
USACE / NAVFAC / AFCEA / NASA UFGS-32 01 28 (April 2006)

Preparing Activity: USACE Replacing without change
UFGS-02980 (March 2005)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMLR dated 18 July 2006

Latest change indicated by CHG tags

SECTION TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 01 28

PATCHING OF RIGID PAVEMENTS

04/06

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 UNIT PRICES
 - 1.2.1 Measurement
 - 1.2.1.1 Concrete
 - 1.2.1.2 Portland Cement
 - 1.2.1.3 Epoxy-Resin Grout
 - 1.2.2 Payment
 - 1.2.2.1 Concrete
 - 1.2.2.2 Portland Cement
 - 1.2.2.3 Epoxy-Resin Grout
- 1.3 SUBMITTALS
- 1.4 MIX DESIGN
- 1.5 EQUIPMENT; APPROVAL AND MAINTENANCE
- 1.6 SAMPLING AND LABORATORY TESTING OF MATERIALS
 - 1.6.1 Cement
 - 1.6.2 Aggregate
 - 1.6.3 Joint-Sealing Materials
 - 1.6.4 Epoxy-Resin Grout
- 1.7 DELIVERY AND STORAGE OF MATERIALS
 - 1.7.1 Cement
 - 1.7.2 Aggregates
 - 1.7.3 Epoxy-Resin Grout
 - 1.7.4 Jet-Fuel Resistant Sealing Material
- 1.8 WEATHER LIMITATIONS

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Coarse Aggregate
 - 2.1.1.1 Composition
 - 2.1.1.2 Quality
 - 2.1.1.3 Particle Shape

- 2.1.1.4 Size and Grading
- 2.1.2 Fine Aggregate
 - 2.1.2.1 Composition
 - 2.1.2.2 Particle Shape
 - 2.1.2.3 Grading
- 2.1.3 Air-Entraining Admixture
- 2.1.4 Cement
- 2.1.5 Curing Materials
 - 2.1.5.1 Burlap
 - 2.1.5.2 Curing Compound
 - 2.1.5.3 Waterproof Blanket Materials
- 2.1.6 Epoxy-Resin Grout
- 2.1.7 Joint-Sealing Materials
 - 2.1.7.1 Jet-Fuel Resistant
 - 2.1.7.2 Non Jet-Fuel Resistant
- 2.1.8 Water

PART 3 EXECUTION

- 3.1 CONDITIONING OF EXISTING PAVEMENT
 - 3.1.1 Preparation of Existing Surfaces
 - 3.1.2 Preparation of Joints
 - 3.1.3 Bonding Course
 - 3.1.3.1 Mixing Epoxy-Resin Grout Components
 - 3.1.3.2 Tools and Equipment
 - 3.1.3.3 Health and Safety Precautions
- 3.2 BATCHING, MIXING AND PROPORTIONING
 - 3.2.1 Equipment
 - 3.2.2 Conveying
 - 3.2.3 Facilities for Sampling
 - 3.2.4 Mix Proportions
 - 3.2.5 Measurement
 - 3.2.6 Workability
- 3.3 PLACING
- 3.4 FIELD TEST SPECIMENS
 - 3.4.1 General
 - 3.4.2 Specimens for Strength Tests
- 3.5 FINISHING
- 3.6 CURING
 - 3.6.1 General
 - 3.6.2 Burlap Curing
 - 3.6.2.1 Waterproof-Paper Blankets or Impermeable Sheets
 - 3.6.2.2 Membrane-Forming Curing Compound
- 3.7 FINISH TOLERANCE
- 3.8 PAVEMENT PROTECTION
- 3.9 JOINTS

-- End of Section Table of Contents --

USACE / NAVFAC / AFCEA / NASA UFGS-32 01 28 (April 2006)

Preparing Activity: USACE Replacing without change
UFGS-02980 (March 2005)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 18 July 2006

Latest change indicated by CHG tags

SECTION 32 01 28

PATCHING OF RIGID PAVEMENTS 04/06

NOTE: This guide specification covers the requirements for patching of rigid pavements.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically
be deleted from this section of the project
specification when you choose to reconcile
references in the publish print process.

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 182 (2005) Burlap Cloth Made from Jute or Kenaf

ASTM INTERNATIONAL (ASTM)

ASTM C 136 (2005) Sieve Analysis of Fine and Coarse
Aggregates

ASTM C 143/C 143M (2005a) Slump of Hydraulic Cement Concrete

ASTM C 150 (2005) Portland Cement

ASTM C 171 (2003) Sheet Materials for Curing Concrete

ASTM C 173/C 173M (2001e1) Air Content of Freshly Mixed
Concrete by the Volumetric Method

ASTM C 192/C 192M (2005) Making and Curing Concrete Test
Specimens in the Laboratory

ASTM C 231 (2004) Air Content of Freshly Mixed
Concrete by the Pressure Method

ASTM C 260 (2001) Air-Entraining Admixtures for
Concrete

ASTM C 31/C 31M (2003a) Making and Curing Concrete Test
Specimens in the Field

ASTM C 78 (2002) Flexural Strength of Concrete
(Using Simple Beam With Third-Point
Loading)

ASTM C 881/C 881M (2002) Epoxy-Resin-Base Bonding Systems
for Concrete

ASTM D 1854 (2002) Jet-Fuel-Resistant Concrete Joint
Sealer, Hot-Applied Elastic Type

ASTM D 3569 (1995; R 2000) Joint Sealant, Hot-Applied,
Elastomeric, Jet-Fuel-Resistant-Type for
Portland Cement Concrete Pavements

ASTM D 75 (2003) Sampling Aggregates

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete

1.2 UNIT PRICES

NOTE: When lump-sum payment is used, this paragraph
will be deleted. If patching is a separate pay
item, the paragraph will be revised accordingly.

1.2.1 Measurement

1.2.1.1 Concrete

The quantity of concrete to be paid for will be the number of square **meters** **feet** placed in the completed and accepted patched areas.

1.2.1.2 Portland Cement

The quantity of portland cement to be paid for will be the number of **kilogram units** (**45 kilogram units**) **hundredweight** (**100 pound units**) of portland cement actually used in the completed and accepted patched areas. No payment will be made for wasted cement nor for cement used for the convenience of the Contractor. The quantity to be paid for will be determined by multiplying the weight of portland cement used in the various approved concrete mixtures by the number of batches of the various concrete mixtures placed within the completed and accepted patched areas and dividing by 100.

1.2.1.3 Epoxy-Resin Grout

The quantity of epoxy-resin grout material to be paid for will be the number of **kilograms** **pounds**, net weight, actually used in the completed and accepted patched areas, except that wasted epoxy-resin grout will not be measured for payment.

1.2.2 Payment

1.2.2.1 Concrete

The quantity of concrete, measured as specified, will be paid for at the contract unit price. The unit price for concrete will include full compensate for furnishing labor; materials, except cement and epoxy-resin grout; tools and equipment; and for performing work involved in patching the pavements as specified.

1.2.2.2 Portland Cement

The quantity of portland cement determined as specified will be paid for at the contract unit price, which price will include all costs of demurrage,

unloading, hauling, handling, and storage at the site.

1.2.2.3 Epoxy-Resin Grout

The quantity of epoxy-resin grout determined as specified will be paid for at the contract unit price, which price will include all costs of handling, hauling, storage at the site, labor, materials, tools and equipment, and for performing work involved in placing epoxy-resin grout on the surface of the existing pavement to be patched.

1.3 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mix Design[; G][; G, [____]]

Three copies of the proposed mix design, prior to placement.
The mix design shall indicate the weight of each ingredient of the

mixture. No concrete shall be placed prior to approval of the proposed mix design. No deviation from the approved job-mix formula will be permitted without prior approval.

SD-06 Test Reports

Test Results[; G][; G, [____]]

[Three] [____] copies of test results, within [24] [____] hours of physical completion of laboratory testing. Manufacturer's certifications may be submitted rather than laboratory test results for proposed materials. Certificates should certify compliance with the appropriate specification referenced herein. No materials shall be placed without prior approval from the Contracting Officer.

1.4 MIX DESIGN

The concrete mixtures shall be designed to produce concrete having an average flexural strength of [____] kPa psi at 28 days of age, determined in conformance with ASTM C 78, using standard 150 x 150 mm 6 x 6 inch beam specimens. The concrete mixtures shall be designed to secure an air content by volume of [____] percent, plus or minus 1-1/2 percent, based on measurements made on concrete immediately after discharge from the mixer in conformance with ASTM C 231. Mix design studies and tests shall be made in accordance with ASTM C 78 and ASTM C 192/C 192M, and the test results submitted for approval.

1.5 EQUIPMENT; APPROVAL AND MAINTENANCE

Dependable and sufficient equipment that is appropriate and adequate to accomplish the work specified shall be assembled at the site of the work a sufficient time before the start of paving to permit thorough inspection, calibration of weighing and measuring devices, adjustment of parts, and the making of any repairs that may be required. The equipment shall be maintained in good working condition.

1.6 SAMPLING AND LABORATORY TESTING OF MATERIALS

**NOTE: Guidance for preparation of criteria to be
used in inspection of laboratory facilities is
contained in NIST IR 91-4576.**

Sampling and testing shall be performed by an approved commercial laboratory or by the Contractor subject to approval. Should the Contractor elect to establish testing facilities, no work requiring testing shall be permitted until the Contractor's facilities have been inspected and approved. The first laboratory inspection shall be at the expense of the Government and the cost of any subsequent inspection resulting from failure of the first inspection shall be at the expense of the Contractor. Such costs shall be deducted from the total amount due the Contractor. All testing shall be performed at no additional cost to the Government.

1.6.1 Cement

Cement shall be tested as prescribed in the referenced specification under which it is furnished. Cement may be accepted on the basis of mill tests

and the manufacturer's certification of compliance with the specification, provided the cement is the product of a mill with a record for the production of high-quality cement for the past 3 years.

1.6.2 Aggregate

Aggregate samples for laboratory testing shall be taken in conformance with [ASTM D 75](#) and tested in accordance with [ASTM C 136](#).

1.6.3 Joint-Sealing Materials

Joint-sealing materials shall be tested for conformance with the referenced applicable material specification.

1.6.4 Epoxy-Resin Grout

Epoxy-resin grout shall be tested for conformance with [ASTM C 881/C 881M](#).

1.7 DELIVERY AND STORAGE OF MATERIALS

1.7.1 Cement

Cement may be furnished in bulk or in suitable bags used for packaging cements and shall be stored in a manner to prevent absorption of moisture.

1.7.2 Aggregates

Aggregates shall be handled and stored in a manner to avoid breakage, segregation, or contamination by foreign materials.

1.7.3 Epoxy-Resin Grout

Epoxy-resin grout shall be delivered to the site in such manner as to avoid damage or loss. Storage areas shall be in a windowless and weatherproof, but ventilated, insulated noncombustible building, with provision nearby for conditioning the material to [20 degrees C](#) [70 degrees F](#) to [30 degrees C](#) [85 degrees F](#) for a period of 48 hours prior to use. The ambient temperature in the storage area of the epoxy materials shall at no time be higher than [40 degrees C](#) [100 degrees F](#).

1.7.4 Jet-Fuel Resistant Sealing Material

Jet-fuel-resistant sealing material shall be stored out of the weather, away from direct sunlight, and at temperatures not less than [15 degrees C](#) [60 degrees F](#) nor more than [40 degrees C](#) [100 degrees F](#).

1.8 WEATHER LIMITATIONS

Concrete shall not be placed when weather conditions detrimentally affect the quality of the finished product. No concrete shall be placed when the air temperature is below [5 degrees C](#) [40 degrees F](#) in the shade. When air temperature is likely to exceed [35 degrees C](#) [90 degrees F](#), the concrete shall have a temperature not exceeding [35 degrees C](#) [90 degrees F](#) when deposited, and the surface of such placed concrete shall be kept damp with a water fog until the approved curing medium is applied.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Coarse Aggregate

2.1.1.1 Composition

Coarse aggregate shall consist of gravel, crushed gravel, crushed stone, or a combination thereof, or crushed blast-furnace slag.

2.1.1.2 Quality

Aggregate as delivered to the mixers shall consist of clean, hard, unweathered, and uncoated particles. Dust and other coatings shall be removed from the coarse aggregates by adequate washing.

2.1.1.3 Particle Shape

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

2.1.1.4 Size and Grading

The maximum nominal size of the coarse aggregate shall be 13 mm 1/2 inch. The coarse aggregate shall be well graded within the limits specified, and when tested in accordance with ASTM C 136, shall conform to the following grading requirements as delivered to the batching hoppers:

Sieve designation U.S. Standard square mesh	Percentage by weight passing individual sieves 4.75 mm to 12.5 mm
19.0 mm	100
12.5 mm	90-100
9.5 mm	40-70
4.75 mm	0-15
2.36 mm	0-5
Sieve designation U.S. Standard square mesh	Percentage by weight passing individual sieves No. 4 to 1/2 inch
3/4 inch	100
1/2 inch	90-100
3/8 inch	40-70
No. 4	0-15
No. 8	0-5

2.1.2 Fine Aggregate

2.1.2.1 Composition

Fine aggregate shall consist of either natural sand, manufactured sand, or a combination of natural and manufactured sand, and shall be composed of clean, hard, durable particles.

2.1.2.2 Particle Shape

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

2.1.2.3 Grading

Grading of the fine aggregate as delivered to the mixer shall conform to the following requirements when tested in accordance with [ASTM C 136](#).

Sieve designation U.S. Standard square mesh	Percentage by weight, passing
9.5 mm	100
4.75 mm	95-100
2.36 mm	80-90
1.18 mm	60-80
0.60 mm	30-60
0.30 mm	12-30
0.15 mm	2-10

Sieve designation U.S. Standard square mesh	Percentage by weight, passing
3/8 inch	100
No. 4	95-100
No. 8	80-90
No. 16	60-80
No. 30	30-60
No. 50	12-30
No. 100	2-10

In addition, the fine aggregate, as delivered to the mixer, shall have a fineness modulus of not less than 2.40 nor more than 2.90, when calculated in accordance with [COE CRD-C 104](#).

2.1.3 Air-Entraining Admixture

Air-entraining admixture shall conform to [ASTM C 260](#).

2.1.4 Cement

NOTE: The use of either Type I, Type II, or Type
III cement will be specified. Type III cement is a
premium product and will be specified only when a
short shutdown time is necessary.

Cement shall be portland cement conforming to [ASTM C 150](#), Type [_____].

2.1.5 Curing Materials

2.1.5.1 Burlap

Burlap shall conform to AASHTO M 182.

2.1.5.2 Curing Compound

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

2.1.5.3 Waterproof Blanket Materials

Waterproof blanket materials shall conform to ASTM C 171, Type optional, color white.

2.1.6 Epoxy-Resin Grout

Epoxy-resin grout shall be a two-component material formulated to meet the requirements of ASTM C 881/C 881M, Type I or II. Type I material shall be used when pavement, materials, or atmospheric temperatures are 20 degrees C 70 degrees F or above. Type II material shall be used when pavement, materials, or atmospheric temperatures are below 20 degrees C 70 degrees F.

2.1.7 Joint-Sealing Materials

Joint-sealing materials shall be as follows:

2.1.7.1 Jet-Fuel Resistant

Jet-fuel resistant material shall conform to [ASTM D 1854] [ASTM D 3569].

2.1.7.2 Non Jet-Fuel Resistant

Non jet-fuel resistant material shall conform to [_____].

2.1.8 Water

Water shall be clean, fresh, and free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances. Water approved by Public Health authorities for domestic consumption may be accepted for use without being tested. Water that is of questionable quality, in the opinion of the Contracting Officer, shall be tested in accordance with COE CRD-C 400.

PART 3 EXECUTION

3.1 CONDITIONING OF EXISTING PAVEMENT

3.1.1 Preparation of Existing Surfaces

In the area to be patched, the surface of the existing concrete shall be removed to a minimum depth of 50 mm 2 inches and to such additional depth where necessary to expose a surface of sound, unweathered concrete that is uncontaminated by oils, greases, or deicing salts or solutions. A vertical saw cut at least 50 mm 2 inches deep shall be made a minimum of 25 mm 1 inch outside of the area to be repaired. The surface shall be thoroughly cleaned by sweeping and blowing with compressed air. Prior to coating with the epoxy-resin grout, areas showing traces of oils or grease shall be

cleaned by sandblasting.

3.1.2 Preparation of Joints

Joint-sealing and expansion-joint materials shall be removed flush with the prepared surface, and, if on the pavement surface to be patched, shall be removed by sandblasting. The use of solvents will not be permitted. Care shall be used to prevent bonding of the adjacent concrete slabs at the location of the existing joints. Maintenance of these existing joints shall be accomplished by the use of fiberboard or other approved inserts of appropriate dimensions.

3.1.3 Bonding Course

Prior to placing concrete, the previously prepared surfaces shall be washed with a high pressure water jet followed by an air jet to remove free water.

The clean surface shall then be coated with a 0.02 to 0.04 mm 20 to 40 mil thick film of the epoxy-resin grout. The epoxy-resin grout shall be placed in one application, just prior to concrete placement, with the use of mechanical combination, mixing and spraying equipment, or shall be applied in two coats with stiff brushes. The first brush coat shall be scrubbed into the concrete surface, followed by an additional brush coat to obtain the required thickness. When the brush method is used, the initial coat may be allowed to dry; however, the final coat shall be applied just prior to placement of the concrete.

3.1.3.1 Mixing Epoxy-Resin Grout Components

Epoxy-resin grout components shall be mixed in the proportions recommended by the manufacturer. The components shall be conditioned to 20 degrees C 70 degrees F to 30 degrees C 85 degrees F for 48 hours prior to mixing. The two epoxy components shall be mixed with a power-driven, explosion-proof stirring device in a metal or polyethylene container having a hemispherical bottom. The polysulfide-curing-agent component shall be added gradually to the epoxy-resin component with constant stirring until a uniform mixture is obtained. The rate of stirring shall be such that the entrained air is a minimum.

3.1.3.2 Tools and Equipment

Tools and equipment used further in the work shall be thoroughly cleaned before the epoxy-resin grout sets.

3.1.3.3 Health and Safety Precautions

The following health and safety precautions shall be followed:

- a. Full face shields shall be provided for all mixing and blending operations and for placing operations as required.
- b. Protective coveralls and neoprene-coated gloves shall be provided for all workmen engaged in the operations.
- c. Protective creams of a suitable nature for the operation shall be supplied.
- d. Adequate fire protection shall be maintained at all mixing and placing operations.

- e. Smoking or the use of spark- or flame-producing devices shall be prohibited within 15 meters 50 feet of mixing and placing operations.
- f. The mixing, placing, or storage of epoxy-resin grout or solvent shall be prohibited within 15 meters 50 feet of any vehicle, equipment, aircraft, or machinery that could be damaged from fire or could ignite vapors from the material.

3.2 BATCHING, MIXING AND PROPORTIONING

3.2.1 Equipment

The Contractor shall provide adequate facilities for the accurate measurement and control of each of the materials entering the concrete. The Contracting Officer shall have free access to the batching and mixing plant at all times. Mixing equipment shall be capable of combining the aggregate, cement, admixture, and water into a uniform mixture and discharging this mixture without segregation.

3.2.2 Conveying

Concrete shall be conveyed from mixer to repair area as rapidly as practicable by methods that will prevent segregation or loss of ingredients.

3.2.3 Facilities for Sampling

Suitable facilities shall be provided for readily obtaining representative samples of aggregate and concrete for uniformity test purposes. Necessary platforms, tools, and equipment for obtaining samples shall be furnished by the Contractor.

3.2.4 Mix Proportions

The proportions of materials entering into the concrete mixtures shall be in accordance with the approved job-mix formula. The proportions shall be changed whenever necessary to maintain the workability, strength, and standard of quality required, and to meet the varying conditions encountered during the construction. However, no changes will be made without prior approval.

3.2.5 Measurement

Equipment necessary to measure and control the amount of each material in each batch of concrete shall be provided. Bulk cement shall be weighed, but cement in unopened bags as packed by the manufacturer may be used without weighing. If bagged cement is used, batches shall be proportioned so that fractional bags will not be required. One bag of portland cement will be considered as weighing 42 kg 94 pounds. Mixing water and air-entraining admixtures may be measured by volume or by weight. One liter gallon of water will be considered as weighing 3.78 kg 8.33 pounds.

3.2.6 Workability

The slump of the concrete shall be maintained at the lowest practicable value, not exceeding 50 mm 2 inches when tested in accordance with ASTM C 143/C 143M.

3.3 PLACING

Concrete shall be placed within 45 minutes from the time all ingredients are charged into the mixing drum, before the concrete has obtained its initial set, and while the epoxy-resin bonding course is tacky. The temperature of the concrete, as deposited in the form, shall be not less than 5 degrees C 40 degrees F nor more than 35 degrees C 90 degrees F. Concrete shall be deposited in such manner as to require a minimum of rehandling, and placement shall be in such manner as to require a minimum of rehandling and in such a manner as to least disturb the epoxy-resin grout. The placing of concrete shall be rapid and continuous for each area. Workmen shall not walk on the bonding-course surface or in the concrete during placing and finishing operations. The concrete shall be thoroughly consolidated by tamping or by means of suitable vibrating equipment.

3.4 FIELD TEST SPECIMENS

3.4.1 General

Concrete samples shall be furnished by the Contractor, and shall be taken in the field and tested to determine the slump, air content, and strength of the concrete. Test beams 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 in service. The air content shall be determined in conformance with ASTM C 173/C 173M. Test beams shall be molded and cured in conformance with ASTM C 31/C 31M and as specified below. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, and protecting test beams at the site and under the supervision of the Contracting Officer. Curing facilities for test beams shall include furnishing and operating water tanks equipped with temperature-control devices that will automatically maintain the temperature of the water at 23 degrees C 73 degrees F plus or minus 3 degrees C 5 degrees F. The Contractor shall also furnish and maintain at the site, boxes or other facilities suitable for storing the specimens while in the mold at a temperature of 23 degrees C 73 degrees F plus or minus 6 degrees C 10 degrees F. Tests of the fresh concrete and of the hardened concrete beams shall be made by and at the expense of the Contractor.

3.4.2 Specimens for Strength Tests

Flexural test beams shall be made each shift that concrete is placed. Each group of test beams shall be molded from the same batch of concrete, and shall consist of a sufficient number of specimens to provide two flexural-strength tests at each test age. One group of specimens shall be made during the first half of each shift, and the other during the last portion of the shift. However, at the start of paving operations and each time the aggregate source, aggregate characteristics, or mix design is changed, one additional set of test beams shall be made.

3.5 FINISHING

Finishing operations shall be started immediately after placement of the concrete. The finished surfaces of patched areas shall have a surface texture approximating that of the adjacent undisturbed pavements.

3.6 CURING

3.6.1 General

NOTE: A minimum curing time of 7 days will be required when Type I or Type II cements are used. A minimum curing period of 3 days will be specified for Type III cement.

Concrete shall be cured by protection against loss of moisture and rapid temperature changes for a period of not less than [_____] days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. The Contractor shall have all equipment needed for adequate curing and protection of the concrete on hand and ready to install before actual concrete placement begins. Failure to comply with curing requirements shall be cause for immediate suspension of concreting operations.

3.6.2 Burlap Curing

Immediately after the finishing operations have been completed and the concrete has set sufficiently to prevent marring the surface, the entire surface of the newly laid concrete shall be covered with approved wetted burlap that shall be kept wet for a period of not less than 24 hours. The surface of the newly laid concrete shall be kept moist until the burlap coverings are in place. Curing of the concrete shall be continued for the duration of the required curing period by this method or one of the methods specified below.

3.6.2.1 Waterproof-Paper Blankets or Impermeable Sheets

Immediately after removing the covering used for initial curing, the exposed concrete surfaces shall be moistened with a fine spray of water and then covered with waterproof-paper blankets, polyethylene-coated-burlap blankets, or impermeable sheets. Burlap of polyethylene-coated burlap shall be saturated with water before placing. Sheets shall be placed with the light-colored side up. Sheets shall overlap not less than 300 mm 12 inches with edges taped or secured to form a completely closed joint. Coverings shall be weighted down to prevent displacement or billowing from winds. Tears or holes appearing during the curing period shall be immediately repaired by patching.

3.6.2.2 Membrane-Forming Curing Compound

Membrane-forming curing compound shall be applied immediately to exposed concrete surfaces after removing burlap coverings. The curing compound shall be applied with an overlapping coverage that will give a two-coat application at a coverage of not more than 20 square m/L 200 square feet per gallon for both coats. When application is made by hand-operated sprayers, the second coat shall be applied in a direction approximately at right angles to the first coat. Concrete shall be properly cured at joints, but no curing compound shall enter joints that are to be sealed with joint-sealing compounds. 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 imperfections. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed at the coverage specified above and at

no additional cost to the Government. Areas covered with curing compound that are damaged by pedestrian and vehicular traffic or by subsequent construction operations within the specified curing period shall be resprayed at no additional cost to the Government.

3.7 FINISH TOLERANCE

The finished surfaces of patched areas shall meet the grade of the adjoining pavements and shall not deviate more than 3 mm 1/8 inch from a true plan surface within the patched area.

3.8 PAVEMENT PROTECTION

The Contractor shall protect the patched areas against damage prior to final acceptance of the work by the Government. Traffic shall be excluded from the patched areas by erecting and maintaining barricades and signs until the completion of the curing period of the concrete.

3.9 JOINTS

Joints shall conform in detail and be in alignment with the existing joints. After curing of the concrete, the joints in the critical areas indicated shall be primed if and as recommended by the sealant formulator and shall then be sealed with jet-fuel resistant joint-sealing material. Other joints shall be sealed with non jet-fuel resistant sealing materials.

Equipment for heating and installing jet-fuel resistant sealers shall be that for which the material was formulated. Equipment for heating and installing non jet-fuel resistant sealers shall be indirect heating type with pressure-type pouring device, and devices for controlling and indicating the temperature of the sealers. Mixing of components of jet-fuel resistant sealers and temperatures of application shall be as recommended by the particular sealer manufacturer. Sealer shall completely fill the joint without discontinuities and without formation of voids or entrapped air. Defective joints shall be satisfactorily replaced.

-- End of Section --