

# AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF	PAGES
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2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. <i>(If applicable)</i>
6. ISSUED BY	CODE	7. ADMINISTERED BY <i>(If other than Item 6)</i>	CODE

8. NAME AND ADDRESS OF CONTRACTOR <i>(No., street, county, State and ZIP Code)</i>	(X)	9A. AMENDMENT OF SOLICIATION NO.
		9B. DATED <i>(SEE ITEM 11)</i>
		10A. MODIFICATION OF CONTRACT/ORDER NO.
		10B. DATED <i>(SEE ITEM 11)</i>
CODE		FACILITY CODE

### 11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers  is extended,  is not extended. Offers 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 \_\_\_\_\_ 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 your 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)*

### 13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: <i>(Specify authority)</i> 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 <i>(such as changes in paying office, appropriation date, etc.)</i> 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 <i>(Specify type of modification and authority)</i>

**E. IMPORTANT:** Contractor  is not,  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.)*

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 <i>(Type or print)</i>	16A. NAME AND TITLE OF CONTRACTING OFFICER <i>(Type or print)</i>
15B. CONTRACTOR/OFFEROR	16B. UNITED STATES OF AMERICA
15C. DATE SIGNED	16C. DATE SIGNED
<i>(Signature of person authorized to sign)</i>	<i>(Signature of Contracting Officer)</i>

Item 14. Continued.

CHANGES TO SOLICITATION, OFFER, AND AWARD FORM, STANDARD FORM 1442

1. Item 13D.: Change the bid acceptance period from 60 days to "**120 days**".

CHANGES TO SECTION 00100 INSTRUCTIONS, CONDITIONS, AND NOTICES TO BIDDERS

2. Page 00100-11, Paragraph 34 52.236-27 SITE VISIT (CONSTRUCTION)(FEB 1995).- Change subparagraph (b) to read as follows:

"(b) Site visits may be arranged during normal duty hours by contacting: Ed Gonzales, at Corps of Engineer Area Office, (915)568-5700."

CHANGES TO THE SPECIFICATIONS

3. Replacement Sections - Replace the following sections with the accompanying new sections of the same number and title, bearing the notation "ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0060:"

01000	CONSTRUCTION SCHEDULE
01090	SOURCES FOR REFERENCE PUBLICATIONS
02314	EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS
02754	CONCRETE PAVEMENTS FOR SMALL PROJECTS
02960	PLANTING OF TREES, SHRUBS, AND VINES

CHANGES TO THE DRAWINGS

4. Narrative Changes to Drawings. - Revise the following drawings in accordance with the narrative description of change:

<u>Sequence No.</u>	<u>Dwg #</u>	<u>Description of Change</u>
32	S2.00	Revise Guard House Foundation Note 5, third sentence to read: "Compact fill to 92% modified proctor density as determined by ASTM 1557." Other sentences in Note 5 remain unchanged.
50 thru 75	S3.14 - S3.39	Add the following not to each drawing:  "TxDOT design standards are authored and copyrighted by the State of Texas, Department of Transportation. The Department of Army, Corps of Engineers has been granted a license for use of this design standard for use on this project only. Any additions or deletions to this design standard shall have the advance written approval of the State.

5. Replacement Drawings.- Replace the drawings listed below with the attached new drawings(s) of the same number, bearing the notation "AM #0002":

<u>Sequence No.</u>	<u>Dwg #</u>	<u>Sheet Title</u>
26	L1.01	Landscaping Plan Area 1
27	L1.02	Landscaping Plan Area 2

END OF AMENDMENT

SECTION 01000

CONSTRUCTION SCHEDULE

05/1998

AMENDMENT NO. 0002

PART 1 GENERAL

1.1 SCHEDULE

Commence, prosecute, and complete the work under this contract in accordance with the following schedule and Section 00800 SPECIAL CONTRACT REQUIREMENT clauses COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK and LIQUIDATED DAMAGES:

Item of Work	Commencement of Work (calendar days)	Completion of Work (calendar days)	Liquidated Damages per calendar day <sup>[1]</sup>
(1) All work	Within 10 days after receipt of Notice to Proceed	300	[AM#2]\$ 555.00
(2) Landscaping	*	*	---

<sup>1</sup>[AM#2]\_\_\_\_\_

\*Landscaping

Planting and maintenance for landscaping shall be in accordance with Section 02960 PLANTING OF TREES, SHRUBS, AND VINES. No payment will be made for landscaping until all requirements of the section are adequately performed and accepted, as determined by the Contracting Officer.

1.2 WORK RESTRICTIONS

1.2.1 Working Hours

The normal duty working shift shall be Monday through Friday, 7:30 a.m. -4:30 p.m.

1.2.2 Access

Access to the Base classification as a General Access. The contractor shall observed all Security, rules and regulations as per Base Requirements.

1.3 UTILITIES

1.3.1 Payment for Utility Services

See Section 00800 SPECIAL CONTRACT REQUIREMENTS.

1.3.2 Outages

The Contractor shall coordinate all requests for utility outages with the Contracting Officer in writing 21 days prior to date of requested outage:

- a. Water, gas, steam, and sewer outages shall be held to a maximum duration of 4 hours unless otherwise approved in writing.
- b. Electrical outages shall have a maximum duration of 4 hours.
- c. All utility outages shall be scheduled only on Saturdays, Sundays, or holidays unless specific approval is otherwise received.

1.4 STREET CLOSINGS

The Contractor shall coordinate all requests for street closings with the Contracting Officer in writing 14 days prior to date of requested outage:

- a. One lane traffic shall be maintained at all times (except that a total closing may be allowed for specific 8-hour periods).
- b. The final street repair shall be completed within 14 days after the start of any street crossing. Any part of the street returned to service prior to final repair shall be maintained smooth with hot-mix cold-lay surface course.
- c. Open cuts across paved roads and streets for utility crossings will not be allowed. Utility crossings will be accomplished by boring or jacking procedures only.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

SECTION 01090

SOURCES FOR REFERENCE PUBLICATIONS

3/99

AMENDMENT NO. 0002

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the sponsoring organization, e.g.

UL 1 (1993; Rev thru Jan 1995) Flexible Metal Conduit. However, when the sponsoring organization has not assigned a number to a document, an identifying number has been assigned for convenience, e.g. UL's unnumbered 1995 edition of their Building Materials Directory is identified as UL-01 (1995) Building Materials Directory. The sponsoring organization number (UL 1) can be distinguished from an assigned identifying number (UL-01) by the lack of a dash mark (-) in the sponsoring organization assigned number.

1.2 ORDERING INFORMATION

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

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Fax: 248-848-3801  
Internet: <http://www.aci-int.org>

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Seed Regulatory and Testing Branch  
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Ph: 301-504-9430  
Fax: 301-504-5454 Internet: <http://www.ams.usda.gov/lsg/ls-sd.htm>  
e-mail: [james\\_p\\_tripplitt@usda.gov](mailto:james_p_tripplitt@usda.gov)

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ATTN: Pubs Dept.  
Arlington, VA 22203  
Ph: 703-524-8800  
Fax: 703-528-3816

E-mail: ari@ari.org  
Internet: www.ari.org

AIR CONDITIONING CONTRACTORS OF AMERICA (ACCA)

1712 New Hampshire Avenue, NW  
Washington, DC 20009  
Ph: 202-483-9370  
FAX: 202-234-4721

AIR DIFFUSION COUNCIL (ADC)

104 So. Michigan Ave., No. 1500  
Chicago, IL 60603  
Ph: 312-201-0101  
Fax: 312-201-0214

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

30 W. University Dr.  
Arlington Heights, IL 60004-1893  
Ph: 708-394-0404  
Fax: 708-253-0088

ALUMINUM ASSOCIATION (AA)

Pubs Department  
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Fax: 301-843-0159  
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(AASHTO)

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Internet: www.aashto.org

NOTE: AASHTO documents with numbers beginning with M or T are  
available only in Standard Specifications for Transportation  
Materials and Methods of Sampling and Testing, 1998 @\$289.00\X

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e-mail: [info@concrete-pipe.org](mailto:info@concrete-pipe.org)

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Fax: 513-742-3355  
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E-mail: [pubs@acgih.org](mailto:pubs@acgih.org)

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NOTE: The annual ASTM Book of Standards (66 Vol) is  
available for \$3500.00. Prices of individual standards vary.

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Fax: 412-274-4722

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

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Glen Ellyn, IL 60137  
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Fax: 630-790-3095

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South Easton, MA 02375  
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Fax: 508-230-3529  
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PLUMBING AND PIPING INDUSTRY COUNCIL (PPIC)

501 Shatto Place, Suite 402  
Los Angeles, CA 90020  
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Fax: 213-487-3880

PORCELAIN ENAMEL INSTITUTE (PEI)

4004 Hillsboro Pike, Suite 224B  
Nashville, TN 37215  
Ph: 615-385-5357  
Fax: 615-385-5463  
Internet: [www.porcelainenamel.com](http://www.porcelainenamel.com)

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175 West Jackson Blvd., Suite 1859  
Chicago, IL 60604-9773  
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Fax: 312-786-0353  
Internet: [www.pci.org](http://www.pci.org)  
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Ph: 202-720-8674 OR 202-720-8679  
Fax: 202-205-3654  
Internet: [www.usda.gov/rus/home/home.htm](http://www.usda.gov/rus/home/home.htm)

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2850 South Ocean Boulevard, Suite 114  
Palm Beach, FL 33480-5535  
Ph: 561-533-0991  
Fax: 561-533-7466  
e-mail: [fscottfitzgerald@compuserve.com](mailto:fscottfitzgerald@compuserve.com)

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION  
(SMACNA)

P.O. Box 221230  
Chantilly, VA 20153-1230  
Ph: 703-803-2980  
Fax: 703-803-3732  
Internet: <http://www.smacna.org>

SINGLE PLY ROOFING INSTITUTE (SPRI)

200 Reservoir St., Suite 309A  
Needham, MA 02494  
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Fax: 781-444-6111  
Internet: [www.spri.org](http://www.spri.org)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

400 Commonwealth Dr.  
Warrendale, PA 15096-0001  
Ph: 724-776-4970  
Fax: 724-776-0790  
Internet: <http://www.sae.org>  
e-mail: [publications@sae.org](mailto:publications@sae.org)

SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL (SBCCI)

900 Montclair Road  
Birmingham, AL 35213-1206  
Ph: 205-591-1853  
Fax: 205-591-0775

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

400 Penn Center Boulevard, Suite 530  
Pittsburgh, PA 15235  
Ph: 412-829-0770  
Fax: 412-829-0844

SOUTHERN PINE INSPECTION BUREAU (SPIB)

4709 Scenic Highway  
Pensacola, FL 32504-9094  
Ph: 850-434-2611  
Fax: 850-433-5594  
e-mail: spib@spib.org

SSPC: THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

40 24th Street, 6th Floor  
Pittsburgh, PA 15222-4656  
Ph: 412-281-2331  
Fax: 412-281-9992  
Internet: www.sspc.org

NOTE: SSPC documents, except as noted otherwise, are available only as a part of the 1995 Steel Structures Painting Manual, 7th Edition @ \$115.00. \F

STEEL DECK INSTITUTE (SDI)

P.O. Box 25  
Fox River Grove, IL 60021  
Ph: 847-462-1930  
Fax: 847-462-1940  
Internet: <http://www.sdi.org>  
e-mail: janet@sdi.org

STEEL DOOR INSTITUTE (SDOI)

30200 Detroit Rd.  
Cleveland, OH 44145-1967  
Ph: 216-899-0010  
Fax: 216-892-1404

STEEL JOIST INSTITUTE (SJI)

3127 Tenth Ave., North Ext.  
Myrtle Beach, SC 29577-6760  
Ph: 803-626-1995  
Fax: 803-626-5565

STEEL TANK INSTITUTE (STI)

570 Oakwood Rd.  
Lake Zurich, IL 60047  
Ph: 847-438-8265

Fax: 847-438-4500  
Internet: www.steeltank.com  
e-mail: technic@interaccess.com

STEEL WINDOW INSTITUTE (SWI)

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Cleveland, OH 44115-2851  
Ph: 216-241-7333  
Fax: 216-241-0105

TILE COUNCIL OF AMERICA (TCA)

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Clemson, SC 29633-1787  
Ph: 864-646-8453  
FAX: 864-646-2821

TRUSS PLATE INSTITUTE (TPI)

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Madison, WI 53719  
Ph: 608-833-5900  
Fax: 608-833-4360

TUBULAR EXCHANGE MANUFACTURERS ASSOCIATION (TEMA)

25 N. Broadway  
Tarrytown, NY 10591  
Ph: 914-332-0040  
Fax: 914-332-1541

UNDERWRITERS LABORATORIES (UL)

333 Pfingsten Rd.  
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E-mail: [global@ihs.com](mailto:global@ihs.com)  
Note: First price is for std only. Second price is for Std, incl  
Revision Subscription Service.

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Dallas, TX 75234  
Ph: 214-243-3902  
Fax: 214-243-3907

U. S. ARMY ENVIORNMENTAL HYGIENE AGENCY (USAEHA)

Waste Disposal Engineering Division  
Aberdeen Proving Ground, MD 21010-5422  
Ph: 410-671-3652

WATER ENVIRONMENT FEDERATION (WEF)

601 Wythe St.  
Alexandria, VA 22314-1994  
Ph: 703-684-2400  
Fax: 703-684-2492  
Internet: www.wef.org

WATER QUALITY ASSOCIATION (WQA)

4151 Naperville Rd.  
Lisle, IL 60532  
Ph: 630-505-0160  
Fax: 630-505-9637

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

P.O. Box 23145  
Portland, OR 97281  
Ph: 503-639-0651  
Fax: 503-684-8928

WESTERN WOOD PRESERVERS INSTITUTE (WWPI)

7017 N.E. Highway 99 # 108  
Vancouver, WA 98666  
Ph: 360-693-9958  
Fax: 360-693-9967

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

Yeon Bldg.  
522 SW 5th Ave.  
Portland, OR 97204-2122  
Ph: 503-224-3930  
Fax: 503-224-3934

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMPMA)

507 First Street  
Woodland, CA 95695  
Ph: 916-661-9591  
Fax: 916-661-9586

1.3 [AM#2] TEXAS DEPARTMENT OF TRANSPORTATION (TxDOT) DESIGN STANDARDS

TxDOT design standards are authored and copyrighted by the State of Texas, Department of Transportation. The Department of Army, Corps of Engineers has been granted a license for use of the following listed design standards for use on this project only. Any additions or deletions to this list shall have the advance written approval of the State.

Bridge Lighting Details BL (M)  
Texas Classic Traffic Railing Type T411 (M) Sht 1 of 2

Texas Classic Traffic Railing Type T411 (M) Sht 2 of 2  
Bridge Approach Slab BAS-99 (M) Sht 1 of 2  
Bridge Approach Slab BAS-99 (M) Sht 2 of 2  
Bridge End Details BED-95 (M)  
Metal Beam Guard Fence MBGF-95A (M)  
Bridge Protective Assembly BPA-1(M)  
Concrete Riprap CRR-(M)  
Minimum Erection and Bracing Requirements Steel I-Beams and Plate  
Girders MEBR-(S) (M) Sht 1 of 2  
Minimum Erection and Bracing Requirements Steel I-Beams and Plate  
Girders MEBR-(S) (M) Sht 2 of 2  
Optional Drilled Shaft Reinforcing ODSR (M)  
Permanent Metal Deck Forms (Steel) PMDF (S) (M)  
Mechanically Stabilized Earth Retaining Wall RW (MSE) (M)  
Elastomeric Bearing Details SEB (M)  
Plate Girder Details SPGD (M) Sht 1 of 2  
Plate Girder Details SPGD (M) Sht 2 of 2  
Sealed Expansion Joint Details SEJ-A (M)  
Traffic Control Plan - TCP Notes - 98 (M)  
Traffic Control Plan - TCP 1-1 - 98 (M)  
Traffic Control Plan - TCP 1-3 - 98 (M)  
Traffic Control Plan - TCP 1-4 - 98 (M)  
Traffic Control Plan - TCP 2-1 - 98 (M)  
Traffic Control Plan - TCP 2-2 - 98 (M)  
Traffic Control Plan - TCP 2-4 - 98 (M)  
Traffic Control Plan - TCP 2-5 - 98 (M)

-- End of Section --

## SECTION 02314

## EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2216	(1992) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	(1994) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1995a) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

## 1.2 DEGREE OF COMPACTION

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, abbreviated as percent laboratory maximum density.

## 1.3 SUBMITTALS

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

SD-09 Reports

Field Density Tests; FIO.

Testing of Backfill Materials; FIO.

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

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Satisfactory Materials

Satisfactory materials ~~shall comprise any~~[AM#002] include materials classified by ASTM D 2487 as GW, GP, GM, GC, SW, and SP-~~[AM#002]~~, SM, SC, CL, and CH and shall be free of trash debris, roots or other organic matter, or stones larger than 76 millimeters in any dimension.

#### 2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 75 mm. The Contracting Officer shall be notified of any contaminated materials.

#### 2.1.3 Cohesionless and Cohesive Materials

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

#### 2.1.4 Expansive Soils

~~[AM#002]Expansive soils are defined as soils that have a plasticity index equal to or greater than 15 when tested in accordance with ASTM D 4318.~~

#### 2.1.5 Non Expansive Soils (ADDED)

Non expansive soils for non expansive fills shall consist of satisfactory materials having a plasticity index not less than 4 nor greater than 12 when tested in accordance with ASTM D 4318.

## 2.2 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 37.5 mm and no more than 2 percent by weight shall pass the 4.75 mm size sieve.

## PART 3 EXECUTION

### 3.1 CLEARING AND GRUBBING

The areas within lines 1.5 m outside of each building and structure line shall be cleared and grubbed of trees, stumps, roots, brush and other vegetation, debris, existing foundations, pavements, utility lines, structures, fences, and other items that would interfere with construction operations. Stumps, logs, roots, and other organic matter shall be completely removed and the resulting depressions shall be filled with satisfactory material, placed and compacted in accordance with paragraph FILLING AND BACKFILLING. Materials removed shall be disposed of outside the limits of Government-controlled property at the Contractor's responsibility.

### 3.2 TOPSOIL

Topsoil shall be stripped to a depth of 150 millimeters below existing grade within the designated excavations and grading lines and deposited in storage piles for later use. Excess topsoil shall be disposed as specified for excess excavated material.

### 3.3 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified, and shall include trenching for utility system to a point 1.5 m beyond the building line of each building and structure. Refer to Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be replaced with satisfactory material; and payment will be made in conformance with the CHANGES clause of the CONTRACT CLAUSES. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced, at no additional cost to the Government, with satisfactory materials to the indicated excavation grade; except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation. Satisfactory material shall be placed and compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

### 3.4 DRAINAGE AND DEWATERING

#### 3.4.1 Drainage

Surface water shall be directed away from excavation and construction sites to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

### 3.5 CLASSIFICATION OF EXCAVATION

Excavation will be unclassified regardless of the nature of material encountered.

### 3.6 UTILITY AND DRAIN TRENCHES

Trenches for underground utilities systems and drain lines shall be excavated to the required alignments and depths. The bottoms of trenches shall be graded to secure the required slope and shall be tamped if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 150 mm below the bottom of the pipe, and the overdepth shall be backfilled with satisfactory material placed and compacted in conformance with paragraph FILLING AND BACKFILLING.

### 3.7 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. Only excavation methods that will leave the foundation [AM#002]rock strata in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. [AM#002]Shales All soils shall be protected from slaking and all surfaces shall be protected from erosion resulting from ponding or flow of water.

### 3.8 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. [AM#002]Provide a minimum of 305 millimeters of compacted nonexpansive fill below all slabs supported on grade. The surface shall be scarified to a depth of 150 mm before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 150 mm, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 300 mm and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to plus or minus 3 percent of optimum moisture. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING.

### 3.9 FILLING AND BACKFILLING

Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. [AM#002] Nonexpansive soils shall be used in nonexpansive fill under building floor slabs and foundations. Removal and replacement of existing material with nonexpansive material shall be as specified in paragraph SUBGRADE PREPARATION and on the plans. Where nonexpansive fill is indicated under floor slabs or foundations all fill under such slabs or foundations shall be nonexpansive fill. The subgrade below the nonexpansive fill shall be loosened to depth of 150 mm, moistened, manipulated and recompacted as specified hereinafter. Satisfactory materials shall be placed in horizontal layers not exceeding 200 mm in loose thickness, or 150 mm when hand-operated compactors are used. After

placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade. Backfill shall not be placed in wet or frozen areas. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 600 mm above sewer lines and 300 mm above other utility lines shall be free from stones larger than 25 mm in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 100 mm in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

	Percent Laboratory maximum density	
	Cohesive material	Cohesionless material
Fill, embankment, and backfill		
Under structures, building slabs, steps, paved areas, around footings, and in trenches	90	95

Approved compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein before to the required density prior to further construction thereon. Recomaction over underground utilities and heating lines shall be by hand tamping.

3.10 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Field in-place density shall be determined in accordance with ASTM D 1556, ~~[AM#002]ASTM D-2167~~, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted if necessary by the procedure described in ASTM D 2922, paragraph ADJUSTING CALIBRATION CURVE. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of

both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. ASTM D 2937 shall be used only for soft, fine-grained, cohesive soils. The following number of tests, if performed at the appropriate time, shall be the minimum acceptable for each type operation.

### 3.10.1 In-Place Densities

In-place density and moisture content test results shall be included with the Contractor's daily construction quality control reports.

#### 3.10.1.1 In-Place Density of Subgrades

One test per 5 square meters or fraction thereof.

#### 3.10.1.2 In-Place Density of Fills and Backfills

One test per 5 square meters or fraction thereof of each lift for fill or backfill areas compacted by other than hand or hand-operated machines.

### 3.10.2 Moisture Content

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D 2216.

### 3.10.3 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material, including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 5 cubic meters of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

## 3.11 CAPILLARY WATER BARRIER

Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

## 3.12 GRADING

Areas within 1.5 m outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

## 3.13 SPREADING TOPSOIL

Areas outside the building lines from which topsoil has been removed shall be topsoiled. The surface shall be free of materials that would hinder planting or maintenance operations. The subgrade shall be pulverized to a depth of 50 mm by disking or plowing for the bonding of topsoil with the subsoil. Topsoil shall then be uniformly spread, graded, and compacted to the thickness, elevations, slopes shown, and left free of surface irregularities. Topsoil shall be compacted by one pass of a cultipacker,

roller, or other approved equipment weighing 1.46 kN/m to 2.34 kN/m of roller. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

3.14 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades reestablished to the required elevations and slopes.

-- End of Section --

## SECTION 02754

## CONCRETE PAVEMENTS FOR SMALL PROJECTS

## 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 305R (1991) Hot Weather Concreting

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 184 (1990) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement

ASTM A 615 (1996) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM C 31 (1996) Making and Curing Concrete Test Specimens in the Field

ASTM C 33 (1993) Concrete Aggregates

ASTM C 39 (1996) Compressive Strength of Cylindrical Concrete Specimens

ASTM C 94 (1996) Ready-Mixed Concrete

ASTM C 123 (1994) Lightweight Pieces in Aggregate

ASTM C 143 (1990a) Slump of Hydraulic Cement Concrete

ASTM C 150 (1997) Portland Cement

ASTM C 192 (1990a) Making and Curing Concrete Test Specimens in the Laboratory

ASTM C 231 (1997) Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C 260 (1995) Air-Entraining Admixtures for Concrete

ASTM C 494 (1992) Chemical Admixtures for Concrete

ASTM C 666 (1992) Resistance of Concrete to Rapid

## Freezing and Thawing

ASTM C 881	(1990) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 1077	(1995a) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

## CORPS OF ENGINEERS (COE)

COE CRD-C 130	(1989) Scratch Hardness of Coarse Aggregate Particles
COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete
COE CRD-C 540	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

## NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1990) Concrete Plant Standards
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## 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 ACCEPTABILITY OF WORK

The pavement will be accepted on the basis of tests made by the Government and by the Contractor or its suppliers, as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing. Concrete samples shall be taken by the Contractor at the placement to determine the slump, air content, and strength of the concrete. Test cylinders shall be made for determining conformance with the strength requirements of these specifications and, when required, for determining the time at which pavements may be placed into service. All air content measurements shall be determined in accordance with ASTM C 231. All slump tests shall be made in accordance

with ASTM C 143. All test cylinders shall be 150 by 300 mm cylinders and shall be fabricated in accordance with ASTM C 192, using only steel molds, cured in accordance with ASTM C 31, and tested in accordance with ASTM C 39.

A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory.

1.3.1 Evaluation Sampling

Sampling, testing, and mixture proportioning shall be performed by a commercial Testing Laboratory, conforming with ASTM C 1077. The individuals who sample and test concrete and concrete constituents shall be certified as American Concrete Institute (ACI) Concrete Field Testing Technicians, Grade I. The individuals who perform the inspection of concrete shall be certified as ACI Concrete Construction Inspector, Level II. All mix design, weekly quality control reports, smoothness reports, and project certification reports shall be signed by a Registered Engineer.

1.3.2 Surface Testing

Surface testing for surface smoothness and plan grade shall be performed as indicated below by the Testing Laboratory. The measurements shall be properly referenced in accordance with paving lane identification and stationing, and a report given to the Government within 24 hours after measurement is made. A final report of surface testing, signed by a Registered Engineer, containing all surface measurements and a description of all actions taken to correct deficiencies, shall be provided to the Government upon conclusion of surface testing.

1.3.2.1 Surface Smoothness Requirements

The finished surfaces of the pavements shall have no abrupt change of 3 mm or more, and all pavements shall be within the tolerances specified in Table 1 when checked with the straightedge.

TABLE 1  
STRAIGHTEDGE SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category -----	Direction of Testing -----	Tolerances mm -----
Roads and Streets	Longitudinal Transverse	5 6.5

1.3.2.2 Surface Smoothness Testing Method

The surface of the pavement shall be tested with the straightedge to identify all surface irregularities exceeding the tolerances specified above. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines approximately 4.5 m apart. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum

gap between the straightedge and the pavement surface, in the area between these two high points.

### 1.3.3 Plan Grade Testing and Conformance

The finished surface of the pavements shall conform, within the tolerances shown in Table 1, to the lines, grades, and cross sections shown. The finished surface of new abutting pavements shall coincide at their juncture. The finished surface of airfield runway, 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 above or below the plan grade line or elevation indicated. Each pavement category shall be checked by the Contractor for conformance with plan grade requirements by running lines of levels at intervals to determine the elevation at each joint intersection.

### 1.4 PRECONSTRUCTION TESTING OF MATERIALS

The Contractor shall not be entitled to any additional payment or extension of time because of delays caused by sampling and testing additional sources, or samples, necessitated by failure of any samples. Aggregates shall be sampled and tested by the [AM#002] certified Test Laboratory and shall be representative of the materials to be used for the project. Test results, signed by a Registered Engineer, shall be submitted [AM#002] ~~120~~ 30 days before commencing paving. No aggregate shall be used unless test results show that it meets all requirements of these specifications, including compliance with ASTM C 33 and deleterious materials limitations.

#### 1.4.1 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.

##### 1.4.1.1 Sampling and Testing

One composite sample of concrete from each subplot shall be obtained in accordance with ASTM C 172 from on batch or truckload. Test beams, 152 by 152 mm shall be fabricated and cured in accordance with ASTM C 31/C 31M; and tested in accordance with ASTM C 78. Two test beams per subplot (8 per lot) shall be fabricated and cured for flexural strength, and tested at 14-day age. At the same time 2 additional test beams to be used for CQC tests shall be fabricated and cured and tested as specified in Paragraph; Testing and Inspection for Quality Control.

### 1.5 SUBMITTALS

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

SD-01 Data

Equipment; FIO.

Manufacturer's literature on the concrete plant; mixing equipment; hauling equipment; placing and finishing, and curing equipment; at least 7 days prior to start of paving.

#### SD-07 Schedules

Paving; FIO.

Paving Schedules at least 7 days prior to start of paving.

#### SD-08 Statements

Mixture Proportions; GA.

The report of the Contractor's mixture proportioning studies showing the proportions of all ingredients and supporting information on aggregate and other materials that will be used in the manufacture of concrete, at least 14 days prior to commencing concrete placing operations.

### 1.6 EQUIPMENT

#### 1.6.1 Batching and Mixing

The batching plant shall conform to NRMCA CPMB 100, the equipment requirements in ASTM C 94, and as specified. Water shall not be weighed or measured cumulatively with another ingredient. All concrete materials batching shall meet ASTM C 94 requirements. Mixers shall be stationary mixers. Truck mixers shall not be used for mixing paving concrete. Batching, mixers, mixing time, permitted reduction of mixing time, and concrete uniformity shall meet the requirements of ASTM C 94, and shall be documented in the initial weekly QC Report.

#### 1.6.2 Transporting Equipment

Transporting equipment shall be in conformance with ASTM C 94 and as specified herein. Concrete shall be transported to the paving site in rear-dump trucks, in truck mixers designed with extra large blading and rear opening specifically for low slump concrete, or in agitators. Bottom-dump trucks shall not be used for delivery of concrete.

#### 1.6.3 Delivery Equipment

When concrete transport equipment cannot operate on the paving lane, side-delivery transport equipment consisting of self-propelled moving conveyors shall be used to deliver concrete from the transport equipment and discharge it in front of the paver. Front-end loaders, dozers, or similar equipment shall not be used to distribute the concrete.

#### 1.6.4 Paver-Finisher

The paver-finisher shall be a heavy-duty, self-propelled machine designed specifically for paving and finishing high quality pavement. The paver-finisher shall spread, consolidate, and shape the plastic concrete to the desired cross section in one pass. The paver-finisher shall be equipped with a full width "knock-down" auger, capable of operating in both directions, which will evenly spread the fresh concrete in front of the screed or extrusion plate. Immersion vibrators shall be gang mounted at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or

completely withdrawn from the concrete. The vibrators shall be automatically controlled so that they will be immediately stopped as forward motion of the paver ceases. The spacing of the immersion vibrators across the paving lane shall be as necessary to properly consolidate the concrete, but the clear distance between vibrators shall not exceed 750 mm, and the outside vibrators shall not exceed 300 mm from the edge of the lane. The paver-finisher shall be equipped with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface.

#### 1.6.4.1 Paver-Finisher with Fixed Forms

The paver-finisher shall be equipped with wheels designed to ride the forms, keep it aligned with the forms, and to spread the preventing deformation of the forms.

#### 1.6.4.2 Slipform Paver-Finisher

The slipform paver-finisher shall be automatically controlled and crawler mounted with padded tracks. Horizontal alignment shall be electronically referenced to a taut wire guideline. Vertical alignment shall be electronically referenced on both sides of the paver to a taut wire guideline, to an approved laser control system, or to a ski operating on a completed lane. Control from a slope-adjustment control or control operating from the underlying material shall not be used.

#### 1.6.4.3 Other Types of Finishing Equipment

Clary screeds or other rotating tube floats will not be allowed on the project.

#### 1.6.5 Curing Equipment

Equipment for curing is specified in paragraph CURING.

#### 1.6.6 Texturing Equipment

Texturing equipment shall be as specified below.

##### 1.6.6.1 Deep Texturing Equipment

Texturing equipment shall consist of a comb with spring wire tines forming a drag at least 1.2 m long. This drag shall be mounted in a wheeled frame spanning the paving lane and constructed to mechanically pull the drag in a straight line across the paving lane perpendicular to the centerline.

##### 1.6.7 Sawing Equipment

Equipment for sawing joints and for other similar sawing of concrete shall be standard diamond-tip-bladed concrete saws mounted on a wheeled chassis.

##### 1.6.8 Straightedge

The Contractor shall furnish and maintain at the job site one 4 m straightedge for testing concrete surface smoothness. The straightedge shall be constructed of aluminum or magnesium alloy and shall have blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Straightedges shall have handles for operation on the pavement.

## PART 2 PRODUCTS

## 2.1 CEMENTITIOUS MATERIALS

Cementitious materials shall be portland cement and shall conform to appropriate specifications listed below.

## 2.1.1 Portland Cement

Portland cement shall conform to ASTM C 150 Type V, low-alkali.

## 2.2 AGGREGATES

Aggregates shall consist of clean, hard, uncoated particles meeting the requirements of ASTM C 33, including deleterious materials, abrasion loss and soundness requirements of ASTM C 33, and other requirements specified herein. Aggregate not having a satisfactory demonstrable service record shall have a durability factor of 50 or more when subjected to freezing and thawing in concrete in accordance with ASTM C 666.

## 2.2.1 Coarse Aggregate

Coarse aggregate shall consist of crushed gravel, crushed stone, or a combination thereof. The nominal maximum size of the coarse aggregate shall be 27.5 mm. When the nominal maximum size is greater than 25.0 mm, the aggregates shall be furnished in two ASTM C 33 size groups, No. 67 and No. 4. The amount of deleterious material in each size of coarse aggregate shall not exceed the limits shown in ASTM C 33 Class 1N, 4M or 4S, depending on the weathering region, and the following limits:

- a. Lightweight particles 1.0 max. percent by mass (ASTM C 123).
- b. Other soft particles 2.0 max. percent by mass (COE CRD-C 130).
- c. Total of all deleterious 5.0 max. percent by mass (substances listed in ASTM C 33 and above, exclusive of material finer than 0.075 mm sieve).
- d. The separation medium for lightweight particles shall have a density of 2.0 Mg/cubic meters.

## 2.2.2 Fine Aggregate

Fine aggregate shall consist of natural sand, manufactured sand, or a combination of the two, and shall be composed of clean, hard, durable particles. All fine aggregate shall be composed of clean, hard, durable particles meeting the requirements of ASTM C 33 and the requirements herein. The amount of deleterious material in the fine aggregate shall not exceed the limits in ASTM C 33 and shall not exceed the following limits:

- a. Lightweight particles (ASTM C 123) 1.0 percent max. by mass using a medium with a density of 2.0 Mg/cubic meter.
- b. The total of all deleterious material types, listed in ASTM C 33 and above, shall not exceed 3.0 percent of the mass of the fine aggregate.

## 2.3 CHEMICAL ADMIXTURES

Air-entraining admixture shall conform to ASTM C 260. An accelerator shall be used only when specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES and shall not be used to reduce the amount of cementitious material used. Accelerator shall conform to ASTM C 494 Type C. Calcium chloride and admixtures containing calcium chloride shall not be used. A water-reducing or retarding admixture shall meet the requirements of ASTM C 494. Type G or H admixtures are not allowed.

## 2.4 CURING MATERIALS

Membrane forming curing compound shall be a white pigmented compound conforming to COE CRD-C 300. Burlap shall be new or shall be clean material never used for anything other than curing concrete.

## 2.5 WATER

Water for mixing and curing shall be clean, potable, and free of injurious amounts of oil, acid, salt, or alkali.

## 2.6 JOINT MATERIALS

### 2.6.1 Expansion Joint Material

Expansion joint filler shall be a preformed material conforming to ASTM D 1751 or ASTM D 1752. Expansion joint filler shall be 20 mm thick.

### 2.6.2 Slip Joint Material

Slip joint material shall be 6 mm thick expansion joint filler conforming to ASTM D 1751 or ASTM D 1752.

### 2.6.3 Contraction Joint Inserts

Sawable contraction joint inserts shall conform to COE CRD-C 540. Nonsawable contraction joint inserts shall have sufficient stiffness to permit placement in plastic concrete without deviation from a straight line and shall conform to the physical requirements of COE CRD-C 540, with the exception of resistance to sawing. Material for polyvinyl chloride inserts shall conform to COE CRD-C 572. No metal inserts of any kind shall be used.

## 2.7 REINFORCING

### 2.7.1 General

Reinforcing bars shall conform to ASTM A 615 Grade 60. Bar mats shall conform to ASTM A 184. Reinforcement shall be free from loose, flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete.

### 2.7.2 Steel Fiber Reinforcing

Minimum ultimate tensile strength of the fibers shall be 345 MPa. The maximum aspect ratio (length divided by diameter) shall not exceed 100. Fibers longer than 60 mm shall not be used. The fibers shall be deformed and shall be furnished in small bundles adhered with water soluble glue.

## 2.8 DOWELS AND TIE BARS

### 2.8.1 Dowels

Dowels shall be single piece, plain (non-deformed) steel bars conforming to ASTM A 615 Grade 60 or higher. Dowels shall be free of loose, flaky rust and loose scale and shall be clean and straight.

#### 2.8.2 Tie Bars

Tie bars shall be deformed steel bars conforming to ASTM A 615 Grade 60. Grade 60 or higher shall not be used for bars that are bent and straightened during construction.

#### 2.9 EPOXY RESIN

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

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

#### ~~[AM#002]2.10 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES~~

~~Specified flexural strength,  $f'r$ , for concrete is 4.48 MPa at 28 days. Maximum allowable water cementitious material ratio is 0.45. The water cementitious material ratio is based on absolute volume equivalency, where the ratio is determined using the weight of cement for a cement only mix, or using the total volume of cement plus pozzolan converted to an equivalent weight of cement by the absolute volume equivalency method described in ACI 211.1. The concrete shall be air entrained with a total air content of 4 plus or minus 1 percent. The maximum allowable slump of the concrete shall be 75 mm for pavement constructed with fixed forms. For slipformed pavement, the maximum allowable slump shall be 30 mm. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified flexural strength  $f'r$  and no individual test result falls below the specified strength  $f'r$  by more than 3.5 MPa. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.~~

#### ~~2.11 MIXTURE PROPORTIONS~~

##### ~~2.11.1 Composition Concrete~~

~~Composition concrete shall be composed of cementitious material, water, fine and coarse aggregates, and admixtures. Fly ash, if used, shall be used only at a rate between 15 and 35 percent by mass of the total cementitious material. Admixtures shall consist of air entraining~~

~~admixture and may also include retarder and/or water-reducing admixture. High range water-reducing admixtures and admixtures to produce flowable concrete shall not be used. No substitutions shall be made in the materials used in the mixture proportions without additional tests to show that the quality of the concrete is satisfactory.~~

#### 2.11.2 ~~Concrete Mixture Proportioning Studies~~

~~Trial design batches, mixture proportioning studies, and testing shall be the responsibility of the Contractor, and shall be performed by the Test Laboratory and signed by a Registered Engineer. No concrete pavement shall be placed until the Contracting Officer has approved the Contractor's mixture proportions. All materials used in mixture proportioning studies shall be representative of those proposed for use on the project. If there is a change in materials, additional mixture design studies shall be made using the new materials. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in ACI 211.1. At least three different water-cementitious ratios, which will produce a range of strength encompassing that required on the project, shall be used. Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content. Maximum sand content shall be 40 percent of the total aggregate SSD weight. Aggregate quantities shall be based on the mass in a saturated surface dry condition.~~

#### 2.11.3 ~~Mixture Proportioning Procedure~~

~~The Contractor shall perform the following:~~

- ~~a. Fabricate, cure and test 6 test cylinders per age for each mixture at 7 and 28 days.~~
- ~~b. Using the average strength for each w/(c+p), plot the results from each of the three mixtures on separate graphs for w/(c+p) versus 28-day strength.~~
- ~~c. From the graphs select a w/(c+p) which will produce a mixture giving a 28-day strength equal to the required strength determined in accordance with the following paragraph.~~

#### 2.11.4 ~~Average Strength Required for Mixtures~~

~~In order to ensure meeting, during production, the strength requirements specified, the mixture proportions selected shall produce a required average strength,  $f'_{cr}$ , exceeding the specified strength,  $f'_c$ , in accordance with procedures in Chapter 3 of ACI 301, "Proportioning."~~

### 2.10 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES

#### 2.10.1 Specified Flexural Strength

Specified flexural strength, R, for concrete is 4,480 kPa psi at 14 days as determined by tests made in accordance with ASTM C 192/C 192M. Maximum allowable water-cementitious material ratio is .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, by the mass equivalency method described in ACI 211.1. The concrete shall be air-entrained with a total air content of 5 plus or minus 1 percentage points, 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 75 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.

#### 2.10.3 Concrete Strength for Final Acceptance

The strength of the concrete will be considered acceptable when the average 14 day flexural strengths for each lot are above the "Specified Flexural Strength", and no individual set (2 beams per subplot) in the lot are 170 kPa 25 psi or more below the "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.

### 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 blended cement or only portland cement in combination with pozzolan. Pozzolan, if used, shall consist of not less than 15 percent of the cementitious material by mass and not more than 35 percent. The total portland cement content shall be at least 6.8 kg/cubic meter. Admixtures shall consist of air entrained admixture and may also include, as approved accelerator retarder 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, by the weight equivalency method as described in ACI 211.1. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by mass of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content.

#### 2.11.2.2 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 90 day Flexural Strength

The following step by step procedure shall be followed:

- a. Fabricate all beams for each mixture from the same batch or blend of batches. Fabricate and cure all beams in accordance with ASTM C 192/C 192M, using 152 by 152 mm beams.
- b. Test beams in accordance with ASTM C 78.
- c. Fabricate and cure test beams from each mixture for 7, 14, and 90-day flexural tests; 6 beams to be tested per age.
- d. 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
- e. From these graphs select a w/c that will produce a mixture giving a 14 day flexural strength equal to the required strength determined in accordance with paragraph "Average Flexural Strength Required for Mixtures."
- f. 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 paragraph "Concrete Strength for Final Acceptance", and it is mandatory that both sets of requirements must be met. If at any time, the 14-day flexural strength, for any lot, is 410 kPa or more below the 'required average 14-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 Flexural Strength Required for Mixtures

In order to ensure meeting, during production, the strength requirements specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES, the mixture proportions selected during mixture proportioning studies and used during construction shall produce a required average flexural strength exceeding the specified strength, R, by the amount indicated below. This required average flexural strength, Ra, will 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 14-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 conditions similar to those expected, shall represent concrete produced to meet a specified flexural strength or strengths within 1 MPa of the 14-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 14-days. Required average flexural strength, Ra, used as the basis for selection of concrete proportions shall be the value from the equation that follows, using the standard deviation as determined above:

$$Ra = R + 1.34S$$

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

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
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,  $R_a$ , shall be determined by adding 15 percent to the specified flexural strength,  $R$ .

### PART 3 EXECUTION

#### 3.1 CONDITIONING OF UNDERLYING MATERIAL

Underlying material, base course, upon which concrete is to be placed shall be clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. After the underlying material has been prepared for concrete placement, no equipment shall be permitted thereon.

#### 3.2 WEATHER LIMITATIONS

##### 3.2.1 Hot Weather Paving

The temperature of concrete shall not exceed 32 degrees C. Steel forms, dowels and reinforcing shall be cooled prior to concrete placement when steel temperatures are greater than 49 degrees C.

##### 3.2.2 Cold Weather Paving

The ambient temperature of the air at the placing site and the temperature of surfaces to receive concrete shall be not less 5 degrees C. The temperature of the concrete when placed shall be not less than 10 degrees C. 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, AND REPLACEMENT OF SLABS.

#### 3.3 CONCRETE PRODUCTION

##### 3.3.1 General Requirements

Concrete shall be deposited in front of the paver within 45 minutes from the time cement has been charged into the mixing drum, except that if the ambient temperature is above 32 degrees C, the time shall be reduced to 30 minutes. Every load of concrete delivered to the paving site shall be accompanied by a batch ticket from the operator of the batching plant. Tickets shall show at least the mass, or volume, of all ingredients in each batch delivered, and the time of day. Tickets shall be delivered to the placing foreman who shall keep them on file and deliver them to the Government daily.

### 3.3.2 Transporting and Transfer-Spreading Operations

Non-agitating equipment shall be used only on smooth roads and for haul time less than 15 minutes. Equipment shall be allowed to operate on the underlying material only if no damage is done to the underlying material and its degree of compaction. Any disturbance to the underlying material that does occur shall be corrected before the paver-finisher reaches the location of the disturbance and the equipment shall be replaced or procedures changed to prevent any future damage. Additional water may be added to truck mixers to bring the slump within the specified range provided the mixture water-cement ratio is not exceeded.

## 3.4 PAVING

Pavement shall be constructed with paving and finishing equipment utilizing fixed forms or slipforms.

### 3.4.1 Consolidation

The paver vibrators shall be inserted into the concrete 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 permitted. Concrete in small, odd-shaped slabs or in locations inaccessible to the paver mounted vibration equipment shall be vibrated with a hand-operated immersion vibrator. Vibrators shall not be used to transport or spread the concrete.

### 3.4.2 Operation

When the paver is operated between or adjacent to previously constructed pavement (fill-in lanes), provisions shall be made to prevent damage to the previously constructed pavement, including keeping the existing pavement surface free of any debris, and placing rubber mats beneath the paver tracks. Transversely oscillating screeds and extrusion plates shall overlap the existing pavement the minimum possible, but in no case more than 200 mm.

### 3.4.3 Required Results

The paver-finisher shall be operated to produce a thoroughly consolidated slab throughout, true to line and grade within specified tolerances. The paver-finishing operation shall produce a surface finish free of irregularities, tears, voids of any kind, and any other discontinuities. It shall produce only a very minimum of paste at the surface. Multiple passes of the paver-finisher shall not be permitted. The equipment and its operation shall produce a finished surface requiring no hand finishing, other than the use of cutting straightedges, except in very infrequent instances. No water, other than true fog sprays (mist), shall be applied to the concrete surface during paving and finishing.

### 3.4.4 Fixed Form Paving

Forms shall be steel, except that wood forms may be used for curves having a radius of 45 m or less, and for fillets. Forms may be built up with metal or wood, added only to the base, to provide an increase in depth of not more than 25 percent. The base width of the form shall be not less than eight-tenths of the vertical height of the form, except that forms 200

mm or less in vertical height shall have a base width not less than the vertical height of the form. Wood forms for curves and fillets shall be adequate in strength and rigidly braced. Forms shall be set on firm material cut true to grade so that each form section when placed will be firmly in contact with the underlying layer for its entire base. Forms shall not be set on blocks or on built-up spots of underlying material. Forms shall remain in place at least 12 hours after the concrete has been placed. Forms shall be removed without injuring the concrete.

#### 3.4.5 Slipform Paving

The slipform paver shall shape the concrete to the specified and indicated cross section in one pass, and shall finish the surface and edges so that only a very minimum amount of hand finishing is required. Dowels shall not be installed by dowel inserters attached to the paver or by any other means of inserting the dowels into the plastic concrete.

#### 3.4.6 Placing Reinforcing Steel

Reinforcement shall be positioned on suitable chairs securely fastened to the subgrade prior to concrete placement, or may be placed on an initial layer of consolidated concrete, with the subsequent layer placed within 30 minutes of the first layer placement.

#### 3.4.7 Placing Dowels and Tie Bars

Dowels shall be installed with alignment not 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 and a vertical tolerance of plus or minus 5 mm. The portion of each dowel intended to move within the concrete or expansion cap shall be painted with one coat of rust inhibiting primer paint, and then oiled just prior to placement. Dowels and tie bars in joints shall be omitted when the center of the dowel or tie bar is located within a horizontal distance from an intersecting joint equal to or less than one-fourth of the slab thickness.

##### 3.4.7.1 Contraction Joints

Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place by means of rigid metal basket assemblies. The dowels and tie bars shall be welded to the assembly or held firmly by mechanical locking arrangements that will prevent them from becoming distorted during paving operations. The basket assemblies shall be held securely in the proper location by means of suitable anchors.

##### 3.4.7.2 Construction Joints-Fixed Form Paving

Installation of dowels and tie bars shall be by the bonded-in-place method, supported by means of devices fastened to the forms. Installation by removing and replacing in preformed holes will not be permitted.

##### 3.4.7.3 Dowels Installed in Hardened Concrete

Installation shall be by bonding the dowels into holes drilled into the hardened concrete. Holes approximately 3 mm greater in diameter than the dowels shall be drilled into the hardened concrete. Dowels shall be bonded in the drilled holes using epoxy resin injected at the back of the hole before installing the dowel and extruded to the collar during insertion of

the dowel so as to completely fill the void around the dowel. Application by buttering the dowel shall not be permitted. The dowels shall be held in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic collar fitted around the dowel. The vertical alignment of the dowels shall be checked by placing the straightedge on the surface of the pavement over the top of the dowel and measuring the vertical distance between the straightedge and the beginning and ending point of the exposed part of the dowel. Where tie bars are required in longitudinal construction joints of slipform pavement, bent tie bars shall be installed at the paver, in front of the transverse screed or extrusion plate. If tie bars are required, a standard keyway shall be constructed, and the bent tie bars shall be inserted into the plastic concrete through a 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. Before placement of the adjoining paving lane, the tie bars shall be straightened, without spalling the concrete around the bar.

#### 3.4.7.4 Expansion Joints

Dowels in expansion joints shall be installed by the bonded-in-place method or by bonding into holes drilled in hardened concrete, using procedures specified above.

### 3.5 FINISHING

Clary screeds, "bridge deck" finishers, or other rotating pipe or tube type equipment shall not be permitted. The sequence of machine operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Hand finishing shall be used only infrequently and only on isolated areas of odd slab shapes and in the event of a breakdown of the mechanical finishing equipment. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Equipment to be used for supplemental hand finishing shall primarily be 3 to 4 m cutting straightedges; only very sparing use of bull floats shall be allowed. At no time shall water be added to the surface of the slab in any way, except for fog (mist) sprays to prevent plastic shrinkage cracking.

#### 3.5.1 Machine Finishing With Fixed Forms

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

#### 3.5.2 Machine Finishing With Slipform Pavers

If there is sufficient concrete slurry or fluid paste on the surface that it runs over the edge of the pavement, the paving operation shall be immediately stopped and the equipment, mixture, or operation modified to prevent formation of such slurry. Any slurry which does run down the vertical edges shall be immediately removed. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens.

### 3.5.3 Surface Correction

While the concrete is still plastic, irregularities and marks in the pavement surface shall be eliminated by means of cutting straightedges, 3 to 4 m in length. Depressions shall be filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. Long-handled, flat "bull floats" shall be used sparingly and only as necessary to correct minor, scattered surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished.

### 3.5.4 Hand Finishing

Hand finishing operations shall be used only for those unusual slabs as specified previously. Grate tampers (jitterbugs) shall not be used. As soon as placed and vibrated, the concrete shall be struck off and screeded. The surface shall be tamped with a strike-off and tamping screed, or vibratory screed. Immediately following the final tamping of the surface, the pavement shall be floated longitudinally. Long-handled, flat bull floats shall be used sparingly and only as necessary to correct surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished. No water shall be added to the pavement during finishing operations.

### 3.5.5 Texturing

Before the surface sheen has disappeared and before the concrete hardens, the surface of the pavement shall be given a texture as described herein. After curing is complete, all textured surfaces shall be thoroughly power broomed to remove all debris. Any type of transverse texturing shall produce grooves in straight lines across each lane within a tolerance of plus or minus 13 mm of a true line. The concrete in areas of recesses for tie-down anchors, lighting fixtures, and other outlets in the pavement shall be finished to provide a surface of the same texture as the surrounding area.

#### 3.5.5.1 Wire-Comb Texturing

Surface texture transverse to the pavement center line shall be applied using a mechanical wire comb drag. The comb 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 comb shall be overlapped the minimum necessary to obtain a continuous and uniformly textured surface. The scores shall be 2 to 5 mm deep, 1.5 to 3 mm wide, and spaced 10 mm apart.

### 3.5.6 Edging

The edges of slipformed lanes shall not be edged. After texturing has been completed, the edge of the slabs along the forms shall be carefully finished with an edging tool to form a smooth rounded surface of 3 mm radius. No water shall be added to the surface during edging.

## 3.6 CURING

Concrete shall be continuously protected against loss of moisture and rapid temperature changes for at least 7 days from the completion of finishing operations. Unhardened concrete shall be protected from rain and flowing

water. During hot weather with low humidity and/or wind, the Contractor shall institute measures to prevent plastic shrinkage cracks from developing. ACI 305R contains means of predicting plastic shrinkage cracking and preventative measures. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry. Curing shall be accomplished by one of the following methods.

### 3.6.1 Membrane Curing

A uniform coating of white-pigmented membrane-forming curing compound shall be applied to the entire exposed surface of the concrete including pavement edges as soon as the free water has disappeared from the surface after finishing. If evaporation is high and no moisture is present on the surface even though bleeding has not stopped, fog sprays shall be used to keep the surface moist until setting of the cement occurs. Curing compound shall then be immediately applied. Curing compound shall be applied to the finished surfaces by means of a self-propelled automatic spraying machine, equipped with multiple spraying nozzles with wind shields, spanning the newly paved lane. The curing compound shall be applied at a maximum application rate of 5 square meters per L. The application of curing compound by hand-operated, mechanical powered pressure sprayers will be permitted only on odd widths or shapes of slabs where indicated and on concrete surfaces exposed by the removal of forms. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel and that will be free from pinholes and other discontinuities. Areas where the curing compound develops the above defects or is damaged by heavy rainfall, sawing or other construction operations within the curing period, shall be immediately resprayed.

### 3.6.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Impervious sheet curing shall not be used.

## 3.7 JOINTS

No deviation from the jointing pattern shown on the drawings shall be made without written approval of the Design District Pavement or Geotechnical Engineer. All joints shall be straight, perpendicular to the finished grade of the pavement, and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 13 mm.

### 3.7.1 Longitudinal Construction Joints

Dowels shall be installed in the longitudinal construction joints, or the edges shall be thickened as indicated.

### 3.7.2 Transverse Construction Joints

Transverse construction joints shall be installed at a planned transverse joint, at the end of each day's placing operations and when concrete placement is interrupted. Transverse construction joints shall be constructed either by utilizing headers and hand placement and finishing techniques, or by placing concrete beyond the transverse construction joint

location and then saw cutting full depth and removing concrete back to the transverse construction joint location. For the latter case, dowels shall be installed using methods for dowels installed in hardened concrete described above. All transverse construction joints shall be dowelled.

### 3.7.3 Expansion Joints

Expansion joints shall be formed where indicated, and about any structures and features that project through or into the pavement, using preformed joint filler of the type, thickness, and width indicated, and shall extend the full slab depth. Edges of the concrete at the joint face shall be edged. The joint filler strips shall be installed to form a recess at the pavement surface to be filled with joint sealant. Expansion joints shall be constructed with thickened edges for load transfer.

### 3.7.4 Slip Joints

Slip joints shall be installed the full depth of the slab using expansion joint preformed joint filler material attached to the face of the original concrete placement. A reservoir for joint sealant shall be constructed at the top of the joint. Edges of the joint face shall be edged.

### 3.7.5 Contraction Joints

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

#### 3.7.5.1 Sawed Joints

Sawed contraction joints shall be constructed by sawing a groove in the concrete with a 3 mm blade to the indicated depth. The time of initial sawing shall vary depending on existing and anticipated weather conditions and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. Sawing at a given joint location shall be discontinued when a crack develops ahead of the saw cut. Immediately after the joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. The surface shall be resprayed with curing compound as soon as free water disappears. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed with cord or backer rod before the concrete in the region of the joint is resprayed with curing compound.

#### 3.7.5.2 Insert-Type Joints

Insert-type joints shall not be used for slipformed pavements. Insert-type non-metallic contraction joints shall be constructed by installing a preformed insert in the plastic concrete to form a weakened plane to induce cracking. Inserts shall be installed using a machine equipped with a vibrating bar for cutting a groove in the plastic concrete for placement of the insert or for vibrating the insert into place at the prescribed joint location. The installed insert shall be perpendicular to the finished grade of the pavement, with the top of the insert not more than 3 mm below

the pavement surface.

### 3.7.6 Thickened Edge Joints

Underlying material in the transition area shall meet the requirements for smoothness and compaction specified for all other areas of the underlying material.

### 3.7.7 Special Joints

Special joints (undercut joints) shall be constructed adjacent to existing pavement as indicated. The concrete shall be worked under the edge of the existing pavement to completely fill the void and shall be thoroughly consolidated by the use of hand-held vibrators.

## 3.8 REPAIR, REMOVAL, AND REPLACEMENT OF SLABS

New pavement slabs that contain full-depth cracks shall be removed and replaced, as specified herein at no cost to the Government. Removal and replacement shall be full depth, shall be full width of the paving lane, and the limit of removal shall be from each original transverse joint. The Contracting Officer will determine whether cracks extend full depth of the pavement and may require minimum 150 mm diameter cores to be drilled on the crack to determine depth of cracking. Cores shall be drilled and the hole later filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin. Drilling of cores and refilling holes shall be at no expense to the Government. Cracks that do not extend full depth of slab shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1. The Contractor shall ensure that the crack is not widened during epoxy resin injection. Where a full depth crack intersects the original transverse joint, the slab(s) containing the crack shall be removed and replaced, with dowels installed, as required below. Spalls along joints shall be repaired as specified.

### 3.8.1 Removal and Replacement of Full Slabs

Unless there are keys or dowels present, all edges of the slab shall be sawcut full depth. If keys, dowels, or tie bars are present along any edges, these edges shall be sawed full depth 150 mm from the edge if only keys are present, or just beyond the end of dowels or tie bars if they are present. These joints shall then be carefully sawed on the joint line to within 25 mm of the depth of the dowel or key. The main slab shall be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. The narrow strips along keyed or doweled edges shall be carefully broken up and removed. Care shall be taken to prevent damage to the dowels, tie bars, or keys or to concrete to remain in place. Protruding portions of dowels shall be painted and lightly oiled. The joint face below keys or dowels shall be suitably trimmed so that there is no abrupt offset. If underbreak occurs at any point along any edge, the area shall be hand-filled with concrete, producing an even joint face from top to bottom, before replacing the removed slab. If underbreak over 100 mm deep occurs, the entire slab containing the underbreak shall be removed and replaced. Where there are no dowels, tie bars, or keys on an edge, or where they have been damaged, dowels of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete. Original damaged dowels or tie bars shall be cut off flush with the joint face. All four edges of the new slab shall thus contain dowels or original keys or original tie bars. Prior to placement of new concrete, the underlying

material shall be graded and recompact, and the surfaces of all four joint faces shall be cleaned of all loose material and contaminants, and coated with a double application of membrane forming curing compound as bond breaker. Placement of concrete shall be as specified for original construction. The resulting joints around the new slab shall be prepared and sealed as specified.

### 3.8.2 Repairing Spalls Along Joints

Spalls along joints and cracks shall be repaired by first making a vertical saw cut at least 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. The cavity shall be thoroughly cleaned with high pressure water jets supplemented with compressed air to remove all loose material. Immediately before filling the cavity, a prime coat shall be applied to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Prime coat for portland cement repairs shall be a neat cement grout and for epoxy resin repairs shall be epoxy resin, Type III, Grade 1. The cavity shall be filled with low slump portland cement concrete or mortar, or with epoxy resin concrete or mortar. Portland cement concrete shall be used for larger spalls, those more than 0.009 cubic meter in size after removal operations; portland cement mortar shall be used for spalls between 0.00085 and 0.009 cubic meter; and epoxy resin mortar or Type III, Grade 3 epoxy resin for those spalls less than 0.00085 cubic meter in size after removal operations. Portland cement concretes and mortars shall be very low slump mixtures, proportioned, mixed, placed, tamped, and cured. Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, using proportions, mixing, placing, tamping and curing procedures as recommended by the manufacturer. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens. Where the spalled area abuts a joint, an insert or other bond-breaking medium shall be used to prevent bond at the joint face. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints.

### 3.8.3 Areas Defective in Plan Grade or Smoothness

In areas not meeting the specified limits for surface smoothness and plan grade, high areas shall be reduced to attain the required smoothness and grade, except as depth is limited below. High areas shall be reduced by grinding the hardened concrete with a surface grinding machine after the concrete is 14 days or more old. The depth of grinding shall not exceed 6 mm. All pavement areas requiring plan grade or surface smoothness corrections in excess of the specified limits, shall be removed and replaced. In pavement areas given a wire comb or tined texture, areas exceeding 2 square meters that have been corrected by rubbing or grinding shall be retextured by grooving machine sawn grooves meeting the requirements for the wire comb or tined texture. All areas in which grinding has been performed will be subject to the thickness tolerances specified in paragraph Thickness. Any grinding performed on individual slabs with excessive deficiencies shall be performed at the Contractor's own decision without entitlement to additional compensation if eventual removal of the slab is required.

### 3.9 EXISTING CONCRETE PAVEMENT REMOVAL AND REPAIR

Existing concrete pavement shall be removed as indicated and as specified

in Section 02220 DEMOLITION modified, and expanded as specified herein. Removal, repair and replacement shall be made as indicated and as specified in paragraph REPAIR, REMOVAL, AND REPLACEMENT OR SLABS.

### 3.10 PAVEMENT PROTECTION

The Contractor shall protect the pavement against all damage prior to final acceptance of the work. Traffic shall be excluded from the new pavement. As a construction expedient in paving intermediate lanes between newly paved pilot lanes, operation of the hauling equipment will be permitted on the new pavement after the pavement has been cured for 7 days and the joints have been sealed or otherwise protected. All new and existing pavement carrying construction traffic or equipment shall be continuously kept completely clean. Special cleaning and care shall be used where Contractor's traffic uses or crosses active airfield pavement.

### 3.11 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL (CQC)

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and submit reports as specified. When, in the opinion of the Contracting Officer, the paving operation is out of control, concrete placement shall cease.

#### 3.11.1 Batch Plant Control

A daily report shall be prepared indicating checks made for scale accuracy with test weights, checks of batching accuracy, and corrective action taken prior to and during placement for weighing or batching, type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water masses per cubic 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.

#### 3.11.2 Concrete Mixture

- a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two other tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of paving. Whenever air content reaches specified limits, an immediate confirmatory test shall be made. If the second test also shows air content at or exceeding specified limits, an adjustment shall immediately be made in the amount of air-entraining admixture batched to bring air content within specified limits. If the next adjusted batch of concrete is not within specified limits, concrete placement shall be halted until concrete air content is within specified limits.
- b. Slump Testing. Slump tests shall be made when test specimens are fabricated. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Whenever slump approaches the maximum limit, an adjustment shall immediately be made in the batch masses of water and fine aggregate, without exceeding the maximum  $w/(c+p)$ . When a slump result exceeds the specification limit, no further concrete shall be delivered to the paving site until adjustments have been made and slump is again within the limit.

- c. Temperature. The temperature of the concrete shall be measured when strength specimens are fabricated.

### ~~3.11.3 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; test them in accordance with ASTM C 39.~~
- ~~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 90 day flexural strength using the Correlation Ratio determined during mixture proportioning studies.~~
- ~~d. Compare the equivalent 90 day flexural strength from the conversion to the Average Flexural Strength Required for Mixtures from paragraph of same title.~~
- ~~e. If the equivalent average 90 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 90 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 90 day equivalent flexural strength of each of these for each lot.~~

### 3.11.3 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 beams in accordance with ASTM C 31/C 31M; test them in accordance with ASTM C 78.
- b. Fabricate and cure 2 test beams per subplot from the same batch or truckload and at the same time acceptance beams are fabricated and test them for flexural strength at 7-day age.
- c. Average all 8 14-day flexural tests per lot.
- d. Compare the 14-day flexural strength to the Average Flexural

Strength Required for Mixtures from paragraph of same title.

- e. If the average 14-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 average 14-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 flexural strength, the 14-day flexural strength (from acceptance tests) and the 7, 14 and 90-day equivalent flexural strength results of each lot.

#### 3.11.4 Inspection Before Placing

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

#### 3.11.5 Paving Operations

The placing foreman shall supervise all placing and paving operations, shall determine that the correct quality of concrete is placed in each location as shown, shall insure that the concrete is consolidated full depth and that finishing is performed as specified. The placing foreman shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume of concrete placed, and method of paving and any problems encountered.

#### 3.11.6 Curing Inspection

- a. Moist Curing Inspections. Each day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded. When any inspection finds an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for the area shall be extended by 1 day.
- b. Membrane Curing Inspection. At the end of each day's placement, the CQC Representative shall determine the quantity of compound used by measurement of the container; shall determine the area of concrete surface covered; shall then compute the rate of coverage in square meters per L and shall also note whether or not coverage is uniform. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

#### 3.11.7 Cold-Weather Protection

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

#### 3.11.8 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report, signed by a registered engineer, shall be prepared for the updating of control charts and test data, and all CQC inspections and actions covering the entire period from the start of the construction through the current week. Reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all CQC records. A copy of weekly reports shall be faxed to the Design District Pavement or Geotechnical Engineer. At the completion of concrete placement, a certification report shall be prepared containing mix designs, all updated control charts and concrete test data, quality control reports, smoothness reports, and other pertinent data on the concrete, with a certification by a registered engineer that the concrete placed meets all specification requirements. A copy of the certification report shall be mailed to the Design District pavement or Geotechnical Engineer.

-- End of Section --

SECTION 02960

PLANTING OF TREES, SHRUBS, AND VINES

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z60.1 (1990) Nursery Stock

AMERICAN JOINT COMMITTEE ON HORTICULTURAL NOMENCLATURE (AJCHN)

AJCHN-01 (1942, 2nd Ed.) Standard Plant Names

ASSOCIATION OF OFFICIAL ANALYTICAL CHEMISTS (AOAC)

AOAC-01 Official Methods of Analysis

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1909 (Basic; Notice 1) Fertilizer

TEXAS DEPARTMENT OF TRANSPORTATION (TxDOT)

TxDOT-01 (1995) Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

1.2 SUBMITTALS

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

SD-06 Instructions

~~[AM#002]Surface Erosion Control Material~~ Jute Mesh; FIO.

Manufacturer's literature including physical characteristics, and application and installation instructions.

SD-09 Reports

Peat Mulch; FIO.

Certified copies of the analysis of each type of peat mulch used in the project, made by an approved, independent, recognized laboratory in accordance with the current method of the AOAC-01. Testing shall be at the

Contractor's expense. Testing shall be submitted for approval of the Contracting Officer before delivery of the peat.

SD-13 Certificates

The certificates listed below shall be submitted for approval prior to commencement of work:

Fertilizer; FIO.

One certificate for each type to be used in the project.

Soil Amendments; FIO.

Certificates for each type of soil amendment.

Peat Mulch; FIO.

Certificates for each type of peat mulch shall be submitted to the Contracting Officer showing type, percent of organic matter, origin, and the amount to be utilized on the project.

Steel Edging; FIO

Woodbark Mulch; FIO.

Certificates shall list all information on the container label and the amounts of each type to be used on the project.

SD-18 Records

Plant Material; FIO.

All necessary inspection certificates shall accompany the invoice for each shipment or order of stock, as may be required by law for the necessary transportation, and such certificates shall be filed with the Contracting Officer prior to acceptance of the materials.

1.3 INSPECTION

1.3.1 Plant Materials

All shipments or orders of plant material shall be properly inspected at the nursery or at the site by the Authorized Federal and State authorities.

1.3.2 Topsoil

Off base sources of topsoil shall be inspected to determine the acceptability of the topsoil, including the maximum depth to which it is to be stripped.

1.4 DIGGING UP, WRAPPING, HANDLING AND DELIVERY

1.4.1 Container-Grown Plants

Container-grown plants, designated "C" in the list of required plants, shall have been grown in cans. Plants shall have sufficient roots to hold earth together intact after removal from containers without being rootbound.

#### 1.4.2 Shipment and Delivery

The Contractor shall promptly notify the Contracting Officer, in advance, when the plant material will be delivered and the manner of shipment. The Contractor shall furnish an itemized list, in duplicate, of the actual quantity of plant material in each delivery, in order to insure satisfactory coordination of delivery and to expedite the required inspection at the point of delivery. The itemized list of the plant material for each delivery shall include the pertinent data as specified in the list of required plants. This list and the necessary inspection certificates to accompany each plant or shipment shall be delivered to the Contracting Officer, prior to acceptance and planting of the plant material.

##### 1.4.2.1 Protection During Delivery

Plants shall be protected during delivery to prevent damage to the root balls or desiccation of leaves. Trees shall be protected during transportation by tying in the branches and covering all exposed branches. When shipment is made by truck, all plant material shall be packed to provide adequate protection against climatic, seasonal, and breakage injuries during transit. The tops shall be securely covered with tarpaulin or canvas to minimize wind-whipping and drying. When shipment is made by rail, box cars shall be carefully packed and adequately ventilated to prevent sweating of the plants during transit. Shipments made by rail to local or nearby freight yards shall be given special attention to insure prompt delivery and careful handling therefrom to the point of final delivery at the planting jobsite. Under no circumstances shall balled plants be dropped from box cars or trucks to the ground. A suitable method of handling shall be employed to preclude cracked or mushroomed plant balls at the point of delivery.

##### 1.4.2.2 Inspection Upon Arrival

Plant material shall be inspected upon arrival at the jobsite. Unacceptable plant material shall be removed from the jobsite.

##### 1.4.2.3 Commercial Fertilizer

Commercial fertilizer shall be delivered to the site in unopened original containers, each fully labeled, conforming to the applicable State fertilizer laws and bearing the trade name or trademark and warranty of the producer. Each sack shall bear the manufacturer's statement of analysis, indicating the percentages of available nitrogen, available phosphoric acid, and potash.

##### 1.4.2.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis and name. In lieu of containers, soil amendments may be furnished in bulk and a certificate from the manufacturer indicating the above information shall accompany each delivery.

##### 1.4.2.5 Mulch

Peat shall be delivered to the jobsite in unopened bags or in unbroken bales. Woodbark shall be delivered to the site in unopened containers and shall be fully labeled.

### 1.4.3 Protection Against Freezing and Drying Out

#### 1.4.3.1 Plant Storage

Care shall be taken to avoid drying or damaging plants being moved from the nursery or storage area to the planting site. All plants shall be handled so that roots are adequately protected at all times from drying out and from other injury. Balled and burlapped plants shall be handled carefully to avoid cracking or breaking the earth ball. The balls of balled plants that cannot be planted immediately on delivery shall be well protected with soil or other acceptable material. The Contractor shall safeguard the unplanted plants during freezing weather by inside storage and other precautionary measures. Bare root plants shall be heeled out with roots completely covered with wet soil or other approved material immediately upon delivery.

#### 1.4.3.2 Storage of Other Materials

Soil amendments shall be kept in dry storage away from contaminants. Storage of materials shall be in areas designated or as approved by the Contracting Officer.

## 1.5 Warranty

Furnished plant material shall have a warranty for plant growth to be in a vigorous growing condition for a minimum 12 month period. A minimum 12 month calendar time period for the warranty of plant growth shall be provided regardless of the contract period. When plant material is determined to be unhealthy in accordance with paragraph REPLACEMENT, it shall be replaced under this warranty at no additional cost to the Government.

## PART 2 PRODUCTS

### 2.1 PLANTS REQUIRED

The species (scientific and common names), size, and manner in which to be furnished, are given in the plant list shown on the drawings.

#### 2.1.1 Substitutions

Plants of kinds other than those named in plant list will not be accepted unless specifically approved in writing by the Contracting Officer. Proposed substitutes, in each case, must possess the same essential characteristics as the kind of plant actually specified in regard to appearance, ultimate height, shape, habit of growth, general soil and other requirements. In no case shall the average cost and value of substituted plants be less than the cost and value of plants actually specified. Plants of greater value may be accepted without additional cost to the Government.

### 2.2 PLANT MATERIALS

All plant material furnished shall be nursery-grown, well branched, full-foliaged, and well proportioned, particularly with respect to the width-height relationship, and shall have a fibrous root system. The Government may inspect plants at place of growth, but such inspection shall

not preclude the right of rejection at the site.

#### 2.2.1 Nomenclature

The scientific and common names of plants herein specified or shown on the drawings conform with the approved names given in AJCHN-01, Standard Plant Names, except that where local usage does not follow this standard, the accepted local names are given in parentheses.

#### 2.2.2 Plant Material Labels

For the purpose of inspection and plant identification, durable, legible labels stating in weather-resistant ink the correct plant name and size, as specified in the list of required plants, shall be securely attached to all plants, bundles, and containers of plant material delivered at the planting site.

#### 2.2.3 Quality and Size

Quality and size of plants shall be in accordance with rules and grading adopted by the American Association of Nurserymen, Inc., and included in ANSI Z60.1. All plants shall be of excellent quality and have a normal habit of growth and shall be sound, healthy, vigorous, and free from disease and insect infestations, and damage. Trees shall have single straight trunks unless otherwise specified. Any tree with weak thin trunk not capable of supporting itself when planted in the open will not be accepted. The minimum acceptable sizes of all plants, measured before pruning, with branches in normal position, shall conform to the measurements specified hereinafter in the list of required plants. Plants larger in size than specified may be used with the approval of the Contracting Officer, but the use of larger plants will make no change in contract price. If the use of larger plants is approved, the ball of earth or spread of roots shall be increased proportionately.

#### 2.3 STEEL EDGING

[AM#002] Galvanized Steel edging shall be [AM#002] 1/8-inch thick, green-painted finish 7 mm to 8 mm thick, 12 mm in width. Edging shall be secured with 500 mm by 50 mm galvanized stakes placed 600 mm on center. Stake shall be bolted to edging with two (2) 8 mm stainless steel bolts and locknuts with nylon insert..

#### 2.4 BURLAP

Burlap shall be made of jute and shall weigh not less than 255 ml per square meter. Substitute cloth shall possess an equal strength and resistance to tearing.

#### 2.5 COMMERCIAL FERTILIZER

Fertilizer shall be commercial grade, free flowing, uniform in composition and conforming to CID A-A-1909.

##### 2.5.1 Dry Fertilizer

###### a. Controlled-Release Fertilizer

Consists of nitrogen-phosphorous-potassium ratio: 20 percent nitrogen 10 percent phosphorous, and 5 percent potassium. Controlled-release

fertilizer may be in packet or tablet form.

#### 2.5.2 Liquid Fertilizer

Commercially available liquid fertilizer shall consist of completely soluble plant foods suitable for application as foliage spray.

### 2.6 SOIL AMENDMENTS

#### 2.6.1 Sulphur

Sulphur shall be finely ground, raw, agricultural grade, with a purity of at least 98 percent.

#### 2.6.2 Iron Sulphate

Iron sulphate shall be the fine salt form of the chemical  $\text{FeSO}_4$ , free of lumps, suitable for uniform mixing with soil.

#### 2.7 GRAVEL

Gravel shall be common stone, 800 to 100 mm in size and conform to TxDOT [AM#002]-01 Item 432.3.1. Colors as indicated on Drawings.

#### 2.8 MULCH

Mulch shall consist of materials as specified below:

a. [AM#002]PeatRecycled Compost

[AM#002]Peat shall be natural product of sphagnum moss or sedge peat, taken from a fresh water site. Peat shall be free of lumps, roots, and stones or other foreign matter, and of such physical condition that the peat can be passed through a 13 mm mesh screen and can be readily incorporated with the topsoil. Peat shall have been conditioned in storage piles after excavation for at least 6 months, including one freezing and thawing period or processed with a dehydrator. Peat shall contain not less than 70 percent organic matter by weight on an oven-dry basis. Compost shall be a well decomposed, stable, weed free organic matter source. Compost shall be derived from food; agricultural or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 10 mm screen possess a pH of 5.5 to 8.0, and have a moisture content between 35 to 55 percent by weight. The material shall not contain more than 1 percent by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 50 mm in length.

b. Woodbark

At the Contractor's option, woodbark may be used as mulch. Woodbark shall be a natural product of pine bark. The bark shall be manufactured for the use of plant mulch and shall be free from weed, seed, soil, plant diseases and insects.

#### 2.9 TOPSOIL

Topsoil shall be obtained from stock piled material located on site or

approved off-post sources. The topsoil source shall be inspected by the Contracting Officer to determine if the selected soils meet the following requirements. The topsoil shall be stripped from the top 100 mm to 150 mm surface layer of soil. Topsoil shall be fertile, friable, natural surface soil, free of subsoil, clods, shale, trash, toxic substances, stones 50 mm in maximum dimension or larger, Bermudagrass, Johnsongrass, nutgrass (Cyperus rotundus), or other objectionable and hard to eradicate weeds or grasses.

#### 2.10 WATER

Water shall be kept free from oil, acids, alkali, salt, and other substances harmful to the growth of plants. The source of water and service outlets used shall be subject to approval of the Contracting Officer.

#### 2.11 [AM#002]JUTE MESH

Net shall be heavy, twisted jute mesh, weighing approximately 605 grams per meter and 1 200 mm wide with mesh openings of approximately 25 mm square.

#### 2.12 FILTER FABRIC

Type 1 standard weight as described in TxDOT Item DMS-6200.

### PART 3 EXECUTION

#### 3.1 PLANTING SEASON

1 January to 15 March. Planting of shrubs for all phases of this contract shall be accomplished within that period. Actual planting shall be performed during the specified periods only when weather and soil conditions are suitable and in accordance with locally accepted practice, as approved by the Contracting Officer. Deviation from the planting dates will be permitted only when approved in writing by the Contracting Officer.

#### 3.2 OBSTRUCTIONS BELOW GROUND

Any rock or other underground obstruction shall be removed to the depth necessary to permit proper planting, according to plans and specifications.

If underground construction, obstructions, or rock are encountered in excavation of planting areas, other locations for the planting may be selected by the Contracting Officer. Explosives may be used for removal of rock or oil foundation structures only where and as expressly approved by the Contracting Officer. The Contractor shall familiarize himself with all existing underground utility locations and shall avoid damaging them during planting operations. The Contractor shall repair at his own expense any damage to existing utilities and such repairs shall be in a manner directed by the Contracting Officer.

#### 3.3 PLANTING OPERATIONS

##### 3.3.1 Layout of Major Planting

Locations for plants and outlines of areas to be planted shall be marked on the ground by the Contractor and approved by the Contracting Officer before any excavation is made. No shrubs shall be planted less than from a building unless specifically indicated on the drawings or designated by the

Contracting Officer. In the event obstructions are encountered which prevent planting as indicated, the plant or plants will be planted in a new location, as directed by the Contracting Officer.

### 3.3.2 Protection of Planting Areas

Before excavations are made, precautionary measures shall be taken to protect all turfed areas that are to be trucked over and upon which soil is to be temporarily stacked pending removal or reuse of the soil for the filling of holes, pits, and beds. Existing trees, shrubbery, and beds that are to be preserved shall be barricaded in a manner to afford effective protection during planting operations.

### 3.3.3 Excavation for Planting

Excavation for planting shall include the stripping and stacking of all acceptable topsoil encountered within the areas to be excavated for trenches, plant pits, and planting beds. Most of the excavated material will not be acceptable for backfill. Except as otherwise indicated, excavations of trenches, tree holes and plant pits shall extend to the required subgrades as indicated on the drawings but in no case shall be less than as specified. Plant pits shall be circular in outline and shall have vertical sides and flat bottoms, or may be machine dug in a square shape with vertical sides and flat bottoms provided the minimum width of square pits is as great as the diameter for the circular pits. The minimum depths of plant pits shown on the drawings shall be measured from finished grade. Planting beds in which ground cover or similar planting are indicated shall be excavated to the depth shown on the drawings and as required to eliminate Bermudagrass, Johnsongrass, nutgrass (*Cyperus rotundus*) or similar objectionable vegetation which would seriously compete with the plantings. In the event such vegetation is present, the surface soil shall be stripped to a depth of 150 mm to 305 mm, as required to eliminate underground rootstalks or rhizomes.

### 3.3.4 Preparation of Planting Beds (PB)

#### 3.3.4.1 Preparation (For Use Without Planters)

The planting beds for ground cover, outlines of which are shown on the Drawings, shall be excavated to a depth of 380 mm. The acceptable topsoil which is free of noxious plants shall be stockpiled and used as backfilled material. Unacceptable excavated soil shall be disposed of as directed by the Contracting Officer. During excavation operations, all roots, stones, grade stakes or other objects 50 mm in maximum dimension or larger shall be removed from beds and disposed of as directed by the Contracting Officer. Plants to be planted in plant beds are indicated by PB in the legend on the Drawings.

#### 3.3.4.2 Backfilling

The plant beds shall be backfilled with topsoil specified herein. [AM#002] Wet peat Recycle compost shall then be spread uniformly over the bed to a depth of 150 mm, and shall be mixed and incorporated into the soil to a depth of 230 mm using a roto-tiller or similar type of equipment to obtain a uniform and well pulverized soil mix. During tillage operations, all roots, stones, stakes, or other objectionable objects shall be removed from the beds and disposed of as directed. Beds shall be brought to a smooth even surface conforming to established grades and the details shown on the drawings after full settlement has occurred. The mixed soil in the beds

shall be moist at the time the plants are set.

### 3.3.5 Disposal of Excess Soil

Acceptable excess excavated topsoil shall be wasted uniformly over nearby low or rough lawn areas, or otherwise disposed of as approved by the Contracting Officer. Excess soils not required or not suitable for above usage shall be disposed of on or off the reservation as directed by the Contracting Officer, within 24 hours following excavation.

### 3.3.6 Setting Plants

Except as otherwise specified, plants shall be planted in pits and shall be set at the level shown in the details on the drawings. Plants shall be planted in approved topsoil, as specified herein, which shall be thoroughly settled by watering and tamping. To compensate for shrinkage, the finished grade of topsoil prior to watering shall be fixed at an elevation 10 percent of the fill depth higher than the desired finished grade, unless otherwise directed by the Contracting Officer. To facilitate watering, each plant shall be set approximately 50 mm below the grade of the existing ground surface to form a saucer as shown on the drawings.

#### 3.3.6.1 Balled Plants

Plants shall be placed in the plant pit, and the topsoil shall be tamped to fill all voids under the base and around the ball to a height of one-half the depth of the ball.

#### 3.3.6.2 Container-Grown Plants

Containers shall be opened, and the plants carefully removed so that the earth around the roots of the plants remains unbroken. Plants shall then be planted in the same manner as balled plants.

### 3.3.7 Steel Edging

Install where shown on Drawings in accordance with manufacturer's instructions.

### 3.3.8 Mulching

After planting and application of fertilizer, plants shall be mulched with a layer of wet mulch material covering the entire saucer area around each plant to a depth of 50 mm.

### 3.3.9 ~~[AM#002]Surface Erosion Control Material~~ Jute Mesh

~~[AM#002]Surface erosion control material~~ Jute mesh shall be installed in accordance with manufacturer's instructions. Placement of material shall be accomplished without damage to installed material or without deviation to finish grade.

### 3.3.10 Gravel

Installation shall conform to TxDOT-01 Item 432.4.2.c stone riprap (common).

### 3.3.11 Filter Fabric

Filter fabric shall be installed in accordance with manufacturer's

instructions.

### 3.4 MAINTENANCE OPERATIONS

Maintenance operations shall begin immediately after each plant is planted and shall continue for a period of 365 calendar days after the last plant of the original planting is planted, mulched, and staked, where applicable and until all landscaping work under this contract is completed and accepted. Plants shall be kept in a healthy growing condition by watering, pruning, spraying, weeding, cultivating, and by any other necessary operations of maintenance. Plant saucers and planting beds shall be kept free of weeds, grass, and other undesired vegetative growth. Plants shall be inspected at least weekly by the Contractor during the maintenance period and necessary work shall be promptly performed. Watering will be required when, in the opinion of the Contracting Officer, the soil moisture is below optimum level for best plant growth. Weekly watering will be required when, in the opinion of the Contractor Officer, the soil moisture is below optimum level for best plant growth. Weekly watering will normally be required during dry weather. Immediately after all plants have been planted and staked, fertilizer and soil amendments specified hereinbefore shall be centrally mixed in a manner approved by the Contracting Officer, using the following proportions:

9 parts of fertilizer.

3 parts of soil sulphur.

1 part of iron sulfate.

In the course of mixing operations, any lumps larger than 13 mm in diameter shall be broken up and when uniformly mixed the material shall be uniformly distributed over the surface of planting pits and beds in the manner described below at the following areas:

Shrubs 0.23 kg

Plant beds per 10 sq. meter 1.00 kg

Fertilizer application shall be accomplished as follows: Fertilizer and soil amendments shall be applied at the specified rates over the planting beds and pits. Fertilizer shall not be applied closer than 150 mm to trunks of trees and stems of shrubs. Any fertilizer on the foliage of plants shall be washed off immediately following application. Following the application of fertilizer and soil amendments, the peat shall be applied as specified over the saucers, and beds and incorporated by forking with the top 50 mm of soil. The pits and beds, shall then be watered with sufficient water to wet the entire root structure of the plants.

### 3.5 REPLACEMENT

During the planting period, plants that die or are, in the opinion of the Contracting Officer, in an unhealthy, unsightly, or impaired condition, shall be replaced by the Contractor prior to the commencement of the maintenance period. Three days prior to the conclusion of the maintenance period, the Contracting Officer and the Contractor will make an inspection of the work to determine condition of all plants. All plants that are dead or not in a healthy growing condition, as determined by the Contracting Officer, will be noted. All plants noted to be unhealthy, unsightly, or damaged, shall be removed from the site and replaced with healthy plants of

the same kinds and sizes as originally specified during the period 180 days. Such replacements shall be made in the same manner as specified for the original planting, except all trees shall be balled-and-burlapped, and at no extra cost to the Government. Maintenance of the replacements will be by the Government after the original maintenance period.

-- End of Section --