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USACE / NAVFAC / AFCEA UFGS-02976 (August 2004)  
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Preparing Activity: NAVFAC Superseding  
UFGS-02976N (September 1999)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 22 December 2004

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### SECTION 02976

#### STRESS-ABSORBING MEMBRANE INTERLAYER 08/04

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NOTE: This guide specification covers the requirements for fabric reinforcement underseal of asphaltic overlays.

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.

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NOTE: To achieve reinforcement by the use of fabrics in asphalt pavement, their range of application must not be overextended. Fabrics have been used successfully in many applications but, likewise, have failed to improve pavement performance in similar situations. Experience has shown, although long-term performance data is not available, some fabric enhance the life of thin asphaltic resurfacings. When used with asphalt overlays of 75 mm 3 inches or less, reduced reflection cracking can be achieved. The fabric not only retards or reduces reflection cracking but prevents surface infiltration of water. Fabrics have performed well when used on pavements with fatigue cracking (alligator skin pattern), on longitudinal construction joint cracks in asphalt pavement, and on the longitudinal joint between portland cement concrete pavement widened with flexible pavement. In general, fabrics have not proven to serve as well on cracks that are greater

than 6 mm 1/4 inch wide. In these cases, the fabrics have not prevented a significant amount of reflection cracking but are believed to protect the pavement from surface water intrusion.

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## PART 1 GENERAL

### 1.1 REFERENCES

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NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

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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.

#### ASTM INTERNATIONAL (ASTM)

ASTM C 136	(2004) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 1777	(1996; R 2002) Thickness of Textile Materials
ASTM D 2397	(2002) Cationic Emulsified Asphalt
ASTM D 3381	(1992; R 1999) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 3776	(1996; R 2002) Mass Per Unit Area (Weight) of Fabric
ASTM D 3910	(1998) Design, Testing, and Construction of Slurry Seal
ASTM D 4632	(1991; R 2003) Grab Breaking Load and Elongation of Geotextiles
ASTM D 946	(1982; R 1999) Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 977	(2003) Emulsified Asphalt

#### U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS SS-S-1401	(Rev C; Am 1) Sealant, Joint, Non-Jet-Fuel-Resistant, Hot-Applied, for Portland Cement and Asphalt Concrete Pavements
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## 1.2 STATE STANDARD SPECIFICATIONS

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NOTE: Where SSS-[ ] is found in the text,  
insert the appropriate State Standard Specification.  
\*\*\*\*\*

Materials and workmanship specified herein with the reference State Standard specifications (SSS) shall be in accordance with the referenced articles, sections and paragraphs of the standard except that contractual and payment provisions do not apply. Where the term "Engineer" is used, it shall mean the Contracting Officer. Where the term "state" is used, it shall mean "Federal Government."

## 1.3 SUBMITTALS

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NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

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 projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

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

SD-05 Design Data

Asphalt concrete mix design

Emulsified asphalt slurry

#### SD-06 Test Reports

Gradation for sand for emulsified asphalt slurry in accordance with ASTM C 136.

#### SD-07 Certificates

Asphalt cement

Emulsified asphalt

Sealant

Reinforcing fabric underseal

### 1.4 DELIVERY AND STORAGE

Deliver materials to job site in original unopened rolls, packages, cartons, bundles, or containers. Prevent damage to materials during loading, transporting, and unloading. Inspect materials for contamination.

Protect materials against dampness. Store aggregates so as to prevent segregation and contamination. Replace defective or damaged materials. Remove rejected materials from Government property.

### 1.5 EQUIPMENT

#### 1.5.1 Asphalt Distributor

Provide a distributor capable of spraying asphalt cement at the prescribed application rate without streaking, skipping, or dripping. Equip distributor with hand spray having single nozzle and positive shut-off valve. Provide calibrated instruments for determining both temperature of asphaltic material in distributor and temperature at which it is applied, and for securing uniformity at junction of two distributor loads. Calibrated instruments shall have been recalibrated by an approved calibration laboratory within [12] [\_\_\_\_\_] months prior to commencing work [and every [\_\_\_\_\_] month, thereafter during the term of the contract].

#### 1.5.2 Fabric Handling Equipment

Provide mechanical or manual laydown equipment capable of laying fabric smoothly without wrinkles or folds.

#### 1.5.3 Vacuum Sweeper

Self-propelled, vacuum pickup capable of completely removing loose material and debris from pavement surface.

#### 1.5.4 Miscellaneous Equipment

Additional equipment shall include, but not be limited to, stiff bristle brooms; squeegees to spread asphalt cement; rollers to smooth fabric; scissors or blades to cut fabric; and brushes for applying cement at fabric overlaps.

#### 1.5.5 Condition of Equipment

Storage tanks, piping, retorts, booster tanks, and distributors used in storing and handling asphalt material shall be kept clean and in good operating condition. Do not allow contamination of asphaltic material with foreign material in equipment during operation. Provide and maintain a recording thermometer in good working order in storage heating unit.

### 1.6 QUALITY ASSURANCE

#### 11.6.1 Design Conformance

\*\*\*\*\*  
NOTE: Insert appropriate Section number and title  
in blank below using format per UFC 1-300-02.  
\*\*\*\*\*

Submit asphalt concrete mix design conforming to the requirements of  
[Section 02742 HOT MIX BITUMINOUS PAVEMENT] [\_\_\_\_].

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Asphalt Cement

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NOTE: Choose one of the following options. The  
fabrics are bonded to the existing asphalt surface  
or the surface of a leveling course by means of  
asphalt cement only. Asphalt cements are graded  
according to viscosity after aging, viscosity based  
on original asphalt, or penetration. When selecting  
an asphalt cement material and the temperature is  
known, the fabric manufacturer's requirements should  
be consulted. Give consideration to the following  
items in the selection of asphalt cement: Major  
criteria include climatic conditions, traffic  
density, wheel loads, and local availability. In  
general, AR-8000 or AC-20 or 60-70 is used in hot  
climate areas and in projects where heavy traffic  
density or high wheel loads occur. AR-4000 is used  
in most temperate regions for projects with average  
traffic density. AR-4000 or AC-10 or 85-100 could be  
used in cold climate areas for projects with heavy  
traffic density. AR-2000 and AR-1000 or AC-5 and  
AC-2.5 or 120-150 and 200-300 are generally used in  
cold to very cold climate areas. The asphalt cement  
should be the same grade of asphalt cement selected  
for the asphalt concrete overlay.  
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NOTE: Add appropriate State Standard specification  
(SSS) in the blanks below.  
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[Viscosity-Graded Residue [AR-1000] [AR-2000] [AR-4000] [AR-8000]: [Section

[\_\_\_\_\_] of SSS-[\_\_\_\_\_] [ASTM D 3381].]

[Viscosity-Graded Original Asphalt [AC-2.5] [AC-5] [AC-10] [AC-20]:  
[Section [\_\_\_\_\_] of SSS-[\_\_\_\_\_] [ASTM D 3381].]

[Penetration-Grade [200-300] [120-150] [85-100] [60-70]: [Section [\_\_\_\_\_] of SSS-[\_\_\_\_\_] [ASTM D 946].]

#### 2.1.2 Emulsified Asphalt

[SS-1] [SS-1h] [CSS-1] [CSS-1h]; [Section [\_\_\_\_\_] of SSS-[\_\_\_\_\_] [ASTM D 977] [ASTM D 2397].

#### 2.1.3 Sand for Emulsified Asphalt Slurry

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NOTE: Gradation listed is the one recommended by  
the International Slurry Seal Association for  
filling cracks. Modify if project conditions  
require a different gradation.  
\*\*\*\*\*

Free of dirt, debris, and organic matter, conforming to ASTM D 3910, Type I gradation.

#### 2.1.4 Asphalt Concrete

\*\*\*\*\*  
NOTE: Insert appropriate Section number and title  
in the blank below using format per UFC 1-300-02.  
\*\*\*\*\*

Provide in accordance with [Section 02742 HOT MIX BITUMINOUS PAVEMENT]  
[\_\_\_\_\_].

#### 2.1.5 Sealant

FS SS-S-1401.

#### 2.1.6 Reinforcing Fabric Underseal

Provide 100 percent woven or nonwoven polypropylene or polyester fabric, resistant to rot and mildew.

##### 2.1.6.1 Fabric

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NOTE: Most fabrics available that meet these  
specifications are nonwoven. The designer should  
check data against any other manufacturers'  
literature or information or data that may be more  
current.  
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NOTE: The tensile strength of the fabric is  
important when the fabric serves as a reinforcement.  
As a pavement system deforms elastically, the  
fabric also deforms, thereby inducing tensile



stresses in the fabric. The fabric must have sufficient tensile strength to resist these stresses. Fabrics used between layers of asphalt paving provide stress relief by absorbing the tensile stresses imparted from lower layer to upper layer. The net result is reduction in reflection cracking.

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TABLE I

REQUIREMENTS		FABRIC
<u>FABRIC PROPERTY</u>	<u>TEST METHOD</u>	<u>(Minimum Values)</u>
Weight, (G/sq. m)	ASTM D 3776	(115)
Thickness, (mm)	ASTM D 1777	(0.30)
Grab Tensile Strength, (N)	ASTM D 4632	(400)
Grab Tensile Elongation, percent	ASTM D 4632	55
Asphalt Retention, (G/sq. m)		(763)
Change in Area from Asphalt, percent		10 (max)

TABLE I

REQUIREMENTS		FABRIC
<u>FABRIC PROPERTY</u>	<u>TEST METHOD</u>	<u>(Minimum Values)</u>
Weight, (oz./sq. yd)	ASTM D 3776	(3.4)
Thickness, (mils)	ASTM D 1777	(12)
Grab Tensile Strength, (lb)	ASTM D 4632	(90)
Grab Tensile Elongation, percent	ASTM D 4632	55
Asphalt Retention, (oz./sq. ft)		(2.5)
Change in Area from Asphalt, percent		10 (max)

Determine asphalt retention and potential change in fabric area as follows:

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NOTE: Machine direction is parallel to the nonwoven's motion in the final forming step and within the plane of the fabric. Cross-machine direction is within the plane of the fabric perpendicular to the nonwoven's motion in the final

forming step. Moisture equilibrium is considered to have been reached when the increase in weight of the specimen in successive weighings made at intervals of not less than 2 hours does not exceed 0.1 percent of the weight of the specimen.

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Select at random from a test sample fabric of 300 mm one foot wide by roll width, three machine direction and three cross machine direction specimens measuring 100 by 200 mm 4 by 8 inches. Condition individual test specimens by bringing them to approximate moisture equilibrium in standard atmosphere for testing (65 percent plus or minus 5 percent relative humidity, 21 degrees plus or minus one degree C 70 degrees plus or minus 2 degrees F. Weigh test specimens individually to nearest 0.1 gram, then submerge individual test specimens in specified asphalt cement for 30 minutes maintained at a temperature of 135 degrees plus or minus 2 degrees C 275 degrees plus or minus 4 degrees F in a mechanical convection oven. After submersion test, remove asphalt cement coated-saturated test specimens and hang to drain (long axis vertical) in oven for an additional 30 minutes at 135 degrees plus or minus 2 degrees C 275 degrees plus or minus 4 degrees F. Remove specimens from oven and hang to drain (long axis vertical) for one hour at a temperature of 25 plus or minus 2 degrees C 76 plus or minus 4 degrees F. Trim off edge drippings.

Weigh asphalt coated specimens to nearest 0.1 gram and then place in naphtha heated to 44 degrees plus or minus 3 degrees C 110 degrees plus or minus 5 degrees F for 30 minutes. Fresh naphtha contained in trays at specified temperature may be alternated during 30 minute period to remove asphalt cement from specimens. Blot specimens with paper towels and allow to air dry to remove naphtha. Measure area of specimens for determination of percent change in area. Calculate asphalt retention and change in area as follows:

Asphalt Retention, G per sq. m =

$$\frac{\text{wt. in grams of asphalt cement retained}}{\text{area of specimen after test in sq.}}$$

Change in Areas, percent =

$$\frac{100 - (\text{area of specimen after test in sq. m}) \times 100}{(\text{original area of specimen in sq. m})}$$

Asphalt Retention, oz./sq. ft =

$$\frac{\text{wt. in grams of asphalt cement retained} \times 0.035}{\text{area of specimen after test in sq. in. divided by 144}}$$

Change in Areas, percent =

$$\frac{100 - (\text{area of specimen after test in sq. in.}) \times 100}{(\text{original area of specimen in sq. in.})}$$

#### 2.1.7 Emulsified Asphalt Slurry

ASTM D 3910, Type I mixture.

## PART 3 EXECUTION

### 3.1 PREPARATION

#### 3.1.1 Cracks

Clean cracks of loose or spalled pieces of asphaltic concrete, vegetation, and debris by use of a power broom and compressed air jet of not less than 620 kPa 90 psi.

##### 3.1.1.1 Crack Sealing 3 to 6 Millimeters 1/8 to 1/4 Inch

Seal with [hot-poured asphalt cement] [emulsified asphalt] [or sealant]. Level material with the pavement surface.

##### 3.1.1.2 Crack Sealing Over 6 Millimeters Over 1/4 Inch

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NOTE: Other materials for sealing cracks may involve the use of modifiers such as rubber, latex, or fibers which may be proprietary. If proprietary materials are to be used, the designer must justify, on a case-by-case basis, that the proprietary material is the only material that will work and must obtain written approval from a Level I Contracting Officer. See NAVFAC P-68, "Contracting Manual" for details.

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Seal with emulsified asphalt slurry level with the existing pavement. Make two passes if necessary to fill void.

#### 3.1.2 Potholes

Remove surface pavement and base course as indicated. Make cut square or rectangular with vertical straight faces. Make one pair of faces at right angles to traffic flow. Spray vertical surfaces with emulsified asphalt. Fill with asphalt concrete, and compact patch level with existing pavement using a vibratory compactor for small patches or a roller for large patches.

#### 3.1.3 Surface Preparation

[Cold-mill existing pavement in accordance with Section 02964 COLD-MILLING OF BITUMINOUS PAVEMENT.] Clean pavement surfaces with a power broom and a power blower using compressed air following brooming.

### 3.2 FABRIC INSTALLATION

#### 3.2.1 Placement Conditions

Place fabric under the following conditions:

- a. Ambient air temperature above 4.5 degrees C 40 degrees F and rising
- b. Dry pavement surface temperature above 4.5 degrees C 40 degrees F and rising.
- c. When wind velocity does not exceed [\_\_\_\_\_] kph mph.

### 3.2.2 Binder

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NOTE: The amount of asphalt cement required depends on the condition and texture of the asphaltic surface on which the fabric is to be placed and on the type of fabric. Most common fabrics require about 0.9 - 1.58 L/sq. m 0.20 - 0.35 gal/sq. yd. of residual asphalt. Use 0.9 - 1.13 L/sq. m 0.20 - 0.25 gal/sq. yd. for tight nonporous surface of existing asphalt pavement. Use 1.13 - 1.36 L/sq. m 0.25 - 0.30 gal/sq. yd. for cracked and weathered surface of existing asphalt pavement. Use 1.36 - 1.58 L/sq. m 0.30 - 0.35 gal/sq. yd. for cracked and open textured surface of existing asphalt pavement. Figure 12 of DM-5.04, "Pavements" Section 13 relates surface texture to asphalt cement quality for a representative type of fabric only. The designer may use the word description of the existing pavement surface or perform texture tests. The texture measure in Figure 12 is based on the putty impression test. The test equipment consists of (1) a 150 mm diameter by 25 mm thick 6 inch diameter by one inch thick metal plate with a 100 mm 4 inch diameter, 2 mm 1/16 inch deep recess machined into one side, and (2) a 15.90 gram ball of silicone putty. When placed on a smooth surface, 15.90 grams of putty will smooth out to a 100 mm 4 inch diameter circle, 2 mm 1/16 inch deep, thus completely filling the recess. If the designated rate of application is not suitable for the project, revise to meet project requirements.

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Spray area to receive fabric with asphalt cement at rate of [1.0 - 1.31] [\_\_\_\_\_] L per square meter [0.22-0.29] [\_\_\_\_\_] gallon per square yard. Minimum width of asphalt application shall be fabric width plus 100 mm 4 inches. Minimize time interval between placing asphalt cement and placing fabric so that temperature loss of asphalt cement does not cause loss of adhesion. Keep newly placed binder areas shall be free of traffic and debris until asphalt overlay is complete.

### 3.2.3 Fabric Placement

Place fabric free of wrinkles and folds. Place fabric manually on areas where it cannot be mechanically installed. In the event of improper alignment which causes the fabric to wrinkle or fold during placement, slit the fabric and realign by overlapping the previous material and proceed as before. Overlap the fabric a minimum of 100 mm 4 inches at all joints [, except as otherwise shown]. Do not lap joints with more than two fabric layers. Construct transverse joints so as to prevent fabric disturbance by paver. Roll fabric in a manner that air bubbles that form under the fabric will be removed. In case binder bleeds through fabric, blot binder with sand before overlay is placed. Remove excess sand before placing overlay. Neatly cut and contour fabric at joints. Remove and replace damaged fabric before resurfacing.

#### 3.2.3.1 Traffic Control

Prohibit vehicles, except handling equipment, from traveling on fabric. Limit equipment speed to 8 kph 5 miles per hour. At intersections and corners, turn equipment gradually to avoid damaging fabric.

#### 3.2.3.2 Additional Asphalt Cement

After fabric placement and prior to placement of overlay, ensure sufficient binder exists to bond subsequent overlay. If fabric lacks tackiness, apply additional binder of at least 0.09 L per square meter 0.02 gallon per square yard to fabric surface.

#### 3.2.4 Asphalt Concrete Overlay

\*\*\*\*\*  
NOTE: Insert the appropriate Section number and  
title in blank below using format per UFC 1-300-02.  
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Place overlay in accordance with [Section 02742 HOT MIX BITUMINOUS  
PAVEMENT] [\_\_\_\_\_]. Paving operation shall closely follow fabric placement.  
Do not place fabric that cannot be covered with overlay the same day.  
-- End of Section --