perform, display, or disclose technical data to be delivered under this contract by marking the deliverable data subject to restriction. Except as provided in paragraph (f)(5) of this clause, only the following legends are authorized under this contract: the government purpose rights legend at paragraph (f)(2) of this clause: the limited rights legend at paragraph (f)(3) of this clause: or the special license rights legend at paragraph (f)(4) of this clause, and/or a notice of copyright as prescribed under 17 U.S.C. 401 or 402.

(1) General marking instructions.

The Contractor, or its subcontractors or suppliers, shall conspicuously and legibly mark the appropriate legend on all technical data that qualify for such markings. The authorized legends shall be placed on the transmittal document or storage container and, for printed material, each page of the printed material containing technical data for which restrictions are asserted. When only portions of a page of printed material are subject to the asserted restrictions, such portions shall be identified by circling, underscoring, with a note, or other appropriate identifier. Technical data transmitted directly from one computer or computer terminal to another shall contain a notice of asserted restrictions. Reproductions of technical data or any portions thereof subject to asserted restrictions shall also reproduce the asserted restrictions.

(2) Government purpose rights markings.

Data delivered or otherwise furnished to the Government with government purpose rights shall be marked as follows:

GOVERNMENT PURPOSE RIGHTS

Contract No. \_\_\_\_\_

Contractor Name \_\_\_\_\_

Contractor Address \_\_\_\_\_

\_\_\_\_\_

Expiration Date \_\_\_\_\_

The Government's rights to use, modify, reproduce, release, perform, display, or disclose these technical data are restricted by paragraph (b)(2) of the Rights in Technical Data--Noncommercial Items clause contained in the above identified contract. No restrictions apply after the expiration date shown above. Any reproduction of technical data or portions thereof marked with this legend must also reproduce the markings.

(End of legend)

(3) Limited rights markings.

Data delivered or otherwise furnished to the Government with limited rights shall be marked with the following legend:

LIMITED RIGHTS

Contract No. \_\_\_\_\_

Contractor Name \_\_\_\_\_

Contractor Address \_\_\_\_\_

\_\_\_\_\_

The Government's rights to use, modify, reproduce, release, perform, display, or disclose these technical data are restricted by paragraph (b)(3) of the Rights in Technical Data--Noncommercial Items clause contained in the above identified contract. Any reproduction of technical data or portions thereof marked with this legend must also reproduce the markings. Any person, other than the Government, who has been provided access to such data must promptly notify the above name Contractor.

(End of legend)

(4) Special license rights markings.

(I) Data in which the Government's rights stem from a specifically negotiated license shall be marked with the following legend:

SPECIAL LICENSE RIGHTS

The Government's rights to use, modify, reproduce, release, perform, display, or disclose these data are restricted by Contract No. \_\_\_\_\_ )Insert contract number) \_\_\_\_\_, License No. \_\_\_\_\_ (Insert license identifier) \_\_\_\_\_. Any reproduction of technical data or portions thereof marked with this legend must also reproduce the markings.

(End of legend)

(ii) For purposes of this clause, special licenses do not include government purpose license rights acquired under a prior contract (see paragraph (b)(5) of this clause)\_.

(5) Pre-existing data markings.

If the terms of a prior contract or license permitted the Contractor to restrict the Government's rights to use, modify, reproduce, release perform, display, or disclose technical data deliverable under this contract, and those restrictions are still applicable, the Contractor may mark such data with the appropriate restrictive legend for which the data qualified under the prior contract or license. The marking procedures in paragraph (f)(1) of this clause shall be followed.

(g) Contractor procedures and records.

Throughout performance of this contract, the Contractor and its subcontractors or suppliers that will deliver technical data with other than unlimited rights, shall--

(1) Have, maintain, and follow written procedures sufficient to assure that restrictive markings are used only when authorized by the terms of this clause, and

(2) Maintain records sufficient to justify the validity of any restrictive markings on technical data delivered under this contract.

(h) Removal of unjustified and nonconforming markings.

(1) Unjustified technical data markings.

The rights and obligations of the parties regarding the validation of restrictive markings or technical data furnished or to be furnished under this contract are contained in the Validation of Restrictive Markings on Technical Data clause of this contract. Notwithstanding any provision of this contract concerning inspection and acceptance, the Government may ignore or, at the Contractor's expense, correct or strike a marking if, in accordance with the procedures in the Validation of Restrictive Markings on Technical Data clause of this contract, a restrictive marking is determined to be unjustified.

(2) Nonconforming technical data markings.

A nonconforming marking is a marking placed on technical data delivered or otherwise furnished to the Government under this contract that is not in the format authorized by this contract. Correction of nonconforming markings is not subject to the Validation of Restrictive

Markings on Technical Data clause of this contract. If the Contracting Officer notifies the Contractor of a nonconforming marking and the Contractor fails to remove or correct such marking within sixty (60) days, the Government may ignore or, at the Contractor's expense, remove or correct any nonconforming marking.

(I) Relation to patents.

Nothing contained in this clause shall imply a license to the Government under any patent or be construed as affecting the scope of any license or other with otherwise granted to the Government under any patent.

(j) Limitation on charges for rights in technical data.

(1) The Contractor shall not charge to this contract any cost, including, but not limited to, license fees, royalties, or similar charges, for rights in technical data to be delivered under this contract when--

(I) The Government has acquired, by any means, the same or greater rights in the data; or

(ii) The data are available to the public without restrictions.

(2) The limitation in paragraph (j)(1) of this clause--

(I) Includes costs charged by a subcontractor or supplier, at any tier, or costs incurred by the Contractor to acquire rights in subcontractor or supplier technical data, if the subcontractor or supplier has been paid for such rights under any other Government contract or under a license conveying the rights to the Government; and

(ii) Does not include the reasonable costs of reproducing, handling, or mailing the documents or other media in which the technical data will be delivered.

(k) Applicability to subcontractors or suppliers.

(1) The Contractor shall ensure that the rights afforded its subcontractors and suppliers under 10 U.S.C. 2320, 10 U.S.C. 2321, and the identification, assertion, and delivery processes of paragraph (e) of this clause are recognized and protected.

(2) Whenever any technical data for noncommercial items is to be obtained from a subcontractor or supplier for delivery to the Government under this contract, the Contractor shall use this same clause in the subcontract or other contractual instrument, and require its subcontractors or suppliers to do so, without alteration, except to identify the parties. No other clause shall be used to enlarge or diminish the Government's, the Contractor's, or a higher-tier subcontractor's or supplier's rights in a subcontractor's or supplier's technical data.

(3) Technical data required to be delivered by a subcontractor or supplier shall normally be delivered to the next higher-tier contractor, subcontractor, or supplier. However, when there is a requirement in the prime contract for data which may be submitted with other than unlimited rights by a subcontractor or supplier, then said subcontractor or supplier may fulfill its requirement by submitting such data directly to the

Government, rather than through a higher-tier contractor, subcontractor, or supplier.

(4) The Contractor and higher-tier subcontractors or suppliers shall not use their power to award contracts as economic leverage to obtain rights in technical data from their subcontractors or suppliers.

(5) In no event shall the Contractor use its obligation to recognize and protect subcontractor or supplier rights in technical data as an excuse for failing to satisfy its contractual obligation to the Government.

1.54 LIMITATIONS ON THE USE OR DISCLOSURE OF GOVERNMENT-FURNISHED INFORMATION MARKED WITH RESTRICTIVE LEGEND DFARS 252.227-7025 (JUN 1995)

2 January 1996

(a)(1) For contracts requiring the delivery of technical data, the terms, "limited rights" and "Government purpose rights" are defined in the Rights in Technical Data--Noncommercial Items clause of this contract.

(2) For contracts that do not require the delivery of technical data, the terms "government purpose rights" and "restricted rights" are defined in the Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation clause of this contract.

(3) For Small Business Innovative Research program contracts, the terms "limited rights" and "restricted rights" are defined in the Rights in Noncommercial Technical Data and Computer Software--Small Business Innovative Research (SBIR) Program clause of this contract.

(b) Technical data or computer software provided to the Contractor as Government furnished information (GFI) under this contract may be subject to restrictions on use, modification, reproduction, release, performance, display, or further disclosure.

(1) GFI marked with limited or restricted rights legends.

The Contractor shall use, modify, reproduce, perform, or display technical data received from the Government with limited rights legends or computer software received with restricted rights legends only in the performance of this contract. The Contractor shall not, without the express written permission of the party whose name appears in the legend, release or disclose such data or software to any person.

(2) GFI marked with government purpose rights legends.

The Contractor shall use technical data or computer software received from the Government with government purpose rights legends for government purposes only. The Contractor shall not, without the express written permission of the party whose name appears in the restrictive legend, use, modify, reproduce, release, perform, or display such data or software for any commercial purpose or disclose such data or software to a person other than its subcontractors, suppliers, or prospective subcontractors or suppliers, who require the data or software to submit offers for, or perform, contracts under this contract. Prior to disclosing the data or software, the Contractor shall require the persons to whom

disclosure will be made to complete and sign the non-disclosure agreement at 227.7103-7 of the Defense Federal Acquisition Regulation Supplement (DFARS).

(3) GFI marked with specially negotiated license rights legends.

The Contractor shall use, modify, reproduce, release, perform, or display technical data or computer software received from the Government with specially negotiated license legends only as permitted in the license. Such data or software may not be release or disclosed to other persons unless permitted by the license and, prior to release or disclosure, the intended recipient has completed the non-disclosure agreement at DFARS 227.7103-7. The Contractor shall modify paragraph (1)(c) of the non-disclosure agreement to reflect the recipient's obligations regarding use, modification, reproduction, release, performance, display, and disclosure of the data of software.

(c) Indemnification and creation of third party beneficiary rights.

The Contractor agrees--

(1) To indemnify and hold harmless the Government, its agents, and employees from every claim or liability, including attorneys fees, court costs, and expenses, arising out of, or in any way related to, the misuse or unauthorized modification, reproduction, release, performance, display, or disclosure of technical data or computer software received from the Government with restrictive legends by the Contractor or any person to whom the Contractor has released or disclosed such data or software; and

(2) That the party whose name appears on the restrictive legend, in addition to any other rights it may have, is a third party beneficiary who has the right of direct action against the Contractor, or any person to whom the Contractor has released or disclosed such data or software, for the unauthorized duplication, release, or disclosure of technical data or computer software subject to restrictive legends.

1.55 NOT USED

#1 1.56 VARIATIONS IN ESTIMATED QUANTITIES - SUBDIVIDED ITEMS (MAR 1995) EFARS 52.212-5001.  
2 JAN 1996

The Variation is Estimated Quantities clause is applicable to Bid Item No. 4.

(a) Variation from the estimated quantity in the actual work performed under any second or subsequent sub-item or elimination of all work under such a second or subsequent sub-item will not be the basis for an adjustment in contract unit price.

(b) Where the actual quantity of work performed for Bid Item No. 4 is less than 85% of the quantity of the first sub-item listed under such item, the contractor will be paid at the contract unit price for that sub-item for the actual quantity of work performed and, in addition, an equitable adjustment shall be made in accordance with clause FAR 52.212-11, Variation in Estimated Quantities.

(c) If the quantity of work performed under Bid Item No. 4 exceeds 115% or is less than 85% of the total estimated quantity of the sub-items under

that item, and/or if the quantity of work performed under the second sub-item or any subsequent sub-item under Bid Item No. 4 exceeds 115% or is less than 85% of the estimated quantity of any such sub-item, and if such variation causes an increase or a decrease in the time required for performance of the contract the contract completion time will be adjusted in accordance with the clause FAR 52.212-11, Variation in Estimated Quantities. \*1

#### 1.57 PARTNERING

August 1996

In order to most effectively accomplish this contract, the Government proposes to form a partnership with the Contractor to develop a cohesive building team. It is anticipated that this partnership would involve the Corps of Engineers, the 99th RSC, the Contractor, primary subcontractors and the designers. This partnership would strive to develop a cooperative management team drawing on the strengths of each team member in an effort to achieve a quality project within budget and on schedule. This partnership would be bilateral in membership and participation will be totally voluntary. All costs, excluding labor and travel expenses, shall be shared equally between the Government and the Contractor. The Contractor and Government shall be responsible for their own labor and travel costs.

#### 1.58 ACTIVITY ENVIRONMENTAL ANALYSIS

1 February 1995

Before starting any major phase of the work, an Activity Environmental Analysis shall be developed by the contractor and reviewed with the Government Representative. A major phase of the work is defined as an operation involving a type of work not previously experienced which presents possible sources of adverse environmental effects. This analysis will evaluate potential environmental consequences of the activity and the techniques which will be utilized to accomplish the work in an acceptable manner. This analysis includes: (1) the phase or activity of work; (2) the potential environmental consequences of the activity; (3) precautionary actions to prevent adverse environmental impacts; (4) actions in the event of an environmental incident; and (5) the appropriate reference to Federal, State, or Local standards, regulations, or laws.

#### 1.59 CONSTRUCTION AND DEMOLITION (C&D) WASTE MANAGEMENT PLAN

16 July 1999

a. The Contractor is required to submit for government approval a detailed C&D Waste Management Plan within 30 days after contract award and prior to initiating any site clearance or C&D work.

b. Specific elements to be addressed in the plan are as follows:  
Designated individuals on the contractor's staff who are responsible for C&D waste prevention and management.

(1) Actions that will be taken to reduce solid waste generation (including use of more efficient facility design and construction processes, reduced packaging and packing materials, supplier take-back programs, etc.). Description of the specific approaches to be used in recycling/reuse of the various materials generated, including, as appropriate, the specification of areas and equipment to be used for processing, sorting, and temporary storage of C&D wastes.

(2) Characterization of the waste to be generated during the C&D project, to include types and quantities of waste materials. The characterization should address site waste materials, building materials, packaging, packing, wastes generated by construction equipment, wastes generated by site offices, and wastes generated by the workforce on-site.

(3) Landfill and/or incinerator name, tipping fee amounts, projected cost of disposing of all trash and waste materials in the landfill/incinerator, as if there would be no salvage or recycling on the project.

(4) Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and public arts programs that accept used materials (e.g., Habitat For Humanity, national materials exchange networks).

(5) A list of specific waste materials that will be salvaged for resale, salvaged and reused, and recycled; the recycling facilities that will be utilized; and copies of their permits and/or registrations.

(6) Identification of materials that cannot be recycled/reused with a written justification. All disposed materials including anticipated hazardous wastes must include names of haulers and disposal sites, and copies of their permits and/or registrations.

(7) Anticipated net cost savings determined by subtracting contractor program management costs and the cost of salvage (deconstruction), separating, and recycling from the following:

- (1) revenue from the sale of salvaged products and materials;
- (2) revenue from the sale of recycled products and materials;
- (3) revenue from the return of materials; and
- (4) incineration and/or landfill tipping fees saved due to diversion of materials.

(8) The plan must cover the following materials if the material is applicable to the specific project.

Asphalt	Gypsum
Concrete	Plastic
Soil	Polystyrene
Metal	Porcelain
Wood	Corrugated cardboard
Brick	Carpet

c. Firms and facilities used by the contractor for recycling, reuse, and disposal shall be appropriately permitted for the contractor's intended use, to the extent required by federal, state, and local regulations. The contractor shall maintain records of disposition of the materials, including all copies of manifests, origin, and disposal forms, and bills of lading. All facility, landfill, and hauler permits showing USEPA and state registration numbers shall be maintained and shall be available to the contracting officer when requested.

d. The Contracting Officer shall review the C&D waste management plan in coordination with the environmental office within 7 calendar days of submittal. Where the contracting officer determines that the contractor has

diligently explored all feasible methods to reduce C&D waste, the plan shall be approved, or approved with comment. Where it is determined that the contractor has not diligently explored all feasible methods, the contracting officer shall request a resubmittal.

e. All revenues generated by reusing, returning, salvaging, or recycling materials, as well as costs avoided by reduced tipping and incineration fees as compared to conventional disposal shall accrue to the contractor's benefit and be reported to the Contracting Officer. Where an on-site Army C&D landfill is the only available disposal facility, the Contractor will be charged the prevailing commercial rate.

1.60 DAMAGE TO WORK (ORL)

15 June 1990

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

1.61 NOT USED

1.62 NOT USED

1.63 NOT USED

1.64 NOT USED

1.65 NOT USED

- 1.66 NOT USED
- 1.67 NOT USED
- 1.68 NOT USED
- 1.69 NOT USED
- 1.70 NOT USED
- 1.71 NOT USED
- 1.72 NOT USED
- 1.73 NOT USED
- 1.74 NOT USED
- 1.75 NOT USED
- 1.76 NOT USED
- 1.77 NOT USED
- 1.78 NOT USED
- 1.79 NOT USED
- 1.80 NOT USED
- 1.81 NOT USED
- 1.82 POLLUTION PREVENTION PLAN 27 AUGUST 2001 (VERSION II)

In accordance with the National Pollutant Discharge Elimination System (NPDES) Permit, a Pollution Prevention Plan has been developed as part of this project. This plan has been developed to meet the erosion and sediment control requirements for the State of Pennsylvania. The Contractor will implement the Pollution Prevention Plan (PPP) that was prepared by the U.S. Army Corps of Engineers as shown on the plans, and as directed in these specifications. This (PPP) which will be provided to the contractor as part of these documents must be implemented in accordance with the NPDES permit. A Notice of Intent (NOI) has been prepared by the U.S. Army Corps of Engineers and submitted to the State of Pennsylvania. Commencement of any construction activity (ground disturbing activity) by the contractor shall not begin until 48-hours after the NOI letter has been postmarked. The Contractor shall maintain a copy of the State compliance letter, NPDES Permit and PPP at the construction site. Any changes made to the PPP must be documented and approved by the Contracting Officer.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION NOT USED

-- End Of Document --

SECTION 02714

EXTERIOR PAVEMENT DRAINAGE LAYER;  
RAPID DRAINAGE MATERIAL (RDM)  
12/92

**AMENDMENT 1**

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 and represent the latest edition in force when this contract is awarded.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	Sampling Aggregates
ASTM D 2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	Water Content of Soil and Rock In Place by Nuclear Methods (Shallow Depth)
ASTM E 548	General Criteria Used for Evaluating Laboratory Competence

1.2 SYSTEM DESCRIPTION

The Contractor shall build a drainage layer for the pavements as indicated and in accordance with the following subparagraphs. All work shall also conform to the requirements shown on the contract drawings.

1.2.1 Aggregate Drainage Layer

A drainage layer consisting of rapid draining materials (RDM) meeting the gradations of Table I.

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

Plant, Equipment, Machines, and Tools.

List of proposed equipment to be used in performance of construction work including descriptive data.

SD-06 Test Reports

Sampling and Testing.

Copies of field test results within 24 hours of completion of tests.

Approval of Materials; G ED.

Material sources and material test results at least 60 days prior to field use. This submittal shall include all laboratory test results for the aggregate.

Evaluation; G ED.

Test section construction report within 10 days of completion of the test section.

SD-07 Certificates

Testing Lab; G AR.

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

1.4 FIELD COMPACTION

Field compaction requirements shall be based on the results of a test section constructed by the Contractor, using the materials, methods, and equipment proposed for use in the work. The test section shall meet the requirements of paragraph TEST SECTION.

1.5 EQUIPMENT

1.5.1 General Requirements

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times.

1.5.2 Placement Equipment

An asphalt paving machine shall be used to place drainage layer material. Alternate methods may be used if it can be demonstrated in the test section that these methods obtain the specified results.

#### 1.5.3 Compaction Equipment

A dual or single smooth drum vibratory roller weighing 9 to 14 metric tons which provides a maximum compactive effort without crushing the drainage layer aggregate shall be used to compact drainage layer material.

#### 1.5.4 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 3.66-meter straightedge for each paver, for use in the testing of the finished surface. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

#### 1.6 WEATHER LIMITATION

Drainage layer material shall be placed when the atmospheric temperature is above 2 degrees C (35 degrees F). Areas of completed drainage layer or underlying courses that are damaged by freezing, rainfall, or other weather conditions or by contamination from sediments, dust, dirt, or foreign material shall be corrected by the Contractor to meet specified requirements.

#### 1.7 SAMPLING AND TESTING

##### 1.7.1 General Requirements

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory, or by the Contractor subject to approval. Approval of testing facilities shall be based on requirements indicated in SECTION 01451. If the Contractor elects to establish testing facilities of his own, approval of such facilities shall be based on compliance with ASTM E 548, and no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved. The first inspection of the facilities will be at the expense of the Government and any subsequent inspections required because of failure of the first inspection shall be at the expense of the Contractor. Such costs will be deducted from the total amount due the Contractor. Drainage layer materials shall be tested to establish compliance with the specified requirements. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of the tests.

##### 1.7.2 Test Results

Results shall verify that materials comply with this specification. When a material source is changed, the new material will be tested for compliance. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced or modified as directed by the Contracting Officer.

1.7.3 Sampling

Aggregate samples shall be taken in accordance with ASTM D 75.

1.7.4 Test Methods

1.7.4.1 Sieve Analyses

Sieve analyses shall be made in accordance with ASTM C 117 and ASTM C 136.

1.7.4.2 Density Tests

Field density tests shall be made in accordance with ASTM D 2922. When using this method, ASTM D 3017 shall be used to determine the moisture content of the aggregate drainage layer material. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph "Calibration" of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed by the Contracting Officer.

1.7.4.3 Soundness Test

Soundness tests shall be made in accordance with ASTM C 88.

1.7.4.4 Los Angeles Abrasion Test

Los Angeles abrasion tests shall be made in accordance with ASTM C 131.

1.7.4.5 Flat or Elongated Particles Tests

Flat and/or elongated particles tests shall be made in accordance with ASTM D 4791.

1.7.4.6 Fractured Faces Tests

When aggregates are supplied from crushed gravel, approved test methods shall be used to assure the aggregate meets the requirements for fractured faces in paragraph AGGREGATES.

1.7.5 Testing Frequency

1.7.5.1 Aggregate Drainage Layer

Sieve analyses shall be performed at a rate of at least one test for every 1200 square meters of completed area and not less than one test for each day's production. Field density and moisture content tests shall be performed at a rate of at least one test for every 1200 square meters of completed area. Soundness tests, Los Angeles abrasion tests, fractured faces tests and flat and/or elongated particles tests shall be performed at the rate of one test for every 10 sieve analysis tests.

1.7.6 Approval of Materials

1.7.6.1 Aggregate

The aggregate source shall be selected at least 60 days prior to field use in the test section. Tentative approval of the source will be based on certified test results to verify that materials proposed for use meet the contract requirements. Final approval of both the source and the material will be based on test section performance and tests for gradation, soundness, Los Angeles abrasion, flat and/or elongated particles tests and fractured faces tests. For aggregate drainage layer materials, these tests shall be performed on samples taken from the completed and compacted drainage layer course within the test section.

PART 2 PRODUCTS

2.1 AGGREGATES

Aggregates shall consist of clean, sound, hard, durable, angular particles of crushed stone or crushed gravel which meet the specification requirements. The aggregates shall be free of silt and clay as defined by ASTM D 2487, vegetable matter, and other objectionable materials or coatings.

2.1.1 Aggregate Quality

The aggregate shall have a soundness loss not greater than 18 percent weighted averaged at five cycles when tested in magnesium sulfate in accordance with ASTM C 88. The aggregate shall have a percentage of loss on abrasion not to exceed 40 after 500 revolutions as determined by ASTM C 131. The percentage of flat and/or elongated particles shall be determined by ASTM D 4791 with the following modifications. The aggregates shall be separated into two size fractions. Particles greater than 12.5 mm sieve and particles passing the 12.5 mm sieve and retained on the 4.75 mm sieve. The percentage of flat and/or elongated particles in either fraction shall not exceed 20. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. When the aggregate is supplied from more than one source, aggregate from each source shall meet the requirements set forth herein. When the aggregate is supplied from crushed gravel it shall be manufactured from gravel particles 90 percent of which by weight are retained on the maximum-size sieve listed in TABLE I. In the portion retained on each sieve specified, the crushed gravel shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the face. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces.

#1 2.1.2 Gradation Requirements

#1 2.1.2.1 Rapid Drainage Material (RDM)

Drainage layer aggregates shall be well graded within the limits specified in TABLE I.

TABLE I. GRADATION OF DRAINAGE LAYER MATERIAL  
Percentage by Weight Passing Square-Mesh Sieve

Designation	Sieve		
	No.1	No.2	No.3
50 mm	100	---	100
37.5 mm	100	100	---
25 mm	95-100	96-100	---
19 mm	82-92	70-83	52-100
12.5 mm	62-80	44-70	---
9.5 mm	59-73	38-59	36-65
4.75 mm	40-55	24-33	8-40
2.36 mm	5-25	20-29	---
1.18 mm	0-5	12-21	0-12
0.30 mm	0-2	2-8	---
0.15 mm	---	0-3	---
0.075 mm	---	---	0-5

NOTE 1: A 50% - 50% blend of No. 57 and No. 9 coarse aggregate (ASTM D 448) will fall within the above gradation band No. 1. A 75% - 25% blend of No.

57 coarse aggregate and concrete fine aggregate (ASTM D 448) will fall within gradation band No. 2. Pennsylvania Department of Transportation OGS Gradation (Section 703.2) will fall within gradation band No. 3. The materials shall be blended at the source prior to shipping to the project site.

NOTE 2: Particles having diameters less than 0.02 mm shall not be in excess of 1.5 percent by weight of the total sample tested.

NOTE 3: The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves may require appropriate correction by the Contracting Officer when aggregates of varying specific gravities are used.

NOTE 4: For RDM, the coefficient of uniformity (CU) shall be greater than 3.5. (CU = D60/D10).

### PART 3 EXECUTION

#### 3.1 REUSE OF RAPID DRAINAGE MATERIAL (RDM) OBTAINED FROM THE DEMOLITION AND REMOVAL OF EXISTING ON-SITE PAVEMENT

Areas designated as "REPLACEMENT CONCRETE PAVEMENT" on the Pavement Layout Plan in the contract drawings require that the entire pavement section, including the resin-modified pavement surface, bituminous base, Rapid Drainage Material (RDM) and Dense Graded Aggregate (DGA) base materials be removed prior to construction of the new pavement section. The contractor may reuse these RDM materials from this existing pavement section only if the materials meet the requirements for RDM as specified in this specification section at the time of placement. Otherwise, these materials shall be considered as unsatisfactory and therefore be disposed of as specified in paragraph SPOIL AREAS of Section 02300, SITE GRADING AND EARTHWORK FOR AIRFIELDS (PAVEMENTS) unless otherwise directed by the Contracting Officer.

#### 3.2 STOCKPILING AGGREGATES

Aggregates shall be stockpiled at locations designated by the Contracting Officer. Stockpile areas shall be cleared and leveled prior to stockpiling aggregates. All aggregates shall be stockpiled so as to prevent segregation and contamination. Aggregates obtained from different sources shall be stockpiled separately.

#### 3.3 TEST SECTION

##### 3.3.1 General

A test section shall be constructed to evaluate the ability to carry traffic and the constructability of the drainage layer including required mixing, placement, and compaction procedures. Test section data will be used by the Contracting Officer to determine the required number of passes and the field dry density requirements for full scale production.

##### 3.3.2 Scheduling

The test section shall be constructed a minimum of 30 days prior to the start of full scale production to provide sufficient time for an evaluation of the proposed materials, equipment and procedures including Government QA testing.

### 3.3.3 Location and Size

The test section shall be placed outside the production paving limits in an area with similar subgrade and subbase conditions approved by the Contracting Officer. The test section may be constructed within a designated paving area as approved by the Contracting Officer. If test results are satisfactory, the section may be retained in place as part of the final work if properly maintained by the contractor. However, if the test results are unsatisfactory, the contractor shall remove the test section and reconstruct the drainage layer to the satisfaction of the Contracting Officer at the Contractors cost and responsibility. The underlying courses and subgrade preparation, required for the pavement section, shall be completed, inspected and approved in the test section prior to constructing the drainage layer. The test section shall be a minimum of 35 m long and one full paving lane wide and of the thickness(es) to be used in the project.

### 3.3.4 Initial Testing

Certified test results, to verify that the materials proposed for use in the test section meet the contract requirements, shall be provided by the Contractor and approved by the Contracting Officer prior to the start of the test section.

### 3.3.5 Mixing, Placement, and Compaction

Mixing, placement, and compaction shall be accomplished using equipment meeting the requirements of paragraph EQUIPMENT. The contractor shall anticipate a minimum of six passes and a maximum of ten passes of the specified equipment followed by a minimum of one static pass of the roller (without vibration) to seal the surface of each lift. Compaction equipment speed shall be no greater than 2.4 km/hour (1.5 miles per hour).

### 3.3.6 Procedure

#### 3.3.6.1 Aggregate Drainage Layer

The test section shall be constructed with aggregate in a moist state so as to establish a correlation between number of roller passes and dry density achievable during field production. Density and moisture content tests shall be conducted at the surface and at intervals of 50 mm of depth down for the total layer thickness, in accordance with ASTM D 2922 and ASTM D 3017. Sieve analysis tests shall be conducted on composite samples, taken adjacent to the density test locations, which represent the total layer thickness. One set of tests (i.e. density, moisture, and sieve analysis) shall be taken before compaction and after each subsequent compaction pass at three separate locations as directed by the Contracting Officer. Compaction passes and density readings shall continue until the difference between the average dry densities of any two consecutive passes is less than or equal to 8 kg per cubic meter (0.5 pcf) unless otherwise directed by the contracting officer. The test sections shall be completed by making one final pass with the roller in the static mode and observing any change in the

drainage layer surface texture. Additional test sections shall be constructed and sampled for conformance to specification requirements as directed, if initial test results are unsatisfactory, if a significant variance in dry density of 2 kilograms (5 pounds) or more occurs during production, or if there is visible difference in the material or its gradation during production. In no case shall the contractor start production, or resume full production after material variances are observed, without approval by the Contracting Officer.

### 3.3.7 Evaluation

Within 10 days of completion of the test section, the Contractor shall submit to the Contracting Officer a Test Section Construction Report complete with all required test data and correlations. The Contracting Officer will evaluate the data and provide to the Contractor the required number of passes of the roller, the dry density for field density control during construction, the depth at which to check the density, and the need for a final static pass of the roller.

### 3.4 PREPARATION OF UNDERLYING COURSE

Prior to constructing the drainage layer, the underlying course shall be cleaned of all foreign materials. During construction, the underlying course shall contain no frozen material. The underlying course shall conform to Section 02300 SITE GRADING AND EARTHWORK FOR AIRFIELDS (PAVEMENTS) and Section 02722 AGGREGATE BASE COURSE AND SUBGRADE STABILIZATION. Ruts or soft yielding spots in the underlying courses having inadequate compaction and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line, and grade, and recompacting to specified density. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the drainage layer is placed.

### 3.5 TRANSPORTING MATERIAL

#### 3.5.1 Aggregate Drainage Layer Material

Aggregate drainage layer material shall be transported to the site in a manner which prevents segregation and contamination of materials.

### 3.6 PLACING

#### 3.6.1 General

Drainage layer material shall be placed on the underlying course in lifts of uniform thickness using equipment meeting the requirements of paragraph EQUIPMENT. When a compacted layer 150 mm or less in thickness is required, the material shall be placed in a single lift. When a compacted layer in excess of 150 mm is required, the material shall be placed in lifts of equal thickness. No lift shall exceed 150 mm or be less than 75 mm when compacted. The lifts shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the drainage layer is placed in more than one lift, the previously constructed lift shall be cleaned of loose and foreign material. Such adjustments in placing procedures or equipment shall be made to obtain

true grades and minimize segregation and degradation of the drainage layer material.

### 3.6.2 Hand Spreading

In areas where machine spreading is impractical, drainage layer material shall be spread by hand. The material shall be spread uniformly in a loose layer so as to prevent segregation along with conforming to the required grade and thickness after compaction.

### 3.7 COMPACTION REQUIREMENTS

Compaction shall be accomplished using rollers meeting the requirements of paragraph EQUIPMENT and operating at a rolling speed of no greater than 2.4 km (1.5 miles) per hour. Each lift of drainage material, including shoulders when specified under the shoulders, shall be compacted with the number of passes of the roller as specified by the Contracting Officer. In addition, a minimum field dry density, as specified by the Contracting Officer, shall be maintained. If the required field dry density is not obtained, the number of roller passes shall be adjusted in accordance with paragraph DEFICIENCIES. Excessive rolling resulting in crushing of aggregate particles shall be avoided. In all places not accessible to the rollers, the drainage layer material shall be compacted with mechanical hand operated tampers.

### 3.8 FINISHING

The top surface of the drainage layer shall be finished after final compaction as determined from the test section. Adjustments in rolling and finishing procedures shall be made to obtain grades and minimize segregation and degradation of the drainage layer material.

### 3.9 EDGES OF DRAINAGE LAYER

Shoulder material shall be placed along the edges of the drainage layer course in such quantity as will compact to the thickness of the layer being constructed. When the drainage layer is being constructed in two or more lifts, at least a one foot width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each lift of the drainage layer.

### 3.10 SMOOTHNESS TEST

The surface of the top lift shall not deviate more than 10 mm when tested with a 3.66 m straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding 10 mm shall be corrected in accordance with paragraph DEFICIENCIES.

### 3.11 THICKNESS CONTROL

The completed thickness of the drainage layer shall be within 13 mm of the thickness indicated. Thickness shall be measured at intervals providing at least one measurement for each 500 square meters of drainage layer. Measurements shall be made in test holes at least 75 mm in diameter. Where the measured thickness is more than 13 mm deficient, such areas shall be corrected in accordance with paragraph DEFICIENCIES. Where the measured thickness is 13 mm more than indicated, it will be considered as conforming

with the requirements plus 13 mm, provided the surface of the drainage layer is within 13 mm of established grade. The average job thickness shall be the average of all job measurements as specified above but within 8 mm of the thickness shown on the drawings.

### 3.12 DEFICIENCIES

#### 3.12.1 Grade and Thickness

Deficiencies in grade and thickness shall be corrected such that both grade and thickness tolerances are met. In no case will thin layers of material be added to the top surface of the drainage layer to meet grade or increase thickness. If the elevation of the top of the drainage layer is more than 13 mm above the plan grade it shall be trimmed to grade and finished in accordance with paragraph FINISHING. If the elevation of the top surface of the drainage layer is 13 mm or more below the required grade, the surface of the drainage layer shall be scarified to a depth of at least 75 mm, new material shall be added, and the layer shall be blended and recompact to bring it to grade. Where the measured thickness of the drainage layer is more than 13 mm deficient, such areas shall be corrected by excavating to the required depth and replaced with new material to obtain a compacted lift thickness of at least 75 mm. The depth of required excavation shall be controlled to keep the final surface elevation within grade requirements and to preserve layer thicknesses of materials below the drainage layer.

#### 3.12.2 Density

Density shall be considered deficient if the field dry density test results are below the dry density specified by the Contracting Officer. If the densities are deficient, the layer shall be rolled with 2 additional passes of the specified roller. If the dry density is still deficient, work will be stopped until the cause of the low dry densities can be determined by the Contracting Officer.

#### 3.12.3 Smoothness

Deficiencies in smoothness shall be corrected as if they are deficiencies in grade or thickness. All tolerances for grade and thickness shall be maintained while correcting smoothness deficiencies.

### 3.13 DISPOSAL OF UNSATISFACTORY MATERIAL

Unsuitable base course material that is removed for the required correction of defective areas, and waste material and debris shall be disposed of as specified in paragraph SPOIL AREAS of Section 02300, SITE GRADING AND EARTHWORK FOR AIRFIELDS (PAVEMENTS).

-- End of Section --

\*\*\*SAFETY PAYS\*\*\*

- End of Section --

SECTION 02753

CONCRETE PAVEMENT FOR AIRFIELDS  
01/02

AMENDMENT 1

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

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

ACI 214.3R (1988; R 1997) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete

ACI 305R (1999) Hot Weather Concreting

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182 (1991; R 1996) Burlap Cloth Made from Jute or Kenaf

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 184/A 184M (2001) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement

ASTM A 185 (1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

ASTM A 497 (1999) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement

ASTM A 53/A 53M (2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 615/A 615M (2000) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM C 1064/C 1064M (1999) Temperature of Freshly Mixed Portland Cement Concrete

- End of Section --

ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 123	(1998) Lightweight Particles in Aggregate
ASTM C 1260	(1994) Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 142	(1978; R 1997) Clay Lumps and Friable Particles in Aggregates
ASTM C 143/C 143M	(2000) Slump of Hydraulic Cement Concrete
ASTM C 150	(1999a) Portland Cement
ASTM C 171	(1997a) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 174/C 174M	(1997) Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
ASTM C 192/C 192M	(2000) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2000) Air-Entraining Admixtures for Concrete
ASTM C 295	(1998) Petrographic Examination of Aggregates for Concrete
ASTM C 31/C 31M	(2000e1) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1999ae1) Concrete Aggregates
ASTM C 39/C 39M	(2001) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 470/C 470M	(1998) Molds for Forming Concrete Test Cylinders Vertically
ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete

- End of Section --

- ASTM C 618 (2000) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
- ASTM C 78 (1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
- ASTM C 881 (1999) Epoxy-Resin-Base Bonding Systems for Concrete
- ASTM C 94/C 94M (2000e2) Ready-Mixed Concrete
- ASTM C 989 (1999) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
- ASTM D 1752 (1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
- ASTM D 3665 (1999) Random Sampling of Construction Materials

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CDT)

- CDT Test 526 (1978) Operation of California Profilograph and Evaluation of Profiles

U.S. ARMY CORPS OF ENGINEERS (USACE)

- COE CRD-C 100 (1975) Method of Sampling Concrete Aggregate and Aggregate Sources, and Selection of Material for Testing
- COE CRD-C 104 (1980) Method of Calculation of the Fineness Modulus of Aggregate
- COE CRD-C 114 (1997) Test Method for Soundness of Aggregates by Freezing and Thawing of Concrete Specimens
- COE CRD-C 119 (1991) Standard Test Method for Flat or Elongated Particles in Coarse Aggregate
- COE CRD-C 130 (1989) Scratch Hardness of Coarse Aggregate Particles
- COE CRD-C 171 (1995) Test Method for Determining Percentage of Crushed Particles in Aggregate
- COE CRD-C 300 (1990) Specifications for Membrane-Forming Compounds for Curing Concrete
- COE CRD-C 400 (1963) Requirements for Water for Use in Mixing or Curing Concrete

- End of Section --

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

COE CRD-C 55 (1992) Test Method for Within-Batch Uniformity of Freshly Mixed Concrete

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-24441/20 (Rev. A) Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type III

1.2 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of concrete (rigid) pavement. However, where the construction covered herein interfaces with other sections, the construction at each interface shall conform to the requirements of both this section and the other section, including tolerances for both.

1.3 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

Equipment; G\_ED

a. Details and data on the batching and mixing plant prior to plant assembly including manufacturer's literature showing that the equipment meets all requirements specified herein.

b. A description of the equipment proposed for transporting concrete mixture from the central mixing plant to the paving equipment at least 7 days prior to start of paving unless otherwise specified.

c. At the time the materials are furnished for the mixture proportioning study, a description of the equipment proposed for the placing of the concrete mixture, method of control, and manufacturer's literature on the paver and finisher, together with the manufacturer's written instructions on adjustments and operating procedures necessary to assure a tight, smooth surface on the concrete pavement, free of tears and other surface imperfections, including excessive paste on the surface. The literature shall show that the equipment meets all details of these specifications.

Proposed Techniques;G\_ED

- End of Section --

a. A description of the placing and protection methods proposed prior to construction of the test section, if concrete is to be placed in or exposed to hot or cold weather conditions.

b. A detailed plan of the proposed paving pattern showing all planned construction joints. No deviation from the jointing pattern shown on the drawings shall be made without written approval of the Baltimore District Geotechnical Branch.

c. Data on the curing media and methods to be used.

Samples for Mixture Proportioning Studies;G\_ED

The results of the Contractor's mixture proportioning studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of concrete at least 14 days prior to commencing concrete placing operations. Aggregate quantities shall be based on the mass in a saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, inspected by the Government, and approved in writing, showing that mixture proportioning 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 proportions without additional tests to show that the quality of the concrete is satisfactory.

Delivery, Storage, and Handling of Materials;G\_AR

Copies of waybills or delivery tickets for cementitious material during the progress of the work. Before the final payment is allowed, waybills and certified delivery tickets shall be furnished for all cementitious material used in the construction.

SD-06 Test Reports

Sampling and Testing; G\_ED

Certified copies of laboratory test reports, including all test data, for cement, pozzolan, aggregate, admixtures, and curing compound proposed for use on this project. Testing shall have been completed within 6 months prior to paving. These tests shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials. No material shall be used until notice of acceptance has been given. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site.

1.4 MEASUREMENT AND PAYMENT

1.4.1 Measurements

- End of Section --

#### 1.4.1.1 Concrete

All costs associated with Concrete Pavements will be measured and paid for at the contract unit price per cubic meter for Payment Item 02753-1 "200 mm Concrete Pavement" and 02753-2 "300 mm Concrete Pavement" of the Unit Price schedule. The quantity of concrete to be paid for will be the volume of concrete in cubic meters placed in the completed and accepted pavement. Concrete will be measured in place in the completed and accepted pavement only within the neat line dimensions shown in the plan and cross section. No deductions will be made for rounded or beveled edges or the space occupied by pavement reinforcement, dowel bars, tie bars, or electrical conduits, nor for any void, or other structure extending into or through the pavement slab, measuring 0.1 cubic meter or less in volume. No other allowance for concrete will be made unless placed in specified locations in accordance with written instructions previously issued by the Contracting Officer.

#### 1.4.1.2 Mixture Proportions By Contractor

The Contractor shall be responsible for the mixture proportions of cementitious materials and chemical admixtures; no separate measurement or payment will be made for any cementitious material, including pozzolan, or for any chemical admixture.

#### 1.4.1.3 Dowels and Steel Reinforcement

The quantity of steel reinforcement, and dowels used in the work will not be measured for payment but will be considered as a subsidiary obligation of the Contractor, covered under the price per cubic meter for concrete.

#### 1.4.1.4 Joint Materials

The quantity of expansion joint filler, slip joint filler, and inserts for contraction joints will not be measured for payment but will be considered as a subsidiary obligation of the Contractor, covered under the price per cubic meter for concrete. Joint sealing materials are covered in Section 02762 PREFORMED ELASTOMERIC COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS.

#### 1.4.2 Payments

##### 1.4.2.1 Concrete

All costs associated with Concrete Pavements will be measured and paid for at the contract unit price per cubic meter for Payment Item 02753-1 "200 mm Concrete Pavement" and 02753-2 "300 mm Concrete Pavement" of the Unit Price schedule. The quantity of concrete measured as specified above will be paid for at the contract unit price when placed in completed and accepted pavements. Payment shall be made at the contract price for cubic meter for the scheduled item, with necessary adjustments as specified in paragraph ACCEPTABILITY OF WORK AND PAYMENT ADJUSTMENTS. Payment will constitute full compensation for furnishing all materials, equipment, plant and tools, and for all labor and other incidentals necessary to complete the concrete pavement, except for other items specified herein for separate payment.

#### 1.5 ACCEPTABILITY OF WORK AND PAYMENT ADJUSTMENTS

- End of Section --

Concrete samples shall be taken by the Contractor in the field to determine the slump, air content, and strength of the concrete. Test beams and test cylinders shall be made for determining conformance with the strength requirements of these specifications and, when required, for determining the time at which pavements may be placed into service. Any pavement not meeting the requirement for 'specified strength' shall be removed and replaced at no additional cost to the Government. The air content shall be determined in accordance with ASTM C 231. Slump tests shall be made in accordance with ASTM C 143/C 143M. Test beams and cylinders shall be molded and cured in accordance with ASTM C 31/C 31M and as specified below. Steel molds shall be used for molding the beams specimens. Molds for cylinder test specimens shall conform to ASTM C 470/C 470M. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Laboratory curing facilities for test specimens shall include furnishing and operating water tanks equipped with temperature-control devices that will automatically maintain the temperature of the water at 23 plus or minus 3 degrees C. The Contractor shall furnish and maintain at the site boxes or other facilities suitable for storing the specimens while in the mold at a temperature of 23 plus or minus 6 degrees C. Tests of the fresh concrete and of the hardened concrete specimens shall be made by and at the expense of the Contractor.

#### 1.5.1 Pavement Lots

Appropriate adjustment in payment for individual lots of concrete pavement will be made in accordance with the following paragraphs. No such adjustment in payment will be made for any material other than concrete. A lot will be that quantity of construction that will be evaluated for compliance with specification requirements. A lot will be equal to one shift (One days production) but not over 10 hour's production. In order to evaluate thickness, each lot will be divided into four equal sublots. Grade and surface smoothness (and condition) determinations will be made on the lot as a whole. However, any pavement not meeting the required 'specified strength' shall be removed and replaced at no additional cost to the Government. Strength will be evaluated, but will not be considered for payment adjustment. Edge slump requirements will be applied to each individual slab into which the primary paving lanes are divided by transverse joints, and will not be considered for payment adjustment. Samples for determining aggregate grading for fine aggregate and each size of coarse aggregate shall be taken as the aggregate bins discharge into the weigh hoppers. Results of tests on aggregates shall be used to control aggregate production and concreting operations, as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL, but will not be used for payment adjustment. Samples for determining air content and slump and for fabricating strength specimens shall be taken in accordance with ASTM C 172 during or immediately following delivery of the concrete at the paving site and deposition of the concrete immediately in front of the paver or transfer spreader. Results of strength tests shall be used to control concreting operations, but will not be used for payment adjustment. Cores for thickness determination shall be drilled and evaluated as specified. Location of all samples shall be as directed and will be deliberately selected on a truly random basis, not haphazard, using commonly recognized methods of assuring randomness, employing randomizing tables or computer programs, in accordance with ASTM D 3665.

- End of Section --

#### 1.5.2 Acceptance of Lots

When a lot of material fails to meet the specification requirements, that lot will be accepted at a reduced price or shall be removed and replaced. The lowest computed percent payment determined for any pavement characteristic (i.e., thickness, grade, and surface smoothness) discussed below shall be the actual percent payment for that lot. The actual percent payment will be applied to the bid price and the quantity of concrete placed in the lot to determine actual payment.

#### 1.5.3 Evaluation

The Contractor shall provide facilities for and, where directed, personnel to assist in obtaining samples for any Government testing, all at no additional cost to the Government. Such testing will in no way relieve the Contractor of any specified testing responsibilities. The Contractor shall provide all sampling and testing required for acceptance and payment adjustment at its expense. Such sampling and testing shall be performed by a commercial testing laboratory inspected by the Government and approved in writing. The laboratory performing the tests shall be on-site and shall conform with ASTM C 1077. The individuals who sample and test concrete or the constituents of concrete as required in this specification shall be certified as American Concrete Institute (ACI) Concrete Field Testing Technicians, Grade I, or shall have otherwise demonstrated to the satisfaction of the Contracting Officer other training providing knowledge and ability equivalent to the ACI minimum requirements for certification. The individuals who perform the inspection of concrete shall be certified as ACI Concrete Construction Inspector, Level II, or have otherwise demonstrated to the satisfaction of the Contracting Officer other training providing knowledge and ability equivalent to the ACI minimum requirements for certification. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations for conformance with ASTM C 1077.

#### 1.5.4 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. Testing in these areas will be in addition to the subplot or lot testing, and the requirements for these areas will be the same as those for a subplot or lot, but shall be at no additional cost to the Government.

#### 1.5.5 Air Content Tests

Air content of the concrete shall be controlled as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL and will not be considered for payment adjustment.

#### 1.5.6 Slump Tests

Slump of the concrete shall be controlled as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL and will not be considered for payment adjustment.

- End of Section --

1.5.7 Surface Smoothness

The Contractor shall use the following methods to test and evaluate surface smoothness of the pavement. All testing shall be performed in the presence of the Contracting Officer's representative. Detailed notes shall be kept of the results of the testing and a copy furnished to the Government immediately after each day's testing. The profilograph method shall be used for all longitudinal and transverse testing, except where the runs would be less than 60 m in length and at the ends where the straightedge shall be used. Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer.

1.5.7.1 Smoothness Requirements

- a. Straightedge Testing: The finished surfaces of the pavements shall have no abrupt change of 3 mm or more, and all pavements shall be within the limits specified in Table 1 when checked with an approved 4 m straightedge.

TABLE 1  
STRAIGHTEDGE SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Limits mm
Taxiways	Longitudinal	3
	Transverse	6
All Other Airfield and Helicopter Paved Areas	Longitudinal	6
	Transverse	6

- b. Profilograph Testing: The finished surfaces of the pavements shall have no abrupt change of 3 mm or more, and all pavement shall have a Profile Index not greater than specified in Table 2 when tested with an approved California-type profilograph. If the extent of the pavement in either direction is less than 60 m, that direction shall be tested by the straightedge method and shall meet requirements specified for such.

TABLE 2  
PROFILOGRAPH SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Maximum Specified Profile Index mm per km
Taxiways	Longitudinal Transverse	140 (Use Straightedge)

- End of Section --

All Other Airfield and	Longitudinal	140
Helicopter Paved Areas	Transverse	140

1.5.7.2 Testing Method

After the concrete has hardened sufficiently to permit walking thereon, but not later than 36 hours after placement, the surface of the pavement in each entire lot shall be tested by the Contractor in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. However, transverse profilograph testing of multiple paving lanes shall be performed at the timing directed. Separate testing of individual sublots is not required. If any pavement areas are ground, these areas shall be retested immediately after grinding. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines. The transverse lines shall be 4.5 m or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane shown on the drawings, regardless of whether the Contractor is allowed to pave two lanes at a time, and at the 1/8th point in from each side of the lane. Other areas having obvious deviations shall also be tested. Longitudinal testing lines shall be continuous across all joints. Transverse testing lines for pilot lanes shall be carried to construction joint lines and for fill-in lanes shall be carried 600 mm across construction joints, and the readings in this area applied to the fill-in lane. Straightedge testing of the longitudinal edges of slipformed pilot lanes shall also be performed before paving fill-in lanes as specified in paragraph "Edge Slump and Joint Face Deformation".

- a. Straightedge Testing: The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface, in the area between these two high points.
- b. Profilograph Testing: Profilograph testing shall be performed using approved equipment and procedures described in CDT Test 526. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate "must-grind" bumps and the Profile Index for the pavement. The "blanking band" shall be 5 mm wide and the "bump template" shall span 25 mm with an offset of 10 mm. The profilograph shall be operated by an approved, factory-trained operator on the alignments specified above. A copy of the reduced tapes shall be furnished the Government at the end of each day's testing.

1.5.7.3 Payment Adjustment for Smoothness

- a. Straightedge Testing: Location and deviation from straightedge for all measurements shall be recorded. When between 5.0 and 10.0 percent and less than 15.0 percent of all measurements made within

- End of Section --

a lot exceed the tolerance specified in paragraph "Smoothness Requirements" above, after any reduction of high spots or removal and replacement, the computed percent payment based on surface smoothness will be 95 percent. When more than 10.0 percent and less than 15.0 percent of all measurements exceed the tolerance, the computed percent payment will be 90 percent. When between 15.0 and 20.0 percent of all measurements exceed the tolerance, the computed percent payment will be 75 percent. When 20.0 percent or more of the measurements exceed the tolerance, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 50 percent shall be corrected by grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.

- b. Profilograph Testing: Location and data from all profilograph measurements shall be recorded. When the Profile Index of a lot exceeds the tolerance specified in paragraph "Smoothness Requirements" above by 16 mm per km but less than 32 mm per km, after any reduction of high spots or removal and replacement, the computed percent payment based on surface smoothness will be 95 percent. When the Profile Index exceeds the tolerance by 32 mm per km but less than 47 mm per km, the computed percent payment will be 90 percent. When the Profile Index exceeds the tolerance by 47 mm per km but less than 63 mm per km, the computed percent payment will be 75 percent. When the Profile Index exceeds the tolerance by 63 mm per km or more, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 79 mm per km or more, shall be corrected by grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.
- c. Bumps ("Must Grind" Areas): Any bumps ("must grind" areas) shown on the profilograph trace which exceed 10 mm in height shall be reduced by grinding in accordance with subparagraph "Areas Defective In Plan Grade Or Smoothness" until they do not exceed 7.5 mm when retested. Such grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. Areas of textured pavement shall be retextured in accordance with the subparagraph listed above. At the Contractor's option, pavement areas including ground areas may be rechecked with the profilograph in order to record a lower Profile Index.

#### 1.5.8 Edge Slump and Joint Face Deformation

The following requirements on testing and evaluation of edge slump and joint face deformation apply only to pavements 250 mm or more in thickness. Use of slip-form paving equipment and procedures that fail to consistently provide edges within the specified tolerances on edge slump and joint face deformation shall be discontinued and the pavements shall be constructed by means of standard paving procedures using fixed forms. Slabs having more than the allowable edge slump shall be removed and replaced as specified in subparagraph "Excessive Edge Slump" before the adjacent lane is placed.

- End of Section --

Edge slump and joint face deformation will not be applied to payment adjustment.

1.5.8.1 Edge Slump

When slip-form paving is used, not more than 15.0 percent of the total free edge of any slab of the pavement, as originally constructed, shall have an edge slump exceeding 6 mm, and no slab shall have an edge slump exceeding 9 mm as determined in accordance with the measurements as specified in paragraph "Determination of Edge Slump". (The total free edge of the pavement will be considered to be the cumulative total linear measurement of pavement edge originally constructed as non-adjacent to any existing pavement; i.e., 30 m of pilot lane, a paving lane originally constructed as a separate lane, will have 60 m of free edge; 30 m of fill-in lane will have no free edge, etc.,). The area affected by the downward movement of the concrete along the pavement edge shall not exceed 450 mm back from the edge.

1.5.8.2 Joint Face Deformation

In addition to the edge slump limits specified above, the vertical joint face shall have a surface within the maximum limits shown below:

Offset from Straightedge Applied Longitudinally To Pavement Surface 25 mm Back From Joint Line	Offset from Straightedge Applied Longitudinally To Vertical Face	Offset From Straightedge Applied Top to Bottom Against the Joint Face	Abrupt Offset in Any Direction	Offset of Joint Face From True Vertical	
Airfield Pavement	3 mm	6 mm	9 mm	3 mm	8 mm per 100 mm

1.5.8.3 Determination of Edge Slump

Immediately after the concrete has hardened sufficiently to permit walking thereon, the pavement surface shall be tested by the Contractor in the presence of a representative of the Contracting Officer. Testing shall be performed with a straightedge to reveal irregularities exceeding the edge slump tolerance specified above. The edge slump shall be determined at each free edge of each slipformed paving lane constructed. The straightedge shall be placed transverse to the direction of paving and the end of the straightedge located at the edge of the paving lane. Measurements shall be made at 1.5 to 4.5 m spacings, as directed, commencing at the header where paving was started. Initially measurements shall be made at 1.5 m intervals in each lane. When no deficiencies are present, the Contracting Officer may approve an increase in the interval. When any deficiencies exist, the interval will be returned to 1.5 m. In no case shall the interval exceed 4.5 m. In addition to the transverse edge slump determination above, the Contractor, at the same time, shall check the longitudinal surface

- End of Section --

smoothness of the joint on a continuous line 25 mm back from the joint line using the straightedge advanced one-half its length for each reading. Other tests of the exposed joint face shall be made as directed to ensure that a uniform, true vertical joint face is attained. These tests shall include longitudinal straightedge testing of the vertical face and vertical testing of the face for both smoothness and angle. The measurements shall be made by the Contractor, shall be properly referenced in accordance with paving lane identification and stationing, and a report given to the Contracting Officer within 24 hours after measurement is made. The report shall also identify areas requiring replacement in accordance with paragraph "Excessive Edge Slump" as well as the cumulative percentage of total free edge of pavement constructed to date which has an edge slump exceeding 6 mm.

#### 1.5.8.4 Excessive Edge Slump

When edge slump exceeding the limits specified above is encountered on either side of the paving lane, additional straightedge measurements shall be made, if required, to define the linear limits of the excessive slump. The concrete for the entire width of the paving lane within these limits of excessive edge slump or joint deformation shall be removed and replaced in conformance with paragraph REPAIR, REMOVAL, REPLACEMENT OR SLABS. Partial slabs removed and replaced shall extend across the full width of the pavement lane, parallel to the transverse joints, and both the section of the slab removed and the section remaining in place shall have a minimum length of 3 m to the nearest scheduled transverse joint. If less than 3 m remains, the entire slab shall be removed and replaced. Adding concrete or paste to the edge or otherwise manipulating the plastic concrete after the sliding form has passed, or patching the hardened concrete, shall not be used as a method for correcting excessive edge slump.

#### 1.5.9 Plan Grade

##### 1.5.9.1 Plan Grade Tolerances

The finished surfaces of pavements shall conform, within the tolerances shown below, to the lines, grades, and cross sections shown. The finished surfaces of airfield taxiway, and apron pavements shall vary not more than 12 mm above or below the plan grade line or elevation indicated. The surfaces of other pavements shall vary not more than 18 mm. Plan grade shall be checked on the lot as a whole and when more than 5.0 and less than 10.0 percent of all measurements made within a lot are outside the specified tolerance, the computed percent payment for that lot will be 95 percent. When more than 10.0 percent are outside the specified tolerances, the computed percent payment for the lot will be 75 percent. However, in any areas where the deviation from grade exceeds the specified tolerances by 50 percent or more, the deficient area shall be removed and replaced at no additional cost to the Government. However, the above deviations from the approved grade line and elevation will not be permitted in areas where closer conformance with the planned grade and elevation is required for the proper functioning of appurtenant structures. The finished surfaces of new abutting pavements shall coincide at their juncture.

##### 1.5.9.2 Grade Conformance Tests

Each pavement category shall be checked by the Contractor for conformance with plan grade requirements. For the purpose of making grade conformance tests, the pavements will be subdivided into the same lots used for all

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other payment adjustment items. Within 5 days after paving of each lot, the finished surface of the pavement area in each lot shall be tested by the Contractor, in the presence of a representative of the Contracting Officer, by running lines of levels at intervals corresponding with every longitudinal and transverse joint to determine the elevation at each joint intersection. The results of this survey shall be recorded and a copy given to the Government at the completion of the survey of each lot.

#### 1.5.10 Flexural Strength

Each lot of pavement will be evaluated for acceptance in accordance with the following procedures. The Contractor shall be responsible for all testing required herein. Testing shall be performed by an approved commercial laboratory. Results of strength tests will not be used for payment adjustment.

##### 1.5.10.1 Sampling and Testing

One composite sample of concrete from each subplot shall be obtained in accordance with ASTM C 172 from one batch or truckload. Test cylinders, 152 x 305 mm shall be fabricated and cured in accordance with ASTM C 31/C 31M; and tested in accordance with ASTM C 39/C 39M. Two test cylinders per subplot (8 per lot) shall be fabricated and cured for compressive strength, and two tested at 14-day age and two at 28-day age. The remaining four shall be tested at the ages directed. At the same time 2 additional test cylinders per subplot to be used for CQC tests shall be fabricated and cured; and tested as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL. Two beams for flexural strength shall be fabricated and cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 78 for every 2000 cubic meters of concrete. These shall be tested at the ages directed.

##### 1.5.10.2 Computations

The following computations shall be performed:

- a. Average the eight 14-day compressive strength tests for the lot and also compute the standard deviation(s) for the eight tests.
- b. Convert the 14-day average compressive strength for the lot to equivalent 28-day and 90-day average flexural strength for the lot, using the Correlation Ratio determined during mixture design studies.
- c. Report results of strength tests to the Contracting Officer daily. These values will be used for acceptance, but will not be used for payment adjustment.

##### 1.5.11 Thickness

Each lot of pavement will be evaluated for acceptance and payment adjustment in accordance with the following procedure. The Contractor shall be responsible for drilling the cores, measuring the cores in the presence of the Contracting Officer's representative, and for filling the core holes as directed.

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1.5.11.1 Drilling, Measuring, and Computations

Two cores, between 75 and 150 mm in diameter, shall be drilled from the pavement, per subplot (8 per lot). The Contractor shall fill the core holes with concrete containing an expanding admixture, as directed. The cores shall be evaluated for thickness of the pavement in accordance with ASTM C 174/C 174M. The pavement thickness from the 8 cores for the lot shall be averaged and the standard deviation for the 8 thickness measurements shall be computed.

1.5.11.2 Evaluation and Payment Adjustment for Thickness

Using the Average Thickness of the lot, the computed percent payment for thickness shall be determined by entering the following table:

Pavements Over 200 mm in Thickness

Deficiency in Thickness Determined by Cores mm	Computed Percent Payment for Thickness
0 to 6	100
6.5 to 12.5	75
13 to 18.5	50
19 or greater	0

Where 0 percent payment is indicated, the entire lot shall be removed and replaced at no additional cost to the Government. Where either of the two cores from a subplot show a thickness deficiency of 19 mm or greater, two more cores shall be drilled in the subplot and the average thickness of the four cores computed. If this average shows a thickness deficiency of 19 mm or more the entire subplot shall be removed.

1.5.12 Partial Lots

When operational conditions cause a lot to be terminated before the specified four sublots have been completed, the following procedure shall be used to adjust the lot size and number of tests for the lot. Where three sublots have been completed, they shall constitute a lot and acceptance criteria adjusted accordingly. Where one or two sublots have been completed, they shall be incorporated into the next lot or the previous lot, as directed, and the total number of sublots shall be used and acceptance criteria adjusted accordingly.

1.5.13 Areas Defective in Plan Grade or Smoothness

In areas not meeting the specified limits for surface smoothness and plan grade, high areas shall be reduced to attain the required smoothness and grade, except as depth is limited below. High areas shall be reduced either by hand rubbing the freshly finished concrete with a silicon carbide brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the

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concrete is 14 days or more old. Rubbing with a silicon carbide brick and water shall be discontinued as soon as contact with the coarse aggregate is made, and all further necessary reduction shall be accomplished by grinding the hardened concrete with a surface-grinding machine after it is 14 days old. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and shall not exceed 1 percent of the total area of any subplot. The depth of grinding shall not exceed 6 mm. All pavement areas requiring plan grade or surface smoothness corrections in excess of the limits specified above, shall be removed and replaced in conformance with paragraph REPAIR, REMOVAL, REPLACEMENT OF SLABS. In pavement areas given a wire comb or tined texture, areas exceeding 2 square meters that have been corrected by rubbing or grinding shall be retextured by transverse grooving using an approved grooving machine of standard manufacture. The grooves shall be 3 mm deep by 6 mm wide on 50 mm centers and shall be carried into, and tapered to zero depth within the non-corrected surface, or shall match any existing grooves in the adjacent pavement. All areas in which rubbing or grinding has been performed will be subject to the thickness tolerances specified in paragraph Thickness. Any rubbing or grinding performed on individual slabs with excessive deficiencies shall be performed at the Contractor's own decision without entitlement to additional compensation if eventual removal of the slab is required.

#### 1.6 ACCEPTABILITY OF WORK

The materials and the pavement itself will be accepted on the basis of tests made by the Government and by the Contractor's approved commercial laboratory or the supplier's approved laboratory, all as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing. If the results of the Government and Contractor tests vary by less than 2.0 percent, of the Government's test results, the results of the Contractor's tests will be used. If the results of the Government and Contractor tests vary by 2.0 percent or more, but less than 4.0 percent, the average of the two will be considered the value to be used. If these vary by 4.0 percent or more, each sampling and testing procedure shall be carefully evaluated and both the Government and the Contractor shall take another series of tests on duplicate samples of material. If these vary by 4.0 percent or more, the results of the tests made by the Government shall be used and the Government will continue check testing of this item on a continuous basis until the two sets of tests agree within less than 4.0 percent on a regular basis. Testing performed by the Government will in no way at any time relieve the Contractor from the specified testing requirements.

#### 1.7 PRECONSTRUCTION TESTING OF MATERIALS

The Contractor shall not be entitled to any additional payment or extension of time because of delays caused by sampling and testing additional sources, or samples, necessitated by failure of any samples.

##### 1.7.1 Aggregates

Aggregates shall be sampled by the Contractor in the presence of a Government representative. Samples shall be obtained in accordance with COE CRD-C 100 and of the size indicated therein, and shall be representative of the materials to be used for the project. Testing of samples shall be the responsibility of the Contractor and shall be performed by an approved

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commercial laboratory. Test results shall be submitted 60 days before commencing paving. No material shall be used unless test results show that it meets all requirements of these specifications.

#### 1.7.2 Chemical Admixtures

The Contractor shall provide satisfactory facilities for ready procurement of adequate test samples. Tests will be conducted with materials proposed for the project. An air-entraining admixture that has been in storage at the project site for longer than 6 months or that has been subjected to freezing will be retested at the expense of the Contractor when considered appropriate and shall be rejected if test results are not satisfactory.

#### 1.7.3 Curing Compound

The Contractor shall provide satisfactory facilities for ready procurement of adequate test samples.

#### 1.7.4 Epoxy-Resin Material

At least 30 days before the material is used, the Contractor shall submit certified copies of test results showing that the specific lots or batches from which the material will be furnished to this project have been tested by the manufacturer and that the material conforms to the requirements of these specifications.

#### 1.7.5 Cements, Pozzolans, and GGBF Slag

Preconstruction sampling and testing of cement, pozzolan, and GGBF slag shall conform to the requirements specified for sampling and testing during construction except that test results showing that each material meets specification requirements shall be available at least 5 days before start of paving operations.

### 1.8 TESTING BY CONTRACTOR DURING CONSTRUCTION

#### 1.8.1 Contractor's Testing Requirements

During construction, the Contractor shall be responsible for sampling and testing aggregates, cementitious materials (cement and pozzolan), and concrete to determine compliance with the specifications. All sampling and testing shall be performed by an approved commercial laboratory, or for cementitious materials, the manufacturer's laboratory. Samples of aggregate shall be obtained as the bins discharge into the weigh hopper. Samples of concrete shall be obtained at the point of delivery to the paver. The Government will sample and test concrete and ingredient materials as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Testing by the Government will in no way relieve the Contractor of the specified testing requirements.

#### 1.8.2 Cementitious Materials

Cement, ground granulated blast furnace (GGBF) slag, and pozzolan will be accepted on the basis of manufacturer's certification of compliance, accompanied by mill test reports showing that the material in each shipment meets the requirements of the specification under which it is furnished. No

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cementitious material shall be used until notice of acceptance has been given by the Contracting Officer. Cementitious material may be subjected to check testing by the Government from samples obtained at the mill, at transfer points, or at the project site.

#### 1.9 QUALIFICATIONS

All 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 approved 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 finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher, or equal. Written documentation shall be furnished for each workman in the above groups.

#### 1.10 TEST SECTION

At least 10 days but not more than 60 days prior to construction of the concrete pavement, a test section shall be constructed as part of the production paving area at an outer edge of the taxiway area. The test section will be allowed to remain in place, if meeting all specification requirements and will be paid for as part of the production pavement. There will be no separate payment for the test section or sections and the cost of the materials, and the construction will be considered a subsidiary cost of constructing the project. The Contractor shall notify the Contracting Officer at least 5 days in advance of the date of test section construction. The test section shall consist of one paving lane at least 130 m long and shall be constructed to a thickness of 300 mm. The lane width shall be the same as that required for use in the project. The test section shall contain at least one transverse construction joint. Where doweled longitudinal construction joints are required in any of the production pavements, they shall be installed full length along one side of the test strip throughout the test section. Two separate days shall be used for construction of the test section. The Contractor shall use the test section to develop and demonstrate to the satisfaction of the Contracting Officer the proposed techniques of mixing, hauling, placing, consolidating, finishing, curing, start-up procedures, testing methods, plant operations, and the preparation of the construction joints. Variations in mixture proportions other than water shall be made if directed. The test section shall be placed as approved by the Government. The Contractor shall vary the water content, as necessary, to arrive at the appropriate w/c ratio. The mixing plant shall be operated and calibrated prior to start of placing the test section. The Contractor shall use the same equipment, materials, and construction techniques on the test section as will be used in all subsequent work. Base course preparation, concrete production, placing, consolidating, curing, construction of joints, and all testing shall be in accordance with applicable provisions of this specification. The Contractor shall construct the test section meeting all specification requirements and being acceptable to the Contracting Officer in all aspects, including surface texture. Failure to construct an acceptable test section will necessitate construction of additional test sections at no additional cost

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to the Government. Test sections allowed to be constructed as part of the production paving which do not meet specification requirements shall be removed at the Contractor's expense. If the Contractor proposes to use slipform paving and is unable to construct an acceptable test section, or if the slipform paving equipment and procedures are found to be unable to produce acceptable pavement at any time, the slipform paving equipment shall be removed from the job and the construction completed using stationary side forms and equipment compatible with them. The Contractor shall provide four cores at least 150 mm diameter and 2 beams at least 150 by 800 mm by full depth (or 4 beams at least 150 by 500 mm by full depth) cut from points selected in the test section by the Government, 5 days after completion of the test section. The Contractor shall trim the beams to dimensions directed before delivery for inspection and testing, as considered appropriate. Production paving may be started immediately after the results of 7-day tests of the cores (and the sawed beams) have been approved and after approval of the test section.

#### 1.11 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

##### 1.11.1 Bulk Cementitious Materials

All cementitious material shall be furnished in bulk. The temperature of the cementitious material, as delivered to storage at the site, shall not exceed 65 degrees C.

###### 1.11.1.1 Transportation

When bulk cementitious material is not unloaded from primary carriers directly into weather-tight hoppers at the batching plant, transportation from the railhead, mill, or intermediate storage to the batching plant shall be accomplished in adequately designed weather-tight trucks, conveyors, or other means that will protect the cementitious material from exposure to moisture.

###### 1.11.1.2 Storage Requirements

Immediately upon receipt at the site of the work, cementitious materials shall be stored in a dry and properly ventilated structure. All storage facilities shall be subject to approval and shall allow easy access for inspection and identification. Sufficient cementitious materials shall be in storage to sustain continuous operation of the concrete mixing plant while the pavement is being placed. To prevent cement from becoming unduly aged after delivery, any cement that has been stored at the site for 60 days or more shall be used before using cement of lesser age.

###### 1.11.1.3 Separation of Materials

Separate facilities shall be provided which will prevent any intermixing during unloading, transporting, storing, and handling of each type of cementitious material.

##### 1.11.2 Aggregate Materials

###### 1.11.2.1 Storage

Aggregate shall be stored at the site of the batching and mixing plant avoiding breakage, segregation, or contamination by foreign materials. Each

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size of aggregate from each source shall be stored separately in free-draining stockpiles. Fine aggregate and the smallest size coarse aggregate shall remain in free-draining storage for at least 24 hours immediately prior to use. Sufficient aggregate shall be maintained at the site at all times to permit continuous uninterrupted operation of the mixing plant at the time concrete pavement is being placed.

#### 1.11.2.2 Handling

Aggregate shall be handled avoiding segregation or degradation. Vehicles used for stockpiling or moving aggregate shall be kept clean of foreign materials. Tracked equipment shall not be allowed on coarse aggregate stockpiles. Stockpiles shall be built up and worked avoiding segregation in the piles and preventing different sizes of aggregate from being mixed during storage or batching. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed and unused.

#### 1.11.3 Other Materials

Reinforcing bars and accessories shall be stored above the ground on platforms, skids, or other supports. Other materials shall be stored avoiding contamination and deterioration. Chemical admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. The Contractor shall ensure that materials can be accurately identified after bundles or containers are opened.

### 1.12 EQUIPMENT

All plant, equipment, tools, and machines used in the work shall be maintained in satisfactory working conditions at all times.

#### 1.12.1 Concrete Production

##### 1.12.1.1 Batching, Mixing, and Transporting Concrete

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

##### 1.12.1.2 Transporting Concrete to Project Site

Concrete shall be transported to the placing site in truck mixers. Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94. Nonagitator 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 nonagitator 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.

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### 1.12.2 Transfer and Spreading Equipment

Equipment for transferring concrete from the transporting equipment to the paving lane in front of the paver shall be specially manufactured, self-propelled transfer equipment which will accept the concrete outside the paving lane and will transfer and spread it evenly across the paving lane in front of the paver and strike off the surface evenly to a depth which permits the paver to operate efficiently. The travelling surge hopper shall be a specially manufactured, self-propelled transfer-placer which will operate in front of the paver and accept the concrete from the transporting equipment outside the paving lane, store it as necessary, and feed it out evenly across the lane in front of the paver at a depth which permits the paver to operate efficiently. The capacity shall be such that concrete is always available in front of the paver, to prevent the need for stopping the paver. It shall be designed to always discharge the oldest concrete remaining in the hopper before the fresher concrete.

### 1.12.3 Paver-Finisher

The paver-finisher shall be a heavy-duty, self-propelled machine designed specifically for paving and finishing high quality pavement. The paver-finisher shall weigh at least 3280 kg per mof lane width, and shall be powered by an engine having at least 15,000 W per meter of lane width. The paver-finisher shall spread, consolidate, and shape the plastic concrete to the desired cross section in one pass. The mechanisms for forming the pavement shall be easily adjustable in width and thickness and for required crown. In addition to other spreaders required by paragraph Transfer and Spreading Equipment, the paver-finisher shall be equipped with a full width knock-down auger or paddle mechanism, capable of operating in both directions, which will evenly spread the fresh concrete in front of the screed or extrusion plate. Immersion vibrators shall be gang mounted at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or completely withdrawn from the concrete, as required. The vibrators shall be automatically controlled so that they will be immediately stopped as forward motion of the paver ceases. The spacing of the immersion vibrators across the paving lane shall be as necessary to properly consolidate the concrete, but the clear distance between vibrators shall not exceed 750 mm. Spud vibrators shall operate at a frequency of not less than 135 Hz and an amplitude of not less than 0.75 mm and tube vibrators at a frequency of not less than 80 Hz and an amplitude of not less than 0.75 mm, as determined by COE CRD-C 521. The paver-finisher shall be equipped with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface and shall so finish the surface that no significant amount of hand finishing, except use of cutting straightedges, is required. The screed or extrusion plate shall be constructed to provide adjustment for crown in the pavement. The entire machine shall provide adjustment for variation in lane width or thickness and to prevent more than 200 mm of the screed or extrusion plate extending over previously placed concrete on either end when paving fill-in lanes. Machines that cause displacement of properly installed forms or cause ruts or indentations in the prepared underlying materials and machines that cause frequent delays due to mechanical failures shall be replaced as directed.

#### 1.12.3.1 Paver-Finisher with Fixed Forms

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The paver-finisher shall be equipped with wheels designed to keep it aligned with the forms and to spread the load so as to prevent deformation of the forms.

#### 1.12.3.2 Slipform Paver-Finisher

The slipform paver-finisher shall be automatically controlled and crawler mounted with four padded tracks so as to be completely stable under all operating conditions. The paver-finisher shall finish the surface and edges so that no edge slump beyond allowable tolerance occurs. Horizontal alignment shall be electronically referenced to a taut wire guideline. Vertical alignment shall be electronically referenced on both sides of the paver to a taut wire guideline, to an approved laser control system, or, only where permitted by paragraph Slipform Paving, to a ski operating on a completed lane. Suitable moving side forms shall be provided that are adjustable and will produce smooth, even edges, perpendicular to the top surface and meeting specification requirements for alignment and freedom from edge slump.

#### 1.12.3.3 Longitudinal Mechanical Float

A longitudinal mechanical float shall be specially designed and manufactured to smooth and finish the pavement surface without working excess paste to the surface. It shall be rigidly attached to the rear of the paver-finisher or to a separate self-propelled frame spanning the paving lane. The float plate shall be at least 1.5 m long by 200 mm wide and shall automatically be oscillated in the longitudinal direction while slowly moving from edge to edge of the paving lane, with the float plate in contact with the surface at all times.

#### 1.12.3.4 Nonrotating Pipe Float

A pipe float if used, shall be a nonrotating pipe 150 to 250 mm in diameter and sufficiently long to span the full paving width when oriented at an angle of approximately 60 degrees with the centerline. The pipe float shall be mounted on a self-propelled frame that spans the paving lane. No means of applying water to the surface shall be incorporated in the pipe float.

#### 1.12.3.5 Other Types of Finishing Equipment

Clary screeds or other rotating tube floats, or bridge deck finishers, shall not be allowed on the project. Concrete finishing equipment of types other than specified above may be demonstrated on a test section outside the production pavement if approved in writing. If the Contracting Officer's representative decides from evaluation of the test section that the equipment is better than the specified finishing equipment, its use will be permitted as long as it continues to perform better than the specified equipment.

#### 1.12.4 Curing Equipment

Equipment for applying membrane-forming curing compound shall be mounted on a self-propelled frame that spans the paving lane. The reservoir for curing compound shall be constantly mechanically (not air) agitated during operation and shall contain means for completely draining the reservoir. The spraying system shall consist of a mechanically powered pump which will maintain constant pressure during operation, an operable pressure gauge, and

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either a series of spray nozzles evenly spaced across the lane to give uniformly overlapping coverage or a single spray nozzle which is mounted on a carriage which automatically traverses the lane width at a speed correlated with the forward movement of the overall frame. All spray nozzles shall be protected with wind screens. Any hand-operated sprayers allowed by paragraph Membrane Curing shall be compressed air supplied by a mechanical air compressor. If the curing machine fails to apply an even coating of compound at the specified rate, it shall immediately be replaced.

#### 1.12.5 Texturing Equipment

Texturing equipment shall be as specified below. Before use, the texturing equipment shall be demonstrated on a test section, and the equipment shall be modified as necessary to produce the texture directed.

##### 1.12.5.1 Deep Texturing Equipment

Texturing equipment shall consist of a stiff bristled broom forming a drag at least 1.2 m long. This drag shall be mounted in a wheeled frame spanning the paving lane and so constructed that the drag is mechanically pulled in a straight line across the paving lane perpendicular to the centerline.

##### 1.12.6 Sawing Equipment

Equipment for sawing joints and for other similar sawing of concrete shall be standard diamond-type concrete saws mounted on a wheeled chassis which can be easily guided to follow the required alignment. Blades shall be diamond tipped. If demonstrated to operate properly, abrasive blades may be used. All saws shall be capable of sawing to the full depth required.

##### 1.12.7 Straightedge

The Contractor shall furnish and maintain at the job site, in good condition, one 4 m straightedge for each paving train for testing the hardened portland cement concrete surfaces. These straightedges shall be constructed of aluminum or magnesium alloy and shall have blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Straightedges shall have handles for operation on the pavement.

##### 1.12.8 Profilograph

The Contractor shall furnish a 7.6 m profilograph for testing the finished pavement surface. The profilograph shall produce a record on tape of the results of testing the pavement surface and shall automatically mark the Profile Index of each section tested as well as indicate and measure each "must grind" point, all in accordance with CDT Test 526 and as required by paragraph Surface Smoothness.

## PART 2 PRODUCTS

### 2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement in combination with pozzolan or ground granulated blast furnace slag and shall conform to the appropriate specifications listed below. Cementitious materials in the completed structure shall be restricted so there is no change in color, source, or

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type of cementitious material. Temperature of cementitious materials as supplied to the project shall not exceed 65 degrees C.

#### 2.1.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type I (low alkali if available). When low alkali cement is not available, the contractor shall use a combination of type I portland cement that does not meet the low-alkali requirement with a pozzolan or ground granulated blast furnace (GGBF) slag provided the following requirement is met. The expansion of the proposed combination shall be equal to or less than the expansion of a low-alkali cement meeting the requirements of this paragraph when tested in general conformance with ASTM C 441. The expansion tests shall be run concurrently at an independent laboratory that is nationally recognized to perform such tests. In addition, tests shall be completed in accordance with ASTM C 1260 as described below in paragraph "Aggregate Sources". The government reserves the right to confirm the test results and to adjust the percentage of pozzolan or GGBF slag in the combination to suit other requirements.

#### 2.1.2 High-Early-Strength Portland Cement

High-early-strength cement shall conform to ASTM C 150, Type III with C3A limited to 8 percent, low-alkali. Type III cement shall be used only in isolated instances and only when approved in writing by the Contracting Officer..

#### 2.1.3 Pozzolan (Fly Ash)

##### 2.1.3.1 Fly Ash

Fly ash shall conform to ASTM C 618, Class F with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of ASTM C 618. Requirement for maximum alkalies from Table 1A of ASTM C 618 shall apply. Loss on ignition shall not exceed 3 percent. Fly ash shall have a Calcium Oxide (CaO) content of less than 8 percent. If pozzolan is used in lieu of GGBF, it shall never be less than 15 percent nor more than 35 percent by weight of the total cementitious material. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

#### 2.1.4 Ground Granulated Blast-Furnace (GGBF) Slag

Ground Granulated Blast-Furnace Slag shall conform to ASTM C 989, Grade 120. If GGBF is used in lieu of Class F fly ash, it shall never be less than 20 percent nor more than 50 percent by weight of the total cementitious material, unless otherwise indicated by the GGBF manufacturer and approved by the Contracting Officer.

### 2.2 AGGREGATES

#### 2.2.1 Aggregate Sources

Fine and coarse aggregates to be used in all concrete shall be evaluated and tested by the Contractor for alkali-aggregate reactivity in accordance with

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ASTM C 1260. Both coarse aggregate size groups shall be tested if from different sources. Test results shall have a measured expansion equal to or less than 0.08 percent at 16 days after casting. Should the test data indicate an expansion greater than 0.08 percent, the aggregate(s) shall be rejected, or additional testing, using a modified version of ASTM C 1260, shall be performed by the Contractor as described below. ASTM C 1260 shall be modified as follows to include one of the following options:

- a. Utilize the Contractor's proposed low alkali portland cement and Class F fly ash in combination for the test proportioning. Class F fly ash shall contain less than 8 percent Calcium Oxide (CaO) and shall be used in the range of 15 to 35 percent of the total cementitious material by mass. The quantity shall be determined that will meet all the requirements of these specifications and which will lower the expansion equal to or less than 0.08 percent at 16 days after casting.
- b. Utilize the Contractor's proposed low alkali portland cement and ground granulated blast furnace (GGBF) slag in combination for the test proportioning. GGBF slag shall be used in the range of 20 to 50 percent of the total cementitious material by mass. The quantity shall be determined that will meet all the requirements of these specifications and which will lower the expansion equal to or less than 0.08 percent at 16 days after casting.

If any of the above options does not lower the expansion equal to or less than 0.08 percent at 16 days after casting, the aggregate(s) shall be rejected and the Contractor shall submit new aggregate sources for retesting. The results of the testing shall be submitted to the Contracting Officer for evaluation and acceptance.

#### 2.2.2 Coarse Aggregate

Coarse aggregate shall have a satisfactory service record of at least 5 years successful service in three paving projects or, if a new source is used, shall meet the requirements when tested for resistance to freezing and thawing.

##### 2.2.2.1 Material Composition

Coarse aggregate shall consist of crushed gravel or crushed stone . Crushed gravel shall contain not less than 75 percent of crushed particles by mass in each sieve size, as determined by COE CRD-C 171.

##### 2.2.2.2 Quality

Aggregates as delivered to the mixers shall consist of clean, hard, uncoated particles meeting the requirements of ASTM C 33 and other requirements specified herein. Coarse aggregate shall be washed. Washing shall be sufficient to remove dust and other coatings..

##### 2.2.2.3 Particle Shape Characteristics

Particles of the coarse aggregate shall be generally spherical or cubical in shape. The quantity of flat and elongated particles in any size group shall not exceed 20 percent by weight as determined by COE CRD-C 119. A flat particle is defined as one having a ratio of width to thickness greater than

- End of Section --

3; an elongated particle is one having a ratio of length to width greater than 3.

2.2.2.4 Size and Grading

The nominal maximum size of the coarse aggregate shall be 37.5 mm. and shall meet the size groups below. When the nominal maximum coarse size is greater than 25 mm, the aggregates shall be furnished in two size groups as follows:

Nominal Maximum Size mm	Size Group
19	ASTM C 33 --No. 67 (4.75 to 19 mm)
37.5	ASTM C 33 --No. 4 (19 to 37.5 mm)

The grading of the coarse aggregate within the separated size groups shall conform to the requirements of ASTM C 33, Sizes 67 and 4 as delivered to the mixer.

2.2.2.5 Deleterious Materials - Airfield Pavements

Weather Severity	Air Freezing Index Coldest year in 30 (a)	Average Precipitation for any Single Month during the Freezing Period
Moderate	500 or less	Any Amount
Moderate (b)	501 or more	Less than 25 mm (1 inch)
Severe	501 or more	25 mm (1 inch) or more

The amount of deleterious material in each sieve size of coarse aggregate shall not exceed the limits shown in Table 5 below, determined in accordance with the test methods shown.

TABLE 5  
LIMITS OF DELETERIOUS MATERIALS IN COARSE AGGREGATE  
FOR AIRFIELD PAVEMENTS  
Percentage by Mass

Clay lumps and friable particles (ASTM C 142)	0.2
Shale (a) (ASTM C 295)	0.1

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Material finer than 0.075 mm (No. 200 sieve) (b) (ASTM C 117)	0.5
Lightweight particles (c) (ASTM C 123)	0.2
Clay ironstone (d) (ASTM C 295)	0.1
Chert and cherty stone (less than 2.40 Mg/cubic meter density SSD (2.40 Sp. Gr.)) (e) (ASTM C 295)	0.1
Claystone, mudstone, and siltstone (f) (ASTM C 295)	0.1
Shaly and argillaceous limestone (g) (ASTM C 295)	0.2
Other soft particles COE CRD-C 130	1.0
Total of all deleterious substances exclusive of material finer than 0.075 mm (No. 200 sieve)	1.0

- a. Shale is defined as a fine-grained, thinly laminated or fissile sedimentary rock. It is commonly composed of clay or silt or both. It has been indurated by compaction or by cementation, but not so much as to have become slate.
- b. Limit for material finer than 0.075 mm (No. 200 sieve) will be increased to 1.5 percent for crushed aggregates if the fine material consists of crusher dust that is essentially free from clay or shale.
- c. The separation medium shall have a density of 2.0 Mg/cubic meter (Sp. Gr. of 2.0). This limit does not apply to coarse aggregate manufactured from blast-furnace slag unless contamination is evident.
- d. Clay ironstone is defined as an impure variety of iron carbonate, iron oxide, hydrous iron oxide, or combinations thereof, commonly mixed with clay, silt, or sand. It commonly occurs as dull, earthy particles, homogeneous concretionary masses, or hard-shell particles with soft interiors. Other names commonly used for clay ironstone are "chocolate bars" and limonite concretions.
- e. Chert is defined as a rock composed of quartz, chalcedony or opal, or any mixture of these forms of silica. It is variable in color. The texture is so fine that the individual mineral grains are too small to be distinguished by the unaided eye. Its hardness is such that it scratches glass but is not scratched by a knife blade. It may contain impurities such as clay, carbonates, iron oxides, and other minerals. Other names commonly applied to varieties of chert are: flint, jasper, agate, onyx, hornstone, porcellanite,

- End of Section --

novaculite, sard, carnelian, plasma, bloodstone, touchstone, chrysoprase, heliotrope, and petrified wood. Cherty stone is defined as any type of rock (generally limestone) that contains chert as lenses and nodules, or irregular masses partially or completely replacing the original stone.

- f. Claystone, mudstone, or siltstone, is defined as a massive fine-grained sedimentary rock that consists predominantly of indurated clay or silt without laminations or fissility. It may be indurated either by compaction or by cementation.
- g. Shaly limestone is defined as limestone in which shale occurs as one or more thin beds or laminae. These laminae may be regular or very irregular and may be spaced from a few inches down to minute fractions of an inch. Argillaceous limestone is defined as a limestone in which clay minerals occur disseminated in the stone in the amount of 10 to 50 percent by weight of the rock; when these make up from 50 to 90 percent, the rock is known as calcareous (or dolomitic) shale (or claystone, mudstone, or siltstone).

#### 2.2.2.6 Testing Sequence Deleterious Materials

The size of the sample shall be at least 90 kg for the 19 to 37 mm size and 12 kg for the 4.75 to 19 mm coarse aggregate and 5 kg for the fine aggregate. The Contractor shall provide facilities for the ready procurement of representative test samples. Samples shall be taken and tested by and at the expense of the Contractor, using appropriate Corps of Engineers laboratory and ASTM test methods. Additional tests and analyses of aggregates at various stages in the processing and handling operations may be made by the Government at the discretion of the Contracting Officer. Such Government testing will not relieve the Contractor of any of its testing responsibilities. The testing procedure on each sample of coarse aggregate for compliance with limits on deleterious materials shall be as follows:

Step 1: Test approximately one-fifth of sample for material finer than the 0.075 mm sieve.

Step 2: Wash off material finer than 0.075 mm sieve from the remainder of the sample and recombine the remainder with material retained on the 0.075 mm sieve from Step 1.

Step 3: Test remaining full sample for clay lumps and friable particles and remove.

Step 4: Test remaining full sample for lightweight particles and remove, and then for chert and/or cherty stone with SSD density of less than 2.40 Mg/cubic meter (Sp. Gr. 2.40) and remove.

Step 5: Test remaining sample for clay-ironstone, shale, claystone, mudstone, siltstone, shaly and/or argillaceous limestone, and remove.

Step 6: Test approximately one-fifth of remaining full sample for other soft particles.

Determination of deleterious materials listed in Steps 4 and 5 shall be performed by an individual specifically trained in petrographic

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identification. The individual selected to perform the identification of these deleterious materials shall be subject to approval and, at least 10 days before any individual is proposed to commence this type of work, the Contractor shall submit a written resume of the individual's training and experience for approval by the Contracting Officer. The Contractor will not be entitled to any extension of time or additional payment due to any delays caused by the testing, evaluation, or personnel requirements.

#### 2.2.2.7 Resistance to Freezing and Thawing

Coarse aggregate not having a satisfactory demonstrable service record shall have a durability factor of 50 or more when subjected to freezing and thawing in concrete in accordance with COE CRD-C 114.

#### 2.2.2.8 Resistance to Abrasion

Coarse aggregate shall not show more than 40 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131.

#### 2.2.3 Fine Aggregate

Fine aggregate shall have a service record of at least 5 years satisfactory service in three paving projects or, if a new source is used, shall meet the requirements for resistance to freezing and thawing.

##### 2.2.3.1 Composition

Fine aggregate shall consist of natural sand, manufactured sand, or a combination of the two, and shall be composed of clean, hard, durable particles. Irrespective of the source from which it is obtained, all fine aggregate shall be composed of clean, hard, durable particles meeting the requirements of ASTM C 33. Each type of fine aggregate shall be stockpiled and batched separately. Any degree of contamination will be cause for the rejection of the entire stockpile.

##### 2.2.3.2 Particle Shape

Particles of the fine aggregate shall be generally spherical or cubical in shape.

##### 2.2.3.3 Grading

Grading of the fine aggregate, as delivered to the mixer, shall conform to the requirements of ASTM C 33. In addition, the fine aggregate, as delivered to the mixer, shall have a fineness modulus of not less than 2.50 nor more than 3.00. The grading of the fine aggregate also shall be controlled so that the fineness moduli of at least nine of every set of ten consecutive samples of the fine aggregate, as delivered to the mixer, will not vary more than 0.15 from the average fineness moduli of all samples previously taken. The fineness modulus shall be determined by COE CRD-C 104.

##### 2.2.3.4 Deleterious Material

The amount of deleterious material in the fine aggregate shall not exceed the following limits by mass:

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Material	Percentage by Mass
Clay lumps and friable particles ASTM C 142	1.0
Material finer than 0.075 mm (No. 200 sieve) ASTM C 117	3.0
Lightweight particles ASTM C 123 using a medium with a density of 2.0 Mg/cubic meter (Sp. Gr. of 2.0))	0.5
Total of all above	3.0

2.2.3.5 Resistance to Freezing and Thawing

Fine aggregate not having a satisfactory demonstrable service record shall have a durability factor of 50 or more when subjected to freezing and thawing in concrete in accordance with COE CRD-C 114.

2.3 CHEMICAL ADMIXTURES

2.3.1 Air-Entraining Admixtures

The air-entraining admixture shall conform to ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entraining admixture shall be in a solution of suitable concentration for field use.

2.3.2 Accelerator

An accelerator shall be used only when specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES and shall not be used to reduce the amount of cementitious material used. Accelerator shall conform to ASTM C 494/C 494M, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

2.3.3 Retarder

A retarding admixture shall meet the requirements of ASTM C 494/C 494M, Type B, except that the 6-month and 1-year compressive strength tests are waived. The use of the admixture is at the option of the Contractor, but shall not be used to reduce the amount of cementitious material.

2.3.4 Water-Reducer

A water-reducing admixture shall meet the requirements of ASTM C 494/C 494M, Type A or D except that the 6-month and 1-year compressive strength tests are waived. The admixture may be added to the concrete mixture only when its use is approved or directed, and only when it has been used in mixture proportioning studies to arrive at approved mixture proportions.

2.4 CURING MATERIALS

2.4.1 Membrane Forming Curing Compound

Membrane forming curing compound shall be a white pigmented compound conforming to COE CRD-C 300.

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#### 2.4.2 Burlap

Burlap used for curing shall conform to AASHTO M 182, Class 3 or 4. Materials shall be new or shall be clean materials never used for anything other than curing concrete.

#### 2.4.3 Impervious Sheet Materials

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

#### 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 JOINT MATERIALS

##### 2.6.1 Expansion Joint Material

Expansion joint filler shall be a preformed material conforming to ASTM D 1752 Type I, II, or III. Expansion joint filler shall be 20 mm thick.

#### 2.7 REINFORCING

All reinforcement shall be free from loose, flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete. Removal of thin powdery rust and tight rust is not required. However, reinforcing steel which is rusted to the extent that it does not conform to the required dimensions or mechanical properties shall not be used.

##### 2.7.1 Reinforcing Bars and Bar Mats

Reinforcing bars shall conform to ASTM A 615/A 615M, billet-steel, Grade 420. Bar mats shall conform to ASTM A 184/A 184M. The bar members shall be billet steel.

##### 2.7.2 Welded Wire Fabric

Welded steel wire fabric shall conform to ASTM A 185.

##### 2.7.3 Deformed Wire Fabric

Welded deformed steel wire fabric shall conform to ASTM A 497.

#### 2.8 DOWELS

##### 2.8.1 Dowels

Dowels shall be single piece bars fabricated or cut to length at the shop or mill before delivery to the site. Dowels shall be free of loose, flaky rust and loose scale and shall be clean and straight. Dowels may be sheared to length provided that the deformation from true shape caused by shearing does not exceed 1 mm on the diameter of the dowel and does not extend more than 1 mm from the end of the dowel. Dowels shall be plain (non-deformed) steel bars conforming to ASTM A 36 or shall be steel pipe conforming to ASTM A

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53/A 53M, extra strong, as indicated. If split dowels are proposed for use, a complete description of the materials and installation procedures shall be submitted for approval at least 15 days before start of construction. Paint for dowels shall conform to MIL-DTL-24441/20.

## 2.9 EPOXY RESIN

All epoxy-resin materials shall be two-component materials conforming to the requirements of ASTM C 881, Class as appropriate for each application temperature to be encountered, except that in addition, the materials shall meet the following requirements:

- a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.
- b. Material for use as patching materials for complete filling of spalls, wide cracks, and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.
- c. Material for use for injecting cracks shall be Type IV, Grade 1.
- d. Material for bonding freshly mixed portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete shall be Type V, Grade as approved.

## 2.10 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES

### 2.10.1 Specified Flexural Strength

Specified flexural strength, R, for concrete is 4.5 MPa at 28 days, as determined by tests made in accordance with ASTM C 78 of beams fabricated and cured in accordance with ASTM C 192/C 192M or as determined by equivalent flexural strength for acceptance as specified in paragraph, Flexural Strength. Maximum allowable water-cementitious material ratio is 0.45. The water-cementitious material ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan and ground granulated blast furnace slag by the mass equivalency method described in ACI 211.1. The concrete shall be air-entrained with a total air content of 6 plus or minus 1 percentage point, at the point of placement. Air content shall be determined in accordance with ASTM C 231. The maximum allowable slump of the concrete at the point of placement shall be 50 mm for pavement constructed with fixed forms. For slipformed pavement, at the start of the project, the Contractor shall select a maximum allowable slump which will produce in-place pavement meeting the specified tolerances for control of edge slump.

### 2.10.2 Concrete Temperature

The temperature of the concrete as delivered shall conform to the requirements of paragraphs, Paving in Hot Weather and Paving in Cold Weather. Temperature of concrete shall be determined in accordance with ASTM C 1064/C 1064M.

### 2.10.3 Concrete Strength for Final Acceptance

The strength of the concrete will be considered acceptable when the average equivalent 28-day Flexural strengths for each lot are above the 'Specified

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Flexural Strength' as determined by correlation with 14-day compressive strength tests specified in paragraph MIXTURE PROPORTIONS BY CONTRACTOR for 28-day flexural Strength, and no individual set (2 cylinders per subplot) in the lot are 170 kPa or more below the equivalent 'Specified Flexural Strength'. If any lot or subplot, respectively, fails to meet the above criteria, the lot or subplot shall be removed and replaced at no additional cost to the Government. This is in addition to and does not replace the average strength required for day-to-day CQC operations as specified in paragraph Average Flexural Strength Required for Mixtures.

## 2.11 MIXTURE PROPORTIONS BY CONTRACTOR

### 2.11.1 Composition

Concrete shall be composed of cementitious material, water, fine and coarse aggregates, and admixtures. The cementitious material shall be portland cement, or only portland cement in combination with pozzolan or ground granulated blast-furnace slag. Fly ash, if used with non alkali-reactive aggregates, shall consist of not less than 15 percent of the cementitious material by mass and not more than 35 percent. GGBF slag, if used with non alkali-reactive aggregates, shall consist of not less than 20 percent of the cementitious material by mass and not more than 50 percent. If Class F fly ash or GGBF slag is required to mitigate potential alkali-aggregate reactivity, the percentage by mass determined from the modified ASTM C 1260 testing shall be used in the mixture proportioning studies... Admixtures shall consist of air entraining admixture and may also include, as approved accelerator retarder or water-reducing admixture. If water-reducer is used, it shall be used only at the dosage determined during mixture proportioning studies. High range water-reducing admixtures and admixtures to produce flowable concrete shall not be used.

### 2.11.2 Concrete Proportioning Studies, Pavement Concrete

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/C 192M 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 proportions, 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.

#### 2.11.2.1 Water-Cement Ratio

At least three 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 Maximum Water-Cement Ratio will be the equivalent water-cement ratio as determined by conversion from the mass ratio of water to cement plus pozzolan, and ground granulated blast furnace (GGBF) slag by the weight equivalency method as described in ACI 211.1. In the case where GGBF slag is used, the mass of

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the GGBF slag shall be included in the equations in ACI 211.1 for the term P, which is used to denote the mass of pozzolan. Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content.

2.11.2.2 Trial Mixture 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:

2.11.2.3 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/C 192M, using 152 x 152 mm beams and 152 x 305 mm cylinders.
- b. Test beams in accordance with ASTM C 78, cylinders in accordance with ASTM C 39/C 39M.
- c. Fabricate and cure test beams from each mixture for 7, 14 and 28 day flexural tests; 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; 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 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 "Average Flexural Strength Required for Mixtures".

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- 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 strength for the mixture.
- h. From the above expected strengths for the selected mixture determine the following Correlation Ratios:
  - (1) Ratio of the 14-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 pavement shall be placed until the Contracting Officer has approved the Contractor's mixture proportions.

### 2.11.3 Contractor Quality Control for Average Flexural Strength

The Contractor's day to day production shall be Controlled (CQC) in accordance with the criteria herein, in the following subparagraphs, and in par. 'Concrete Strength Testing for CQC'. This is entirely different from the acceptance requirements of par. 'Concrete Strength for Final Acceptance', and it is mandatory that both sets of requirements must be met. If at any time, the 'equivalent average 28-day flexural strength', for any lot, as determined by correlation with results of 7-day compressive test specimens, is 410 kPa or more below the 'required equivalent average 28-day flexural strength', as specified below, the paving operation shall be stopped and the Contractor shall take necessary steps to improve the mixture proportioning, materials, or the batching and mixing to increase the strength. The paving operations shall not recommence until the Contracting Officer has approved the Contractor's Proposed changes in writing.

#### 2.11.3.1 Average CQC Flexural Strength Required for Mixtures

In order to ensure meeting, the strength requirements specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES, during production, the mixture proportions selected during mixture proportioning studies and used during construction shall produce a required average CQC flexural strength exceeding the specified strength, R, by the amount indicated below. This required average CQC flexural strength, Ra, will be used only for CQC operations as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL and as specified in the previous paragraph. 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 paving.

- a. 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

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conditions similar to those expected, shall represent concrete produced to meet a specified flexural strength or strengths within 1 MPa 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 specimens made from the same sample of concrete and tested at 28 days. Required average CQC 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:

$$Ra = R + 1.34S$$

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:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

- b. 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, Ra, shall be determined by adding 15 percent to the specified flexural strength, R.

PART 3 EXECUTION

3.1 PREPARATION FOR PAVING

Before commencing paving, the following shall be performed. Surfaces to receive concrete shall be prepared as specified below. If used, forms shall be in place, cleaned, coated, and adequately supported. Any reinforcing steel needed shall be at the paving site. All transporting and transfer equipment shall be ready for use, clean, and free of hardened concrete and foreign material. Equipment for spreading, consolidating, screeding, finishing, and texturing concrete shall be at the paving site, clean and in proper working order. All equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the paving site, in proper working condition, and in sufficient amount for the entire placement. When hot, windy conditions during paving appear probable, equipment and material shall be at the paving site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

- End of Section --

### 3.2 CONDITIONING OF UNDERLYING MATERIAL

#### 3.2.1 General Procedures

Underlying material, base course, upon which concrete is to be placed shall be clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. Prior to setting forms or placement of concrete, the underlying material shall be well drained and shall have been satisfactorily graded and uniformly compacted in accordance with the applicable Section of these specifications. The surface of the subgrade or base course shall be tested as to crown, elevation, and density in advance of setting forms or of concrete placement using slip-form techniques. High areas shall be trimmed to proper elevation. Low areas shall be filled and compacted to a condition similar to that of surrounding grade, or filled with concrete monolithically with the pavement. Where low areas are filled with concrete, the areas shall be marked, as approved, and cores for thickness determinations as required by paragraph, Flexural Strength and Thickness shall not be drilled in those areas. Any underlying material disturbed by construction operations shall be reworked and recompacted to specified density immediately in front of the paver. If a slipform paver is permitted and is used, the same underlying material under the paving lane shall be continued beyond the edge of the lane a sufficient distance and shall be thoroughly compacted and true to grade to provide a suitable trackline for the slipform paver and firm support for the edge of the paving lane. Where an open-graded granular base is required under the concrete, the Contractor shall select paving equipment and procedures which will operate properly on the base course without causing displacement or other damage.

#### 3.2.2 Traffic on Underlying Material

After the underlying material has been prepared for concrete placement, no equipment shall be permitted thereon. Subject to specific approval, crossing of the prepared subgrade or base course at specified intervals for construction purposes may be permitted, provided rutting or indentations do not occur; however, if traffic has been allowed to use the prepared subgrade or base course, the surface shall be reworked and reprepared to the satisfaction of the Contracting Officer before concrete is placed.

### 3.3 WEATHER LIMITATIONS

#### 3.3.1 Placement and Protection During Inclement Weather

The Contractor shall not commence placing operations when heavy rain or other damaging weather conditions appear imminent. At all times when placing concrete, the Contractor shall maintain on-site sufficient waterproof cover and means to rapidly place it over all unhardened concrete or concrete that might be damaged by rain. Placement of concrete shall be suspended whenever rain or other damaging weather commences to damage the surface or texture of the placed unhardened concrete, washes cement out of the concrete, or changes the water content of the surface concrete. All unhardened concrete shall be immediately covered and protected from the rain or other damaging weather. Any pavement damaged by rain or other weather shall be completely removed and replaced at the Contractor's expense as specified in paragraph, Repair, Removal, Replacement of Slabs.

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3.3.2 Paving in Hot Weather

When the ambient temperature during paving is expected to exceed 32 degrees C, the concrete shall be properly placed and finished in accordance with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064/C 1064M. Cooling of the mixing water or aggregates or placing in the cooler part of the day may be required to obtain an adequate placing temperature. An approved retarder may be used to facilitate placing and finishing. Steel forms and reinforcing shall be cooled as approved prior to concrete placement when steel temperatures are greater than 49 degrees C. Transporting and placing equipment shall be cooled or protected if necessary to maintain proper concrete-placing temperature. Concrete shall be placed continuously and rapidly at a rate of not less than 30 m of paving lane per hour. The finished surfaces of the newly laid pavement shall be kept damp by applying a fog spray (mist) with approved spraying equipment until the pavement is covered by the curing medium. If necessary, wind screens shall be provided to protect the concrete from an evaporation rate in excess of 1 kg/square meter per hour, as determined by method shown in Figure 2.1.5 of ACI 305R.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature in Degrees C
Greater than 60	33
40-60	30
Less than 40	27

3.3.3 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, the Contractor shall develop and institute measures to prevent plastic shrinkage cracks from developing. 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 to the protective measures specified in the previous paragraph, the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding, or wet covering. When such water treatment is stopped, curing procedures shall be immediately commenced. 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.

3.3.4 Paving in Cold Weather

Special protection measures, as submitted and approved, and as specified herein, shall be used if freezing temperatures are anticipated before the

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expiration of the specified curing period. The ambient temperature of the air at the placing site and the temperature of surfaces to receive concrete shall be not less 5 degrees C. However, placement may begin when both the ambient temperature and the temperature of the underlying material are at least 2 degrees C and rising. When the ambient temperature is less than 10 degrees C, the temperature of the concrete when placed shall be not less than 10 degrees C nor more than 25 degrees C. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Calcium chloride shall not be used at any time. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 10 degrees C for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period. Pavement damaged by freezing shall be completely removed and replaced at the Contractor's expense as specified in paragraph REPAIR, REMOVAL, REPLACEMENT OF SLABS.

### 3.4 CONCRETE PRODUCTION

Batching, mixing, and transporting equipment shall have a capacity sufficient to maintain a continuous, uniform forward movement of the paver of not less than 0.8 m per minute. Concrete shall be deposited in front of the paver within 45 minutes from the time cement has been charged into the mixing drum, except that if the ambient temperature is above 32 degrees C, the time shall be reduced to 30 minutes. No water shall be added to the concrete after it is batched except that, if truck mixers are permitted, water may be added at the paving site to adjust the slump as approved, provided the maximum allowable w/c is not exceeded. Such water shall be injected under pressure as described in subparagraph, Truck Mixers. Every load of concrete delivered to the paving site shall be accompanied by a batch ticket from the operator of the batching plant. Tickets shall be on approved forms and shall show at least the mass, or volume, of all ingredients in each batch delivered, the water meter and revolution meter reading on truck mixers and the time of day. Tickets shall be delivered to the placing foreman who shall keep them on file and deliver them to the Government weekly.

#### 3.4.1 Batching and Mixing Concrete

The batching and mixing equipment and the operation thereof shall conform to the requirements of paragraph EQUIPMENT and as specified herein. All equipment shall be kept clean and in operable condition at all times. Scale pivots and bearings shall be kept clean and free of rust. Any equipment which fails to perform as specified shall immediately be removed from use until properly repaired and adjusted, or replaced.

#### 3.4.2 Transporting and Transfer - Spreading Operations

The transporting and transfer equipment and the operation thereof shall conform to the requirements of paragraph EQUIPMENT and as specified herein. All equipment shall be kept clean and in operable condition at all times. Non-agitating equipment shall be used only on smooth roads and for haul time less than 15 minutes at all times during the work day. No transporting equipment shall be allowed to operate on the prepared and compacted underlying material in front of the paver-finisher. Equipment shall be allowed to operate on the underlying material only if approved in writing

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and only if no damage is done to the underlying material and its degree of compaction. Any disturbance to the underlying material that does occur shall be corrected, as approved, before the paver-finisher or the deposited concrete reaches the location of the disturbance and the equipment shall be replaced or procedures changed to prevent any future damage. An approved transfer spreader shall be used if a travelling surge hopper is not used, to transfer the concrete from hauling equipment outside the paving lane and to spread it evenly and strike it off to approximate grade in front of the paver-finisher. A travelling surge hopper may be used to accept the concrete from the transporting equipment, store it as necessary, and feed it evenly across the paving lane at a depth which permits the paver to operate efficiently and at a rate that permits the paver to have a continuous forward movement. Concrete shall be deposited as close as possible to its final position in the paving lane. All equipment shall be operated to discharge and transfer concrete without segregation. In no case shall dumping of concrete in discrete piles be permitted. No transfer or spreading operation which requires the use of front-end loaders, dozers, or similar equipment to distribute the concrete will be permitted. All batching and mixing, transporting, transferring, paving, and finishing shall be properly coordinated and controlled such that the paver-finisher has a continuous forward movement at a reasonably uniform speed from beginning to end of each paving lane, except for inadvertent equipment breakdown. Failure to achieve this shall require the Contractor to halt operations, regroup, and modify operations to achieve this requirement.

### 3.5 PAVING

#### 3.5.1 General Requirements

The paving and finishing equipment and the operation thereof shall conform to the requirements of paragraph EQUIPMENT and as specified herein. All equipment shall be kept clean and properly operable at all times. Pavement shall be constructed with paving and finishing equipment utilizing rigid fixed forms or by use of slipform paving equipment. Paving and finishing equipment and procedures shall be capable of constructing paving lanes of the required width at a rate of at least 30 m of paving lane per hour on a routine basis. Paving equipment and its operation shall be controlled, and coordinated with all other operations, such that the paver-finisher has a continuous forward movement, at a reasonably uniform speed, from beginning to end of each paving lane, except for inadvertent equipment breakdown. Workmen with foreign material on their footwear or construction equipment that might deposit foreign material shall not be permitted to walk or operate in the plastic concrete.

#### 3.5.2 Consolidation

Concrete shall be consolidated with the specified type of lane-spanning, gang-mounted, mechanical, immersion type vibrating equipment mounted in front of the paver, supplemented, in rare instances as specified, by hand-operated vibrators. Gang-mounted vibrator spuds shall be spaced so as to thoroughly consolidate the entire paving lane, but not more than 750 mm spacing, and with the outside vibrators not more than 300 mm from the edge of the lane. The vibrators shall be inserted into the concrete to a depth that will provide the best full-depth consolidation but not closer to the underlying material than 50 mm. The vibrators or any tamping units in front of the paver shall be automatically controlled so that they shall be stopped immediately as forward motion ceases. Excessive vibration shall not be

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permitted. If the vibrators cause visible tracking in the paving lane, the paving operation shall be stopped and equipment and operations modified to prevent it. Concrete in small, odd-shaped slabs or in isolated locations inaccessible to the gang-mounted vibration equipment shall be vibrated with an approved hand-operated immersion vibrator. Vibrators shall not be used to transport or spread the concrete. Hand-operated vibrators shall not be operated in the concrete at one location for more than 20 seconds. For each paving train, at least one additional vibrator spud, or sufficient parts for rapid replacement and repair of vibrators shall be maintained at the paving site at all times. Any evidence of inadequate consolidation (honeycomb along the edges, large air pockets, or any other evidence) shall require the immediate stopping of the paving operation and approved adjustment of the equipment or procedures.

### 3.5.3 Operation

When the paver approaches a header at the end of a paving lane, a sufficient amount of concrete shall be maintained ahead of the paver to provide a roll of concrete which will spill over the header. The amount of extra concrete shall be sufficient to prevent any slurry that is formed and carried along ahead of the paver from being deposited adjacent to the header. The spud vibrators in front of the paver shall be brought as close to the header as possible before they are lifted. Additional consolidation shall be provided adjacent to the headers by hand-manipulated vibrators. When the paver is operated between or adjacent to previously constructed pavement (fill-in lanes), provisions shall be made to prevent damage to the previously constructed pavement. Transversely oscillating screeds and extrusion plates shall overlap the existing pavement the minimum possible, but in no case more than 200 mm. These screeds or extrusion plates shall be electronically controlled from the previously placed pavement so as to prevent them from applying pressure to the existing pavement and to prevent abrasion of the pavement surface. The overlapping area of existing pavement surface shall at all times be kept completely free of any loose or bonded foreign material as the paver-finisher operates across it. When the paver travels on existing pavement, approved provisions shall be made to prevent damage to the existing pavement. Pavers using transversely oscillating screeds shall not be used to form fill-in lanes that have widths less than a full width for which the paver was designed or adjusted.

### 3.5.4 Required Results

The paver-finisher, and its gang-mounted vibrators, together with its operating procedures shall be adjusted and operated and coordinated with the concrete mixture being used to produce a thoroughly consolidated slab throughout, true to line and grade within specified tolerances. The screed or the extrusion plate shall be properly adjusted to produce a pavement surface true to line and grade. Any necessary adjustment to compensate for surging behind the screed or for inadequate height of surface after paving shall be carefully made and checked frequently. The paver-finishing operation shall produce a surface finish free of irregularities, tears, voids of any kind, and any other discontinuities. It shall produce only a very minimum of paste at the surface; never more than 2.5 mm cover over the top layer of coarse aggregate. The paver-finisher shall make only one pass across the pavement; multiple passes will not be permitted. The equipment and its operation shall produce a finished surface requiring no hand finishing other than the use of cutting straightedges, except in very infrequent instances. If any equipment or operation fails to produce the

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above results, the paving shall be stopped, the equipment shall be replaced or properly adjusted, the operation shall be appropriately modified, or the mixture proportions modified, in order to produce the required results before recommencing paving. No water, other than true fog sprays (mist) as specified in paragraph, Prevention of Plastic Shrinkage Cracking, shall be applied to the concrete or the concrete surface during paving and finishing.

### 3.5.5 Fixed Form Paving

Paving equipment for fixed-form paving and the operation thereof shall conform to the requirements of paragraph EQUIPMENT, all requirements specified above under paragraph PAVING and as specified herein.

#### 3.5.5.1 Forms for Fixed-Form Paving

- a. Forms shall be steel, except that wood forms may be used for curves having a radius of 45 m or less, and for fillets. Forms shall be equal in depth to the edge thickness of the slab as shown on the drawings. Forms shall be in one piece for the full depth required, except as permitted below. Under no conditions shall forms be adjusted by filling or excavating under the forms to an elevation other than the bottom of the pavement slab. Where the project requires several different slab thicknesses, forms may be built up with metal or wood to provide an increase in depth of not more than 25 percent. The required form depth may be obtained by securely bolting or welding to the bottom of the form a tubular metal section of the proper thickness or by securely bolting wood planks to the bottom of the form. The tubular metal section or wood planks shall completely cover the underside of the base of the form and shall extend beyond the edge of the base a sufficient distance to provide the necessary stability. The base width of the one-piece form, or built-up form, shall be not less than eight-tenths of the vertical height of the form, except that forms 200 mm or less in vertical height shall have a base width not less than the vertical height of the form. Forms shall not be built-up by adding to the top. The top surface of each form section shall not vary more than 1.5 mm in 4 m from a true line. The face of the form shall not vary more than 5 mm in 4 m from a true plane. Forms with battered top surfaces or distorted faces or bases shall be removed from the project. Where keyway forms are required, they shall be rigidly attached to the main form so no displacement can take place. Metal keyway forms shall be tack-welded to steel forms. Keyway forms shall be so aligned that there is no variation over 6 mm either vertically or horizontally, when tested with a 4 m template after forms are set, including tests across form joints.
- b. Steel forms shall be furnished in sections not less than 3 m in length, except that on curves having a radius of 45 m or less, the length of the sections shall be 1.5 m unless the sections are flexible or curved to the proper radius. Each 3 m length of form shall be provided with at least three form braces and pin sockets so spaced that the form will be rigidly braced throughout its length. Lock joints between form sections shall be free from play or movement. Forms shall be free of warps, bends, or kinks.

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- c. Wood forms for curves and fillets shall be made of well-seasoned, surfaced plank or plywood, straight, and free from warp or bend. Wood forms shall be adequate in strength and rigidly braced.
- d. The forms shall be set on firm material cut true to grade so that each form section when placed will be firmly in contact with the underlying layer for its entire length and base width. Underlying material shall be thoroughly compacted and trimmed to grade before forms are set in place. Setting forms on blocks or on built-up spots of underlying material will be not permitted under any condition. The form sections shall be staked into position and tightly locked together. The length of pins and quantity provided in each section shall be sufficient to hold the form at the correct line and grade. When tested with a straightedge, the top of the installed form shall conform to the requirements specified for the finished surface of the concrete, and the longitudinal axis of the upstanding leg shall not vary more than 6 mm from the straightedge. Conformity to the alignment and grade elevations shown on the drawings shall be checked and necessary corrections shall be made immediately prior to placing the concrete. Forms shall be set well in advance of concrete placement. The forms shall be cleaned and oiled each time before concrete is placed. No concrete shall be placed until setting of forms has been checked and approved by the CQC team.

#### 3.5.5.2 Form Removal

Forms shall remain in place at least 12 hours after the concrete has been placed. When conditions are such that the early strength gain of the concrete is delayed, the forms shall be left in place for a longer time, as directed. Forms shall be removed by procedures that do not injure the concrete. Bars or heavy metal tools shall not be used directly against the concrete in removing the forms. Any concrete found to be defective after form removal shall be repaired promptly, using procedures specified hereinafter or as directed.

#### 3.5.6 Slipform Paving

##### 3.5.6.1 General

Paving equipment for slipform paving and the operation thereof shall conform to the requirement of paragraph EQUIPMENT, all requirements specified above in subparagraphs, General, Consolidation, Operation, and Required Results, and as specified herein. The slipform paver shall shape the concrete to the specified and indicated cross section, meeting all tolerances, in one pass. The slipform paver shall finish the surface and edges so that only a very minimum isolated amount of hand finishing is required. If the paving operation does not meet the above requirements and the specified tolerances, the operation shall be immediately stopped, and the Contractor shall regroup and replace or modify any equipment as necessary, modify paving procedures or modify the concrete mix, in order to resolve the problem. The slipform paver shall be automatically electronically controlled from a taut wire guideline for horizontal alignment and on both sides from a taut wire guideline for vertical alignment, except that electronic control from a ski operating on a previously constructed adjoining lane shall be used where

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applicable for either or both sides. Automatic, electronic controls for vertical alignment shall always be used on both sides of the lane. Control from a slope-adjustment control or control operating from the underlying material shall never be used. If approved by the Contracting Officer after a preconstruction demonstration, automatic laser controls may be used in lieu of or to supplement the taut wire guidelines. Side forms on slipform pavers shall be properly adjusted so that the finished edge of the paving lane meets all specified tolerances. Dowels in longitudinal construction joints shall be installed as specified below. The installation of these dowels by dowel inserters attached to the paver or by any other means of inserting the dowels into the plastic concrete shall not be permitted.

#### 3.5.6.2 Guideline for Slipform Paving

Guidelines shall be accurately and securely installed well in advance of concrete placement. Supports shall be provided at necessary intervals to eliminate all sag in the guideline when properly tightened. The guideline shall be high strength wire set with sufficient tension to remove all sag between supports. Supports shall be securely staked to the underlying material or other provisions made to ensure that the supports will not be displaced when the guideline is tightened or when the guideline or supports are accidentally touched by workmen or equipment during construction. The appliances for attaching the guideline to the supports shall be capable of easy adjustment in both the horizontal and vertical directions. When it is necessary to leave gaps in the guideline to permit equipment to use or cross underlying material, provisions shall be made for quickly and accurately replacing the guideline without any delay to the forward progress of the paver. Supports on either side of the gap shall be secured in such a manner as to avoid disturbing the remainder of the guideline when the portion across the gap is positioned and tightened. The guideline across the gap and adjacent to the gap for a distance of 60 m shall be checked for horizontal and vertical alignment after the guideline across the gap is tightened. Vertical and horizontal positioning of the guideline shall be such that the finished pavement shall conform to the alignment and grade elevations shown on the drawings within the specified tolerances for grade and smoothness. The specified tolerances are intended to cover only the normal deviations in the finished pavement that may occur under good supervision and do not apply to setting of the guideline. The guideline shall be set true to line and grade.

#### 3.5.6.3 Laser Controls

If the Contractor proposes to use any type of automatic laser controls, a detailed description of the system shall be submitted and a trial field demonstration shall be performed in the presence of the Contracting Officer at least one week prior to start of paving. Approval of the control system will be based on the results of the demonstration and on continuing satisfactory operation during paving.

#### 3.5.7 Placing Reinforcing Steel

The type and amount of steel reinforcement shall be as shown on the drawings. For pavement thickness of 300 mm or more, the reinforcement steel shall be installed by the strike-off method wherein a layer of concrete is deposited on the underlying material, consolidated, and struck to the indicated elevation of the steel reinforcement. The reinforcement shall be laid upon the prestruck surface, and the remaining concrete shall

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then be placed and finished in the required manner. When placement of the second lift causes the steel to be displaced horizontally from its original position, provisions shall be made for increasing the thickness of the first lift and depressing the reinforcement into the unhardened concrete to the required elevation. The increase in thickness shall be only as necessary to permit correct horizontal alignment to be maintained. Any portions of the bottom layer of concrete that have been placed more than 30 minutes without being covered with the top layer shall be removed and replaced with newly mixed concrete without additional cost to the Government. For pavements less than 300 mm thick, the reinforcement shall be positioned on suitable chairs securely fastened to the subgrade prior to concrete placement. Concrete shall be vibrated after the steel has been placed. Regardless of placement procedure, the reinforcing steel shall be free from coatings which could impair bond between the steel and concrete, and laps in the reinforcement shall be as indicated. In lieu of the above, automatic reinforcement depressing attachments may be used to position the reinforcement, either bar mats or welded wire fabric, provided the entire operation is approved by the Contracting Officer. Regardless of the equipment or procedures used for installing reinforcement, the Contractor shall ensure that the entire depth of concrete is adequately consolidated. Where reinforcing for Continuously Reinforced Concrete Pavement (CRCP) is required, the entire operating procedure and equipment proposed shall be submitted for approval at least 30 days prior to proposed start of paving.

### 3.5.8 Placing Dowels

The method used in installing and holding dowels in position shall ensure that the error in alignment of any dowel from its required alignment after the pavement has been completed will not be greater than 1 mm per 100 mm. Except as otherwise specified below, location of dowels shall be within a horizontal tolerance of plus or minus 15 mm. The Contractor shall furnish an approved template for checking the alignment and position of the dowels. The portion of each dowel intended to move within the concrete or expansion cap shall be painted with one coat of the specified paint. When dry, the painted portion shall be wiped clean and coated with a thin, even film of lubricating oil before the concrete is placed. Pipe used as dowels shall be filled with a stiff sand-asphalt mixture or portland-cement mortar. Dowels in joints shall be omitted when the center of the dowel or tie bar is located within a horizontal distance from an intersecting joint equal to or less than one-fourth of the slab thickness. Dowels shall be installed as specified in the following subparagraphs.

#### 3.5.8.1 Contraction Joints

Dowels in longitudinal and transverse contraction joints within the paving lane shall be held securely in place, as indicated, by means of rigid metal frames or basket assemblies of an approved type. The assemblies shall consist of a framework of metal bars or wires arranged to provide rigid support for the dowels throughout the paving operation, with a minimum of four continuous bars or wires extending along the joint line. The dowels shall be welded to the assembly or held firmly by mechanical locking arrangements that will prevent them from rising, sliding out, or becoming distorted during paving operations. The basket assemblies shall be held securely in the proper location by means of suitable pins or anchors. At the Contractor's option, in lieu of the above, dowels in contraction joints shall be installed near the front of the paver by insertion into the plastic concrete using approved equipment and procedures. Approval will be

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based on the results of a preconstruction demonstration which the Contractor shall conduct, showing that the dowels are installed within specified tolerances.

### 3.5.8.2 Construction Joints-Fixed Form Paving

Installation of dowels shall be by the bonded-in-place method. Installation by removing and replacing in preformed holes will not be permitted. Dowels shall be prepared and placed across joints where indicated, correctly aligned, and securely held in the proper horizontal and vertical position during placing and finishing operations, by means of devices fastened to the forms. The spacing of dowels in construction joints shall be as indicated, except that, where the planned spacing cannot be maintained because of form length or interference with form braces, closer spacing with additional dowels shall be used.

### 3.5.8.3 Dowels Installed in Hardened Concrete

Dowels installed in hardened concrete, such as in longitudinal construction joints for slipform paving, in joints between new and existing pavement, and similar locations, shall be installed by bonding the dowels into holes drilled into the hardened concrete. The installation of dowels in longitudinal construction joints by dowel inserters attached to a slipform paver or by any other means of inserting the dowels into the plastic concrete shall not be permitted. However, when paving two lanes together with a longitudinal contraction joint between, any dowels required may be installed in this joint with an approved inserter. Holes approximately 3 mm greater in diameter than the dowels shall be drilled into the hardened concrete with rotary core drills to receive the dowels. In lieu of rotary drills, the contractor may use percussion drills, provided that spalling at the collar of the hole does not occur. Regardless of the type of drill used, the drill shall be held rigidly in exact alignment by means of a stable jig or framework, solidly supported; gang drills meeting this are acceptable. Any damage to the concrete face during drilling shall be repaired as directed; continuing damage shall require modification of the equipment and operation. Dowels shall be bonded in the drilled holes using epoxy resin. Epoxy resin shall be injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel shall not be permitted. The dowels shall be held in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic collar fitted around the dowel. The vertical alignment of the dowels shall be checked by placing a straightedge on the surface of the pavement over the top of the dowel and measuring the vertical distance between the straightedge and the beginning and ending point of the exposed part of the dowel. The horizontal alignment shall be checked with a framing square. Dowels required to be installed in any joints between new and existing concrete shall be grouted in holes drilled in the existing concrete, all as specified above. Where tie bars are required in longitudinal construction joints of slipform pavement, bent tie bars shall be installed at the paver, in front of the transverse screed or extrusion plate. If tie bars are required, a standard keyway shall be constructed, and the bent tie bars shall be inserted into the plastic concrete through a 0.45 to 0.55 mm thick metal keyway liner. Tie bars shall not be installed in preformed holes. The keyway liner shall be protected and shall remain in place and become part of the joint. When bending tie bars, the radius of bend shall not be less than the minimum

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recommended for the particular grade of steel in the appropriate material standard. Before placement of the adjoining paving lane, the tie bars shall be straightened, using procedures which will not spall the concrete around the bar.

### 3.6 FINISHING

The finishing machine, or paver-finisher, shall meet all requirements specified in paragraph EQUIPMENT and herein. Finishing operations shall be a continuing part of placing operations starting immediately behind the strike-off of the paver and the machines shall be designed and operated to strike off, screed, and consolidate the concrete. Initial finishing shall be provided by the transverse screed or extrusion plate. The sequence of operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Finishing shall be by the machine method. The hand method shall be used only infrequently and only on isolated areas of odd slab widths or shapes and in the event of a breakdown of the mechanical finishing equipment. When approved, the hand finishing method may also be used for separate, isolated slabs during removal and replacement type repair operations. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Equipment to be used for supplemental hand finishing shall primarily be 3 to 4 m cutting straightedges; only very sparing use of bull floats shall be allowed. Any machine finishing operation which requires appreciable hand finishing, other than a moderate amount of straightedge finishing, shall be immediately stopped and proper adjustments made or the equipment replaced. Every effort shall be made to prevent bringing excess paste to the surface and any operations which produce more than 2.5 mm of paste (mortar, water, laitance, etc.) over the top layer of coarse aggregate shall be halted immediately and the equipment, mixture, or procedures modified as necessary. Compensation shall be made for surging behind the screeds or extrusion plate and settlement during hardening and care shall be taken to ensure that paving and finishing machines are properly adjusted so that the finished surface of the concrete (not just the cutting edges of the screeds) will be at the required line and grade. Surface checks shall be made regularly and paving operations immediately halted and adjustments made whenever compensation is inadequate. Screed and float adjustments of the machines shall be checked at the start of each day's paving operations and more often if required. Machines that cause frequent delays due to mechanical failure shall be replaced. When machines ride the edge of a previously constructed slab, the edge shall be kept clean and provision shall be made to protect the surface of the slab. Clary screeds, "bridge deck" finishers, or other rotating pipe or tube type equipment will not be permitted. Finishing equipment and tools shall be maintained clean and in an approved condition. At no time shall water be added to the surface of the slab with the finishing equipment or tools, or in any other way, except for fog (mist) sprays specified to prevent plastic shrinkage cracking.

#### 3.6.1 Longitudinal Floating

When the equipment contains a mechanical, longitudinal, oscillating float, the float shall be operated to smooth and finish the pavement immediately behind the transverse screed or extrusion plate. The float shall be operated maintaining contact with the surface at all times. Care shall be taken to prevent working paste to the surface in excess of the amount specified above.

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### 3.6.2 Other Types of Finishing Equipment

Concrete finishing equipment of types other than those specified above may be used on a trial basis, when specifically approved, except that rotating pipe or tubes or bridge deck finishers will not be permitted. Approval will be given after demonstration on a test section prior to start of construction, and provided the Contracting Officer determines that the pavement produced is better than that produced by the specified equipment. The use of equipment that fails to produce finished concrete of the required quality, using concrete proportions and slump as specified, shall be discontinued, and the concrete shall be finished with specified equipment and in the manner specified above. Vibrating screeds or pans shall be used only for isolated slabs where hand finishing is permitted as specified, and only where specifically approved. Slipform paving equipment shall not be operated on fixed forms unless approved in writing prior to use.

### 3.6.3 Machine Finishing With Fixed Forms

The machine shall be designed to ride the forms and shall be operated to screed and consolidate the concrete. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

### 3.6.4 Machine Finishing With Slipform Pavers

The slipform paver shall be operated so that only a very minimum of additional finishing work is required to produce pavement surfaces and edges meeting the specified tolerances. Any equipment or procedure that fails to meet these specified requirements shall immediately be replaced or modified as necessary. A self-propelled nonrotating pipe float may be used if the Contractor desires while the concrete is still plastic, to remove minor irregularities and score marks. The pipe float shall be 150 to 250 mm in diameter and sufficiently long to span the full paving width when oriented at an angle of approximately 60 degrees with the center line. Only one pass of the pipe float shall be allowed. If there is sufficient concrete slurry or fluid paste on the surface that it runs over the edge of the pavement, the paving operation shall be immediately stopped and the equipment, mixture, or operation modified to prevent formation of such slurry. Any slurry which does run down the vertical edges shall be immediately removed by hand, using stiff brushes or scrapers. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens. Slabs having areas of edge slump in excess of the specified tolerances shall be removed and replaced in accordance with paragraph, REPAIR, REMOVAL, REPLACEMENT OF SLABS; repair operations on such areas will not be permitted.

### 3.6.5 Surface Correction and Testing

After all other finishing is completed but while the concrete is still plastic, minor irregularities and score marks in the pavement surface shall be eliminated by means of cutting straightedges. Such straightedges shall be 4 m in length and shall be operated from the sides of the pavement and from bridges. A straightedge operated from the side of the pavement shall

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be equipped with a handle 1 m longer than one-half the width of the pavement. The surface shall then be tested for trueness with a straightedge held in successive positions parallel and at right angles to the center line of the pavement, and the whole area covered as necessary to detect variations. The straightedge shall be advanced along the pavement in successive stages of not more than one-half the length of the straightedge. Depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. The straightedge testing and finishing shall continue until the entire surface of the concrete is free from observable departure from the straightedge and conforms to the surface requirements specified in paragraph ACCEPTABILITY OF WORK AND PAYMENT ADJUSTMENTS. Long-handled, flat bull floats shall be used very sparingly and only as necessary to correct minor, scattered surface defects. If frequent use of bull floats is necessary, the paving operation shall be stopped and the equipment, mixture or procedures adjusted to eliminate the surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Extreme care shall be taken to prevent overfinishing joints and edges. The surface finish of the pavement shall be produced essentially by the finishing machine and not by subsequent hand finishing operations. All hand finishing operations shall be subject to approval and shall be modified when directed. No water shall be added to the pavement surface during these operations.

### 3.6.6 Hand Finishing

Hand finishing operations shall be used only as specified above.

#### 3.6.6.1 Equipment

In addition to approved mechanical internal vibrators for consolidating the concrete, a strike-off and tamping template and a longitudinal float shall be provided for hand finishing. The template shall be at least 300 mm longer than the width of pavement being finished, of an approved design, and sufficiently rigid to retain its shape, and shall be constructed of metal or other suitable material shod with metal. The longitudinal float shall be at least 3 m long, of approved design, and rigid and substantially braced, and shall maintain a plane surface on the bottom. Grate tampers (jitterbugs) shall not be used.

#### 3.6.6.2 Finishing and Floating

As soon as placed and vibrated, the concrete shall be struck off and screeded to the crown and cross section and to such elevation above grade that when consolidated and finished, the surface of the pavement will be at the required elevation. In addition to previously specified complete coverage with handheld immersion vibrators, the entire surface shall be tamped with the strike-off and tamping template, and the tamping operation continued until the required compaction and reduction of internal and surface voids are accomplished (grate tampers shall not be used). Immediately following the final tamping of the surface, the pavement shall be floated longitudinally from bridges resting on the side forms and spanning but not touching the concrete. If necessary, additional concrete shall be placed and screeded, and the float operated until a satisfactory surface has been produced. The floating operation shall be advanced not more than half the length of the float and then continued over the new and previously floated surfaces. Long-handled, flat bull floats shall be used

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very sparingly and only as necessary to correct minor, scattered surface defects. If frequent use of bull floats is necessary, the operation shall be stopped and adjusted to eliminate the surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Extreme care shall be taken to prevent overfinishing joints and edges. No water shall be added to the pavement during finishing operations.

### 3.6.7 Texturing

Before the surface sheen has disappeared and before the concrete hardens, the surface of the pavement shall be given a texture as described herein. After curing is complete, all textured surfaces shall be thoroughly power broomed to remove all debris.

#### 3.6.7.1 Broom Texturing

Surface texture shall be applied using an approved mechanical stiff bristle broom drag of a type that will uniformly score the surface. The broom shall be operated to score the surface transverse to the pavement center line. The broom shall be capable of traversing the full width of the pavement in a single pass at a uniform speed and with a uniform pressure. Successive passes of the broom shall be overlapped the minimum necessary to obtain a uniformly textured surface. Brooms shall be washed thoroughly at frequent intervals during use. Worn or damaged brooms shall be removed from the job site. Brooming should be completed before the concrete has hardened to the point where the surface will be unduly torn or roughened, but after hardening has progressed enough so that the mortar will not flow and reduce the sharpness of the scores. Specific requirements for the texturing will be given on the drawings, but, if not given, the scores shall be uniform in appearance and approximately 1.5 mm in depth but not more than 3 mm in depth. Hand brooming will be permitted only on isolated odd shaped slabs or slabs where hand finishing is permitted. For hand brooming, the brooms shall have handles longer than half the width of slab to be finished. The hand brooms shall be drawn transversely across the surface from the center line to each edge with slight overlapping strokes.

### 3.6.8 Edging

After texturing has been completed, the edge of the slabs along the forms, along the edges of slipformed lanes, and at the joints shall be carefully finished with an edging tool to form a smooth rounded surface of 3 mm radius. Tool marks shall be eliminated, and the edges shall be smooth and true to line. No water shall be added to the surface during edging. Extreme care shall be taken to prevent overworking the concrete.

### 3.6.9 Outlets in Pavement

Recesses for the tie-down anchors, lighting fixtures, and other outlets in the pavement shall be constructed to conform to the details and dimensions shown. The concrete in these areas shall be carefully finished to provide a surface of the same texture as the surrounding area that will be within the requirements for plan grade and surface smoothness.

## 3.7 CURING

### 3.7.1 Protection of Concrete

- End of Section --

Concrete shall be continuously protected against loss of moisture and rapid temperature changes for at least 7 days from the completion of finishing operations. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Sufficient sheet material to protect unhardened concrete from rain shall be at the paver at all times. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, the damaged pavement shall be removed and replaced, and another method of curing shall be employed as directed. Curing shall be accomplished by one of the following methods except that only moist curing shall be used for the first 24 hours.

### 3.7.2 Membrane Curing

A uniform coating of white-pigmented, membrane-forming, curing compound shall be applied to the entire exposed surface of the concrete as soon as the free water has disappeared from the surface after moist curing ceases. If evaporation is high and no moisture is present on the surface even though bleeding has not stopped, fog sprays shall be used to keep the surface moist until setting of the cement occurs and bleeding is complete. Curing compound shall then be immediately applied. Along the formed edge faces, it shall be applied immediately after the forms are removed. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water, and the curing compound applied as soon as the free water disappears. The curing compound shall be applied to the finished surfaces by means of an approved automatic spraying machine. The spraying machine shall be self-propelled and shall span the newly paved lane. The machine shall have one or more spraying nozzles that can be controlled and operated to completely and uniformly cover the pavement surface with the required amount of curing compound. The curing compound in the drum used for the spraying operation shall be thoroughly and continuously agitated mechanically throughout the full depth of the drum during the application. Air agitation may be used only to supplement mechanical agitation. Spraying pressure shall be sufficient to produce a fine spray as necessary to cover the surface thoroughly and completely with a uniform film. Spray equipment shall be kept clean and properly maintained and the spray nozzle or nozzles shall have adequate wind shields. The curing compound shall be applied with an overlapping coverage that will give a two-coat application at a coverage of 10 square meters per L, plus or minus 5.0 percent for each coat. A one-coat application may be applied provided a uniform application and coverage of 5 square meters per L., plus or minus 5.0 percent is obtained. The application of curing compound by hand-operated, mechanical powered pressure sprayers will be permitted only on odd widths or shapes of slabs where indicated and on concrete surfaces exposed by the removal of forms. When the application is made by hand-operated sprayers, the second coat shall be applied in a direction approximately at right angles to the direction of the first coat. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel and that will be free from pinholes and other discontinuities. If pinholes, abrasions, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound

- End of Section --

is damaged by subsequent construction operations within the curing period shall be immediately resprayed. The surfaces adjacent to joint sawcuts shall be cleaned and resprayed with curing compound immediately after cutting. Approved standby facilities for curing concrete pavement shall be provided at an accessible location at the job site for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

### 3.7.3 Moist Curing

All concrete pavements must be moist cured for the first 24-hours. Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, or until curing compound is applied, commencing immediately after finishing. If 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 and that the entire surface is wet.

## 3.8 JOINTS

### 3.8.1 General Requirements for Joints

Joints shall conform to the details indicated and shall be perpendicular to the finished grade of the pavement. All joints shall be straight and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 12 mm. Before commencing construction, the Contractor shall submit for approval a control plan and equipment to be used for ensuring that all joints are straight from edge to edge of the pavement within the above tolerances. Where any joint fails to meet these tolerances, the slabs adjacent to the joint shall be removed and replaced at no additional cost to the Government. No change from the jointing pattern shown on the drawings shall be made without written approval of the Contracting Officer. Sealing of joints shall be in accordance with Section 02762.

### 3.8.2 Longitudinal Construction Joints

Longitudinal construction joints between paving lanes shall be located as indicated. Dowels shall be installed in the longitudinal construction joints, or the edges shall be thickened as indicated. Dowels shall be installed in conformance with paragraph, Placing Dowels. After the end of the curing period, longitudinal construction joints shall be sawed to provide a groove at the top for sealant conforming to the details and dimensions indicated.

### 3.8.3 Transverse Construction Joints

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Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for 30 minutes or longer. When concrete placement cannot be continued, the transverse construction joint shall be installed at a planned transverse joint, if possible. Transverse construction joints shall be constructed by utilizing headers and the very minimum amount of hand placement and finishing techniques. Pavement shall be constructed with the paver as close to the header as possible, and the paver shall be run out completely past the header. Transverse construction joints installed at a planned transverse joint shall be constructed as shown or, if not shown otherwise, shall be dowelled. Those not at a planned transverse joint shall be constructed with tie bars and shall not be sawed or sealed.

#### 3.8.4 Expansion Joints

Expansion joints shall be formed where indicated, and about any structures and features that project through or into the pavement, using joint filler of the type, thickness, and width indicated, and shall be installed to form a complete, uniform separation between the structure and the pavement. The filler shall be attached to the original concrete placement with adhesive or other fasteners and shall extend the full slab depth. Adjacent sections of filler shall be fitted tightly together, and the filler shall extend across the full width of the paving lane or other complete distance in order to prevent entrance of concrete into the expansion space. Edges of the concrete at the joint face shall be finished with an edger with a radius of 3 mm. The joint filler strips shall be installed 20 mm below the pavement surface with a slightly tapered, dressed-and-oiled wood strip or other approved material temporarily secured to the top of the filler to form a recess to be filled with joint sealant. The wood strip shall be removed soon after the concrete has set and the reservoir temporarily filled with an approved material to protect the reservoir until the joint sealer is installed. Expansion joints shall be constructed with thickened edges for load transfer.

#### 3.8.5 Contraction Joints

Transverse and longitudinal contraction joints shall be of the weakened-plane or dummy type and shall be constructed as indicated. Longitudinal contraction joints shall be constructed by sawing a groove in the hardened concrete with a power-driven saw in conformance with requirements for sawed joints, unless otherwise approved in writing. Transverse contraction joints shall be constructed in conformance with requirements for sawed joints.

##### 3.8.5.1 Sawed Joints

Sawed contraction joints shall be constructed by sawing an initial groove in the concrete with a 3 mm blade to the indicated depth. During sawing of joints, and again 24 hours later, the CQC team shall inspect all exposed lane edges for development of cracks below the saw cut, and shall immediately report results to the Contracting Officer. If the Contracting Officer determines that there are more uncracked joints than desired, the Contractor will be directed to saw succeeding joints 25 percent deeper than originally indicated at no additional cost to the Government. After expiration of the curing period, the upper portion of the groove shall be widened by sawing to the width and depth indicated for the joint sealer. The time of initial sawing shall vary depending on existing and anticipated

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weather conditions and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. The sawed faces of joints will be inspected for undercutting or washing of the concrete due to the early sawing, and sawing shall be delayed if undercutting is sufficiently deep to cause structural weakness or excessive roughness in the joint. The sawing operation shall be carried on as required during both day and night regardless of weather conditions. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. A chalk line or other suitable guide shall be used to mark the alinement of the joint. Before sawing a joint, the concrete shall be examined closely for cracks, and the joint shall not be sawed if a crack has occurred near the planned joint location. Sawing shall be discontinued when a crack develops ahead of the saw cut. Workmen and inspectors shall wear clean, rubber-soled footwear, and the number of persons walking on the pavement shall be limited to those actually performing the sawing operation. Immediately after the joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. The surface shall be resprayed with curing compound as soon as free water disappears. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, but that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed with cord, backer rod, or other approved material before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period and shall prevent infiltration of foreign material until removed immediately before sawing joint sealant reservoir. The sawing equipment shall be adequate in the number of units and the power to complete the sawing at the required rate. An ample supply of saw blades shall be available on the job before concrete placement is started and at all times during sawing. At least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operation.

### 3.8.6 Thickened Edge Joints

Thickened edge joints shall be constructed as indicated on the drawings. Underlying material in the transition area shall be graded as shown and shall meet the requirements for smoothness and compaction specified for all other areas of the underlying material.

### 3.8.7 Sealing Joints

Joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit. Sawing or other removal of filler type joint formers shall be accomplished immediately before sealing of the joints. Joints shall be sealed as specified in Section 02762A PREFORMED ELASTOMERIC COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS.

## 3.9 REPAIR, REMOVAL, REPLACEMENT OF SLABS

### 3.9.1 General Criteria

New pavement slabs that are broken or contain cracks shall be removed and replaced or repaired, as specified hereinafter at no cost to the Government. Spalls along joints shall be repaired as specified. Where removal of

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partial slabs is permitted, as specified, removal and replacement shall be full depth, shall be full width of the paving lane, and the limit of removal shall be normal to the paving lane and not less than 3 m from each original transverse joint (i.e., removal portion shall be at least 3 m longitudinally, and portion to remain in place shall be at least 3 m 10 feet longitudinally; thus, if original slab length is less than 6 m, the entire slab shall be removed). The Contracting Officer will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores shall be at least 150 mm diameter, shall be drilled by the Contractor and shall be filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin, using approved procedures. Drilling of cores and refilling holes shall be at no expense to the Government. All epoxy resin used in this work shall conform to paragraph EPOXY RESIN, Type and Grade as specified.

### 3.9.2 Slabs with Cracks Thru Interior Areas

Interior area is defined as that area more than 600 mm from either adjacent original transverse joint. Slabs with any cracks that extend into the interior area, regardless of direction, shall be treated by one of the following procedures.

#### 3.9.2.1 Cracks That Do Not Extend Full Depth of Slab

These cracks, and similar cracks within the areas 600 mm each side of transverse joints, shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1, using procedures as approved. The procedure shall not widen the crack during epoxy resin injection. All epoxy resin injection shall take place in the presence of a representative of the Contracting Officer.

#### 3.9.2.2 Cracks That Extend Full Depth of Slab

Where there is any full depth crack at any place within the interior area, the full slab shall be removed. However, if the cracked area all lies within 3 m of one original transverse joint, only a partial slab need be removed provided all criteria specified above for distance from each original transverse joint is met.

### 3.9.3 Cracks close to and Parallel to Transverse Joints

All cracks essentially parallel to original transverse joints, extending full depth of the slab, and lying wholly within 600 mm either side of the joint shall be treated as specified hereinafter. Any crack extending more than 600 mm from the transverse joint shall be treated as specified above for Slabs With Cracks Through Interior Areas. Any cracks which do not extend full depth of the slab shall be treated as specified above in subparagraph, Cracks That Do Not Extend Full Depth Of Slab, and the original transverse joint constructed as originally designed.

#### 3.9.3.1 Full Depth Cracks Present, Original Joint Not Opened

When the original transverse joint has not opened, the crack shall be routed and sealed, and the original transverse joint filled with epoxy resin. The crack shall be routed with an easily guided, wheel mounted, vertical shaft, powered rotary router designed so the routing spindle will caster as it

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moves along the crack, or with a small diameter saw designed for this use. The reservoir for joint sealant in the crack shall be formed by routing to a depth of 19 mm, plus or minus 1.5 mm, and to a width of 16 mm, plus or minus 3 mm. Any equipment or procedure which causes raveling or spalling along the crack shall be modified or replaced to prevent such raveling or spalling. The joint sealant shall be a liquid sealant as specified for rigid pavement joints. Installation of joint seal shall be as specified for sealing joints or as directed. The uncracked transverse joint shall be filled with epoxy resin. If the joint sealant reservoir has been sawed out, the reservoir and as much of the lower saw cut as possible shall be filled with epoxy resin, Type IV, Grade 2, thoroughly tooled into the void using approved procedures. If only the original narrow saw cut has been made, it shall be cleaned and pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. If filler material (joint insert) has been used to form a weakened plane in the transverse joint, it shall be completely sawed out and the saw cut pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. Where a parallel crack goes part way across the paving lane and then intersects and follows the original transverse joint which is cracked only for the remainder of the width, it shall be treated as follows: The area with the separate crack shall be treated as specified above for a parallel crack, and the cracked original joint shall be prepared and sealed as originally designed.

#### 3.9.3.2 Full Depth Cracks, Original Joint Also Cracked

At a transverse joint, if there is any place in the lane width where a parallel crack and a cracked portion of the original joint overlap, a section of the slab containing the crack shall be removed and replaced for the full lane width and at least 3 m long. If this partial slab removal places the limit of removal less than 3 m from the next transverse joint, the entire slab shall be removed. If the parallel crack crosses the transverse joint line, a similar area shall be removed and replaced in both slabs.

#### 3.9.4 Removal and Replacement of Full Slabs

Where it is necessary to remove full slabs, unless there are dowels present, all edges of the slab shall be cut full depth with a concrete saw. All saw cuts shall be perpendicular to the slab surface. If dowels are present along any edges, these edges shall be sawed just beyond the end of dowels if they are present. These joints shall then be carefully sawed on the joint line to within 25 mm of the depth of the dowel. The main slab shall be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. Suitable equipment shall be used to provide a truly vertical lift, and approved safe lifting devices used for attachment to the slabs. The narrow strips along doweled edges shall be carefully broken up and removed using light, hand-held jackhammers, 14 kg or less, or other approved similar equipment. Care shall be taken to prevent damage to the dowels or to concrete to remain in place. The joint face below dowels shall be suitably trimmed so that there is no abrupt offset in any direction greater than 12 mm and no gradual offset greater than 25 mm when tested in a horizontal direction with a straightedge. No mechanical impact breakers, other than the above hand-held equipment shall be used for any removal of slabs. If underbreak between 37 and 100 mm deep occurs at any point along any edge, the area shall be repaired as directed before replacing the removed slab. Procedures directed will be similar to those specified for surface spalls, modified as necessary. If underbreak

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over 100 mm deep occurs, the entire slab containing the underbreak shall be removed and replaced. Where there are no dowels on an edge, or where they have been damaged, dowels of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete using procedures as specified in paragraph, Placing Dowels. Original damaged dowels shall be cut off flush with the joint face. Protruding portions of dowels shall be painted and lightly oiled. All four edges of the new slab shall thus contain dowels. Placement of concrete shall be as specified for original construction. Prior to placement of new concrete, the underlying material shall be recompacted and shaped as specified in the appropriate section of these specifications, and the surfaces of all four joint faces shall be cleaned of all loose material and contaminants and coated with a double application of membrane forming curing compound as bond breaker. Care shall be taken to prevent any curing compound from contacting dowels. The resulting joints around the new slab shall be prepared and sealed as specified for original construction.

### 3.9.5 Removal and Replacement of Partial Slabs

Where the above criteria permits removal of partial slabs, removal and replacement operations shall be as specified for full slabs, except that the joint between the removed area and the partial slab to remain in place shall consist of a full depth saw cut across the full lane width and perpendicular to the centerline of the paving lane. Replacement operations shall be the same as specified above, except that, at the joint between the removed area and the partial slab to remain, deformed tie bars shall be epoxy resin grouted into holes drilled into the slab to remain in place. Size and spacing of the tie bars shall be as specified for dowels. Drilling of holes and installation of tie bars shall be as specified for dowels in paragraph, Placing Dowels and Tie Bars, except that no portion of the tie bars shall be painted or oiled. No curing compound shall be used on this joint face and, immediately before placing new concrete, the joint surface of the partial slab remaining in place shall be coated with epoxy resin, Type V, Grade 2.

### 3.9.6 Repairing Spalls Along Joints

Where directed, spalls along joints of new slabs, along edges of adjacent existing concrete, and along parallel cracks shall be repaired by first making a vertical saw cut at least 25 mm outside the spalled area and to a depth of at least 50 mm. Saw cuts shall be straight lines forming rectangular areas. The concrete between the saw cut and the joint, or crack, shall be chipped out to remove all unsound concrete and at least a depth of 12 mm of visually sound concrete. The cavity thus formed shall be thoroughly cleaned with high pressure water jets supplemented with compressed air to remove all loose material. Immediately before filling the cavity, a prime coat shall be applied to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Prime coat for portland cement repairs shall be a neat cement grout and for epoxy resin repairs shall be epoxy resin, Type III, Grade 1. The cavity shall be filled with low slump portland cement concrete or mortar or with epoxy resin concrete or mortar. Portland cement concrete shall be used for larger spalls, those more than 0.009 cubic meter in size after removal operations; portland cement mortar shall be used for spalls between 0.00085 cubic meter and 0.009 cubic meter; and epoxy resin mortar or Type III, Grade 3 epoxy resin for those spalls less than 0.00085 cubic

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meter in size after removal operations. Portland cement concretes and mortars shall be very low slump mixtures, 12 mm slump or less, proportioned, mixed, placed, consolidated by tamping, and cured, all as directed. If the materials and procedures are approved in writing, latex modified concrete mixtures may be used for repairing spalls less than 0.009 cubic meter in size. Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, using proportions and mixing and placing procedures as recommended by the manufacturer and approved by the Contracting Officer. The epoxy resin materials shall be placed in the cavity in layers not over 50 mm thick. The time interval between placement of additional layers shall be such that the temperature of the epoxy resin material does not exceed 60 degrees C at any time during hardening. Mechanical vibrators and hand tampers shall be used to consolidate the concrete or mortar. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens. Where the spalled area abuts a joint, an insert or other bond-breaking medium shall be used to prevent bond at the joint face. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints, or as required to be routed for cracks. The reservoir shall be thoroughly cleaned and then sealed with the sealer specified for the joints. If any spall penetrates half the depth of the slab or more, the entire slab, or 3 m portion thereof, shall be removed and replaced as previously specified. In lieu of sawing, spalls not adjacent to joints, and popouts, both less than 150 mm in maximum dimension, may be prepared by drilling a core 50 mm in diameter greater than the size of the defect, centered over the defect, and 50 mm deep or 12 mm into sound concrete, whichever is greater. The core hole shall be repaired as specified above for other spalls.

### 3.10 EXISTING CONCRETE PAVEMENT REMOVAL AND REPAIR

Existing concrete pavement shall be removed as indicated. and as specified in Section 02220 DEMOLITION, modified, and expanded as specified herein. Repairs shall be made as indicated and as specified herein. All operations shall be carefully controlled to prevent damage to the concrete pavement and to the underlying material to remain in place. All saw cuts shall be made perpendicular to the slab surface, and forming rectangular areas.

#### 3.10.1 Removal of Existing Pavement Slab

When existing concrete pavement is to be removed and adjacent concrete is to be left in place, the joint between the removal area and adjoining pavement to stay in place, including dowels, tie bars or keys, shall first be cut full depth with a standard diamond-type concrete saw. If keys or dowels are present at this joint, the saw cut shall be made full depth at 150 mm from the joint if only keys are present, or just beyond the end of dowels if dowels are present. The edge shall then be carefully sawed on the joint line to within 25 mm of the top of the dowel or key. Next, a full depth saw cut shall be made parallel to the joint at least 600 mm from the joint and at least 150 mm from the end of any dowels. This saw cut shall be made with a wheel saw as specified in paragraph SAWING EQUIPMENT. All pavement to be removed beyond this last saw cut shall be removed using equipment and procedures specified in Section 02220 DEMOLITION and as approved. All pavement between this last saw cut and the joint line shall be removed by carefully pulling pieces and blocks away from the joint face with suitable equipment and then picking them up for removal. In lieu of this method, this strip of concrete may be carefully broken up and removed using hand-held jackhammers, 14 kg or less, or other approved light-duty equipment

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which will not cause stress to propagate across the joint saw cut and cause distress in the pavement which is to remain in place. In lieu of the above specified removal method, the slab may be sawcut full depth to divide it into several pieces and each piece lifted out and removed. Suitable equipment shall be used to provide a truly vertical lift, and safe lifting devices used for attachment to the slab. Where dowels or keys are present, care shall be taken to produce an even, vertical joint face below the dowels or keys. This joint face shall be trimmed so that there is no abrupt offset in any direction greater than 12 mm and no gradual offset greater than 25 mm when tested in a horizontal direction with a straightedge. If the Contractor is unable to produce such a joint face, or if underbreak or other distress occurs, the Contractor shall saw the dowels or keys flush with the joint. The Contractor shall then install new dowels, of the size and spacing used for other similar joints, by epoxy resin bonding them in holes drilled in the joint face as specified in paragraph, Placing Dowels and Tie-bars. All this shall be at no additional cost to the Government. Dowels of the size and spacing indicated shall be installed as shown on the drawings by epoxy resin bonding them in holes drilled in the joint face as specified in paragraph, Placing Dowels and Tie Bars.

### 3.10.2 Edge Repair

The edge of existing concrete pavement against which new pavement abuts shall be protected from damage at all times. Areas which are damaged during construction shall be repaired at no cost to the Government; repair of previously existing damage areas will be considered a subsidiary part of concrete pavement construction.

#### 3.10.2.1 Spall Repair

Spalls along joints and along cracks shall be repaired where indicated and where directed. Repair materials and procedures shall be as previously specified in subparagraph, Repairing Spalls Along Joints.

#### 3.10.2.2 Underbreak Repair

All underbreak shall be repaired. First, all delaminated and loose material shall be carefully removed. Next, the underlying material shall be recompacted, without addition of any new material. Finally, the void shall be completely hand-filled with paving concrete mixture, thoroughly consolidated. Care shall be taken to produce an even joint face from top to bottom. Prior to placing concrete, the underlying material shall be thoroughly moistened. After placement, the exposed surface shall be heavily coated with curing compound. All this shall be done at least 24 hours before placing the new paving concrete against the joint.

#### 3.10.2.3 Underlying Material

The underlying material adjacent to the edge of and under the existing pavement which is to remain in place shall be protected from damage or disturbance during removal operations and until placement of new concrete, and shall be shaped as shown on the drawings or as directed. Sufficient underlying material shall be kept in place outside the joint line to completely prevent disturbance of material under the pavement which is to remain in place. Any material under the portion of the concrete pavement to remain in place which is disturbed or loses its compaction shall be carefully removed and replaced with concrete as specified above under

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Underbreak Repair. The underlying material outside the joint line shall be thoroughly compacted and shall be moist when new concrete is placed.

### 3.11 PAVEMENT PROTECTION

The Contractor shall protect the pavement against all damage prior to final acceptance of the work by the Government. Aggregates rubble, or other similar construction materials shall not be piled on airfield pavements. Traffic shall be excluded from the new pavement by erecting and maintaining barricades and signs until the concrete is at least 14 days old, or for a longer period if so directed. As a construction expedient in paving intermediate lanes between newly paved pilot lanes, operation of the hauling equipment will be permitted on the new pavement after the pavement has been cured for 7 days and the joints have been sealed or otherwise protected. Also, the subgrade planer, concrete paving and finishing machines, and similar equipment may be permitted to ride upon the edges of previously constructed slabs when the concrete has attained a minimum flexural strength of 2.8 MPa and approved means are furnished to prevent damage to the slab edge. All new and existing pavement carrying construction traffic or equipment shall be continuously kept completely clean, and spillage of concrete or other materials shall be cleaned up immediately upon occurrence. Special care shall be used where Contractor's traffic uses or crosses active airfield pavement. In these areas, if necessary in order to accomplish this, full-time workmen with hand brooms shall be used at anytime there is traffic. Other existing pavements used by the Contractor shall be power broomed at least daily when traffic operates. For fill-in lanes, equipment shall be used that will not damage or spall the edges or joints of the previously constructed pavement.

### 3.12 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

#### 3.12.1 Testing and Inspection by Contractor

The Contractor shall perform the inspection and tests described below, and based upon the results of these inspections and tests, shall take the action required and submit reports as required. When, in the opinion of the Contracting Officer, the paving operation is out of control, concrete placement shall cease. The laboratory performing the tests shall be on-site and shall conform with 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 Technicians, Grade I. The individuals who perform the inspection of concrete 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. This testing shall be performed by the Contractor regardless of any other testing performed by the Government, either for pay adjustment purposes or for any other reason.

#### 3.12.2 Testing and Inspection Requirements

##### 3.12.2.1 Fine Aggregate

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

#### 3.12.2.2 Coarse Aggregate

- a. Grading. 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 approved limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling.
- b. Corrective Action for Grading. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer, and steps taken to correct the grading. 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, paving shall be stopped, and immediate steps shall be taken to correct the grading.

#### 3.12.2.3 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests specified for aggregate quality, including deleterious materials. In addition, after the start of paving, the Contractor shall perform similar tests for aggregate quality at least once every month, and when the source of aggregate or aggregate quality changes. Testing interval may be increased to three months when the previous two tests indicate the aggregate meets all quality requirements. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

#### 3.12.2.4 Scales, Batching and Recording

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

#### 3.12.2.5 Batch-Plant Control

The measurement of all constituent materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate masses 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 masses per cubic meter, amount of water as free moisture in each size of aggregate, and the batch aggregate and water masses per cubic meter for each class of concrete batched during each day's plant operation.

#### 3.12.2.6 Concrete Mixture

- a. Air Content Testing. Air content tests shall be performed when test specimens are fabricated. In addition, air content tests shall be performed on each concrete truck until the test results show consistent results within the specified air content requirements, as determined by the Contracting Officer. In any event, at least two other tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of paving. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with ASTM C 231. Test results shall be plotted on control charts which are kept current and shall, at all times, be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial

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action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an average line is set at the midpoint of the specified air content range from paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content shall be taken at the paving site. The Contractor shall deliver the concrete to the paving site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the paving site, correlation samples shall be taken at the paving site as required by the Contracting Officer, and the air content at the mixer controlled as directed.

- b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to insure that it is operating accurately and with good reproducibility. Whenever a point on either control chart (single test or result of two tests made concurrently, as specified above) reaches an action limit line, the air content shall be considered out of control and the paving operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when paving is restarted.
- c. Slump Testing. Slump tests shall be performed when test specimens are fabricated. In addition, slump tests shall be performed on each concrete truck until the test results show consistent results within the specified slump requirements, as determined by the Contracting Officer. In any event, at least four other slump tests shall be made on randomly selected batches in accordance with ASTM C 143/C 143M for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond the upper 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 chart for slump and the chart for range, and for determining need for any remedial action. An upper warning limit shall be set at 12 mm below the maximum allowable slump on separate control charts for slump used for each type of mixture as specified in paragraph, SPECIFIED

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CONCRETE STRENGTH AND OTHER PROPERTIES, and an upper action limit line shall be set at the maximum allowable slump, as specified in the same paragraph for fixed form paving or as selected by the Contractor at the start of the project for slipform paving. 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 38 mm. Samples for slump shall be taken at the paving site. The Contractor is responsible for delivering the concrete to the paving site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the paving site, correlation samples shall be taken at the paving site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

- d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an approved adjustment shall immediately be made in the batch masses of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c specified, based on aggregates which are in a saturated surface dry condition. When a slump result (average of two tests made concurrently, as specified above) exceeds the upper action limit, no further concrete shall be delivered to the paving 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 masses, produce a point on the control chart for range at or above the upper action limit, the paving operation shall immediately be halted, and the Contractor shall take approved steps to bring the slump under control. Additional slump tests shall be made as directed.
- e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064/C 1064M. The temperature shall be reported along with the compressive strength data.

#### 3.12.2.7 Concrete Strength Testing for CQC

Contractor Quality Control operations for concrete strength shall consist of the following steps:

- a. Take samples for strength tests at the paving site. Fabricate and cure test cylinders in accordance with ASTM C 31/C 31M; test them in accordance with ASTM C 39/C 39M.
- b. Fabricate and cure 2 test cylinders per subplot from the same batch or truckload and at the same time acceptance cylinders are fabricated and test them for compressive strength at 7-day age.
- c. Average all 8 compressive tests per lot. Convert this average 7-day compressive strength per lot to equivalent 28-day flexural strength using the Correlation Ratio determined during mixture proportioning studies.

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- d. Compare the equivalent 28-day flexural strength from the conversion to the Average Flexural Strength Required for Mixtures from paragraph of same title.
- e. If the equivalent average 28-day strength for the lot is below the Average Flexural Strength Required for Mixtures by 138 kPa flexural strength or more, at any time, adjust the mixture to increase the strength, as approved.
- f. If the equivalent average 28-day strength is above the Average Flexural Strength Required for Mixtures by 138 kPa flexural strength or more for 2 consecutive days, the Contractor will be permitted to adjust the mixture to decrease the strength, as approved.
- g. The Contractor's CQC testing agency shall maintain up-to-date control charts for strength, showing the 7-day CQC compressive strength, the 14-day compressive strength (from acceptance tests) and the 28-day equivalent flexural strength of each of these for each lot.

#### 3.12.2.8 Inspection Before Placing

Underlying materials, construction joint faces, forms, reinforcing, dowels, and embedded items shall be inspected by the Contractor in sufficient time prior to each paving operation in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

#### 3.12.2.9 Paving

- a. Paving Inspection. The placing foreman shall supervise all placing and paving operations, shall determine that the correct quality of concrete is placed in each location as shown and that finishing is performed as specified; shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume of concrete placed, and method of paving and any problems encountered.
- b. Placing and Paving Corrective Action. The paving foreman shall not permit batching and paving to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Paving shall not be continued if piles of concrete exist or if the concrete is inadequately consolidated or if surface finish is not satisfactory. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

#### 3.12.2.10 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 at least once a month when paving is in progress. 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

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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.

- b. **Vibrator Corrective Action.** Any vibrator not meeting the requirements of subparagraphs, Paver-Finisher and Consolidation, shall be immediately removed from service and repaired or replaced.

#### 3.12.2.11 Curing Inspection

- a. **Moist Curing Inspections.** At least twice each shift, and not less than four times per day (never more than 7 hours apart) 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 any inspection finds an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for the area shall be extended by 1 day.
- 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 day's operation, the quantity of compound used shall be determined by measurement of the container and the area of concrete surface covered; the Contractor shall then compute the rate of coverage in square meters per L and shall also note whether or not coverage is uniform. All this shall be reported daily.
- d. **Membrane Curing Corrective Action.** When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.
- e. **Sheet Curing Inspection.** At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.
- f. **Sheet Curing Corrective Action.** When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

#### 3.12.2.12 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

- End of Section --

### 3.12.2.13 Mixer Uniformity

- a. Stationary Mixers. Prior to the start of concrete placing and once every 4 months when concrete is being placed, or once for every 38,000 cubic meters of concrete placed, whichever results in the longest time interval, uniformity of concrete mixing shall be determined in accordance with COE CRD-C 55. The original test shall be a Regular Test. After the mixing operation has been tested and approved, subsequent tests shall be Abbreviated Tests.
- b. Truck Mixers. Prior to the start of concrete placing and at least once every 4 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94/C 94M. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.
- c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved. After adjustments have been made, another uniformity test shall be made.

### 3.12.2.14 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

- End of Section --

\*\*\*SAFETY PAYS\*\*\*

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