

# MISSISSIPPI DEPARTMENT OF TRANSPORTATION

**SPECIAL PROVISION NO. 907-411-1**

**CODE: (SP)**

**DATE: 06/28/2010**

**SUBJECT: Ultra-Thin Asphalt Pavement (UTAP)**

Section 907-411, Ultra-Thin Asphalt Pavement, is hereby added to and made part of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows:

## **SECTION 907-411 - ULTRA-THIN ASPHALT PAVEMENT**

**907-411.01--Description.** These specifications include general requirements that are applicable to Ultra-Thin Hot Mix Asphalt (UHMA) and Ultra-Thin Warm Mix Asphalt (UWMA).

This work consists of the construction of one lift of UTAP in accordance with these specifications and the specific requirements for the mixture to be produced and placed in reasonable close conformity with the lines, grades, thicknesses and typical sections shown on the plans or established by the Engineer.

### **907-411.01.1--Definitions.**

**Maximum Sieve Size** - Maximum sieve size is the smallest sieve size at which 100 percent of the aggregate passes.

**Nominal Maximum Sieve Size** - The nominal maximum sieve size is one sieve size larger than the first sieve to retain more than 10 percent of the aggregate.

**Maximum Density Line** - The maximum density line is a straight line plot on the FHWA 0.45 power gradation chart which extends from the zero origin point of the chart through the plotted point of the combined aggregate gradation curve on the nominal maximum sieve size.

**Mechanically Fractured Face** - An angular, rough, or broken surface of an aggregate particle created by crushing as determined by ASTM Designation: D 5821.

### **907-411.02--Materials.**

#### **907-411.02.1--Component Materials.**

**907-411.02.1.1--Aggregates.** The source of aggregates shall meet the applicable requirements

of Section 703.

**907-411.02.1.1.1--Coarse Aggregate Blend.** Mechanically fractured faces by weight of the combined mineral aggregate coarser than the No. 4 sieve shall be 90 percent, two faces.

**907-411.02.1.1.2--Fine Aggregate Blend.** Uncrushed natural sand shall pass the 3/8" sieve and can be used, excluding the content in RAP, as no greater than 30 percent of the total mineral aggregate by weight.

**907-411.02.1.1.3--Combined Aggregate Blend.** The gradation requirements for Ultra-thin asphalt pavements are provided in the following table:

<b>Sieve Size</b>	<b>Percent Passing</b>
1/2 inch	100
3/8 inch	95-100
No. 4	75 min
No. 8	22-70
No.16	--
No. 200	4-12

The ultra-thin mixtures shall have a minimum fine aggregate angularity of 40.0 when tested on combined aggregate in accordance with ASTM Designation: C1252 Method A.

The minus No. 40 fraction of the combined aggregate shall be non-plastic when tested according to AASHTO T 90. The clay content shall not exceed 0.5 percent by weight of the total mineral aggregate when tested according to AASHTO T 88.

**907-411.02.1.2--Reclaimed Asphalt Pavement.** Reclaimed asphalt pavement may be used in ultra-thin asphalt pavement and shall be no greater than 25 percent of the total mix weight.

Reclaimed asphalt pavement shall be separated into coarse and fine aggregate stockpiles using a 1/2" sieve as the break point.

**907-411.02.1.3--Bituminous Materials.** Bituminous materials shall meet the applicable requirements of Section 702 for the grade specified.

**907-411.02.1.4--Hydrated Lime.** Hydrated lime shall meet the requirements of Subsection 714.03.2 for lime used in soil stabilization.

**907-411.02.1.5--Mineral Filler.** Mineral filler shall meet the requirements of Subsection 703.16.

**907-411.02.2--Composition of Mixtures.**

**907-411.02.2.1--General.** Unless otherwise specified or permitted, the UTAP shall consist of a uniform mixture of asphalt, aggregate, mineral filler, hydrated lime and, when required or necessary to obtain desired properties, antistripping agent and/or other materials.

Hydrated lime shall be used in all UTAP at the rate of one percent (1%) by weight of the total dry aggregate. The aggregate, prior to the addition of the hydrated lime, shall contain sufficient surface moisture.

The Contractor shall obtain a shipping ticket for each shipment of hydrated lime. The Contractor shall provide the District Materials Engineer with a copy of each shipping ticket from the supplier, including the date, time and weight of hydrated lime shipped.

Mixtures will require the addition of an antistripping agent when the Tensile Strength Ratio (MT-63) and/or the Boiling Water Test (MT-59) fail to meet the following criteria.

Tensile Strength Ratio (TSR - MT-63)

Wet Strength / Dry Strength 85 percent minimum

Interior Face Coating 95 percent minimum

Boiling Water Test (MT-59)

Particle Coating 95 percent minimum

**907-411.02.2.2--Mixture Properties.** Ultra-thin asphalt pavement shall be designed at  $N_{design}$  of 50 revolutions of the gyratory compactor.

Mixtures shall be designed such that the percent of maximum specific gravity ( $G_{mm}$ ) shall be between 94.0 and 96.0.

There will not be voids in mineral aggregate (VMA) requirement for ultra-thin hot mix asphalt. However, the specified volume of effective binder (the difference between total air voids and VMA) shall be a minimum of 12 percent.

Dust/Binder Ratio (Percent Passing No. 200 / Effective Binder Content) for ultra-thin asphalt pavement shall be between 1.0 and 2.0.

**907-411.02.2.3--Job Mix Formula.** At least 10 working days prior to the proposed use of each mixture, the Contractor shall submit in writing to the Engineer a proposed job-mix formula or request the transfer of a verified job-mix formula as set forth in the latest edition of MDOT's Field Manual for HMA. The job-mix formula shall be signed by a Certified Mixture Design Technician (CMDT).

The Department will perform the tests necessary for review of a proposed job-mix formula for each required mixture free of charge one time only. A charge will be made for additional job-mix formulas submitted by the Contractor for review.

The mixture shall conform thereto within the range of tolerances specified for the particular

mixture. No change in properties or proportion of any component of the job-mix formula shall be made without permission of the Engineer. The job-mix formula for each mixture shall be in effect until revised in writing by the Engineer.

A job-mix formula may be transferred to other contracts in accordance with conditions set forth in the Department's Field Manual for HMA.

The Contractor shall not place any UTAP prior to receiving "tentative" approval and a MDOT design number from the Central Laboratory.

When a change in source of materials, unsatisfactory mixture production results such as segregation, bleeding, shoving, rutting over 1/8 inch, raveling & cracking, or changed conditions make it necessary, a new job-mix formula will be required. The conditions set out herein for the original job-mix formula are applicable to the new job-mix formula.

**907-411.02.2.4--Single Lift Laying Thickness.** The minimum lift thickness for ultra-thin asphalt pavement shall be 1/2 inch and the maximum lift thickness shall not exceed one inch (1").

**907-411.02.2.5--UWMA Products and Processes.** The Department will maintain a list of qualified UWMA products and processes. No product or process shall be used unless it appears on this list.

The Contractor may propose other products or processes for approval by the Product Evaluation Committee. Documentation shall be provided to demonstrate laboratory performance, field performance, and construction experience.

**907-411.02.3--Contractor's Quality Management Program.**

**907-411.02.3.1--General.** The Contractor shall have full responsibility for quality management and maintain a quality control system that will furnish reasonable assurance that the mixtures and all component materials incorporated in the work conform to contract requirements. The Contractor shall have responsibility for the initial determination and all subsequent adjustments in proportioning materials used to produce the specified mixture. Adjustments to plant operation and spreading and compaction procedures shall be made immediately when results indicate that they are necessary. Mixture produced by the Contractor without the required testing or personnel on the project shall be subject to removal and replacement by the Contractor at no additional cost to the State.

**907-411.02.3.2--Personnel Requirements.** The Contractor shall provide at least one Certified Asphalt Technician-I (CAT-I) full-time during UTAP production at each plant site used to furnish material to the project. Sampling shall be conducted by a certified technician or by plant personnel under the direct observation of a certified technician. All testing, data analysis and data posting will be performed by the CAT-I or by an assistant under the direct supervision of the CAT-I. The Contractor shall have a Certified Asphalt Technician-II (CAT-II) available

to make any necessary process adjustments. An organizational chart, including names, telephone numbers and current certification, of all those responsible for the quality control program shall be posted in the contractor's laboratory while the UTAP paving work is in progress

**907-411.02.3.3--Testing Requirements.** As a minimum, the Contractor's quality management program shall include the following:

- (a) Bituminous Material. Provide Engineer with samples in a sealed one-quart metal container at the frequency given in MDOT SOP TMD-20-04-00-000.
- (b) Mechanically Fractured Face. Determine mechanically fractured face content of aggregates retained on the No. 4 sieve, at a minimum of one test per day of production.
- (c) Mixture Gradation. Conduct extraction tests for gradation determination on the mixture. Sample according to the frequency in paragraph (i) and test according to Mississippi Test Method MT-31.
- (d) Total Voids and  $V_{be}$ . Determine total voids and volume of effective binder ( $V_{be}$ ), at  $N_{Design}$ , from the results of bulk specific gravity tests on laboratory compacted specimens. Sample according to the sampling frequency in paragraph (h) and test according to the latest edition of MDOT's Field Manual for HMA.
- (e) Asphalt Content. Sample according to the sampling frequency in paragraph (i), and determine the asphalt content using one of the following procedures.
  - (1) Nuclear gauge. (Mississippi Test Method MT-6)
  - (2) Incinerator oven. (AASHTO T 308, Method A)
- (f) Stripping Tests. Conduct a minimum of one stripping test at the beginning of each job-mix production and thereafter, at least once per each two weeks of production according to Mississippi Test Method: MT-63 and one stripping test per day of production according to Mississippi Test Method: MT-59. Should either the TSR (MT-63) or the boiling water (MT-59) stripping tests fail, a new antistrip additive or rate shall be established or other changes made immediately that will result in a mixture which conforms to the specifications; otherwise, production shall be suspended until corrections are made.
- (g) Quality Control Charts. Plot the individual test data, the average of the last four tests and the control limits for the following items as a minimum:

Mixture Gradation (Percent Passing) Sieves:  
1/2-in, 3/8-in, No. 4, No. 8, No. 30, and No. 200.  
Asphalt Content, Percent  
Maximum Specific Gravity

Total Voids @  $N_{Design}$ , Percent  
 $V_{be}$  @  $N_{Design}$ , Percent

Keep charts up-to-date and posted in a readily observable location. Charts may be kept on a computer; however, the charts shall be printed out a minimum of once each production day and displayed in the laboratory. Note any process changes or adjustments on the Air Voids chart.

- (h) Sampling Frequency. Conduct those tests as required above at the following frequency for each mixture produced based on the estimated plant tonnage at the beginning of the day.

<u>Total Estimated Production, tons</u>	<u>Number of Tests</u>
0-500	1
501-1000	2
1001-1500	3
1501-2000	4
2001+	5

- (j) Sample Requirements. Obtain the asphalt mixture samples from trucks at the plant. Obtain aggregate samples from cold feed bins or aggregate stockpile. Save a split portion of all mixture samples at the laboratory site in a dry and protected location for 14 calendar days. At the completion of the project, the remaining samples may be disposed of with the approval of the Engineer.

The above testing frequencies are for the estimated plant production for the day. If production is discontinued or interrupted, the tests will be conducted at the previously established sample tonnage points for the materials that are actually produced. If the production exceeds the estimated tonnage, sampling and testing will continue at the testing increments previously established for the day. A testing increment is defined as the estimated daily tonnage divided by the required number of tests from the table in Subsection 907-411.02.3.3 paragraph (h).

In addition to the above program, aggregate stockpile gradation tests (AASHTO T-11 and T-27) shall be conducted every other production day. Fine aggregate angularity tests (ASTM C 1252, Method A) shall be conducted on the first day of production and once for every eight production samples thereafter, with a minimum of one test per production week.

**907-411.02.3.4--Documentation.** The Contractor shall document all observations, records of inspection, adjustments to the mixture, and test results on a daily basis. All tests conducted by the Contractor in accordance with Subsection 907-411.02.3.3 (g) shall be included in the running average calculations. If single tests are performed as a check on individual UTAP properties, between regular samples, without performing all tests required in Subsection 907-411.02.3.3 (g), the results of those individual tests shall not be included in the running average calculations for that particular property. The Contractor shall record the results of observations and records of inspection as they occur in a permanent field record. The Contractor shall

record all process adjustments and job mix formula (JMF) changes on the air void charts. The Contractor shall provide copies of all test data sheets and the daily summary reports on the appropriate Mississippi DOT forms to the Engineer on a daily basis. The Contractor shall provide a written description of any process change, including blend proportions, to the Engineer as they occur. Information provided to the Engineer must be received in the Engineer's office by no later than 9:00 AM the day after the UTAP is produced. Fourteen days after the completion of the placement of the UTAP, the Contractor shall provide the Engineer with the original testing records and control charts in a neat and orderly manner

**907-411.02.3.5--Control Limits.** The following control limits for the job mix formula (JMF) and warning limits are based on a running average of the last four data points.

<u>Sieve - % Passing</u>	<u>JMF Limits</u>	<u>Warning Limits</u>
1/2-in	± 5.5	± 4.0
3/8-in	± 5.5	± 4.0
No. 4	± 4.0	± 3.0
No. 8	± 4.0	± 3.0
No. 30	± 4.0	± 3.0
No. 200	± 2.0	± 1.5
Asphalt Content, %	-0.3 to +0.5	-0.2 to +0.4
Design Total Voids	± 1.3	± 1.0
@N <sub>Design</sub> , %		
V <sub>be</sub> @ N <sub>Design</sub> , %	- 1.5	- 1.0

**907-411.02.3.6--Warning Bands.** Warning bands are defined as the area between the JMF limits and the warning limits.

**907-411.02.3.7--Job Mix Formula Adjustments.** A request for a JMF adjustment signed by a CAT-II may be made to the Engineer by the Contractor. Submit sufficient testing data with the request to justify the change. The requested change will be reviewed by the State Materials Engineer for the Department. If current production values meet the mixture design requirements, a revised JMF will be issued. Adjustments to the JMF shall conform to the latest edition of MDOT's Field Manual for HMA. Adjustments to the JMF to conform to actual production shall not exceed the tolerances specified for the JMF limits. Regardless of such tolerances, any adjusted JMF gradation shall be within the range given in Subsection 907-411.02.1.1.3 for the mixture specified. **The JMF asphalt content may only be reduced if the production V<sub>be</sub> meets or exceeds the minimum design V<sub>be</sub> requirements for the mixture being produced.**

**907-411.02.3.8--Actions and Adjustments.** Actions and adjustments shall be in accordance with Subsection 401.02.5.8.

**907-411.02.4--Standards of Acceptance.**

**907-411.02.4.1--General.** Acceptance for mixture quality ( $V_{be}$  and total voids @  $N_{Design}$ , gradation, and asphalt content) will be based on random samples tested in accordance with the latest edition of MDOT’s Field Manual for HMA. Smoothness will be accepted by lots as set out in Subsection 907-411.02.4.3.

**907-411.02.4.2--Assurance Program for Mixture Quality.** The Engineer will conduct a quality assurance program in accordance with Subsection 401.02.6.2.

**907-411.02.4.3--Acceptance Procedure for Mixture Quality.** All obviously defective material or mixture will be subject to rejection by the Engineer. Such defective material or mixture shall not be incorporated into the finished work. If the defective material has already been placed in the work, the material shall be removed and replaced at no additional cost to the State.

The Engineer will base final acceptance of the asphalt mixture production on the results of the Contractor's testing for total voids and  $V_{be}$  @  $N_{Design}$ , gradation, and asphalt content as verified by the Engineer in the manner hereinbefore described and the uniformity and condition of the completed pavement. Areas of pavement that exhibit nonuniformity or failures (materials or construction related) such as but not limited to segregation, bleeding, shoving, rutting over 1/8 inch, raveling, slippage, or cracking will not be accepted. Such areas will be removed and replaced at no additional cost to the State.

Bituminous mixture placed prior to correction for deficiencies in  $V_{be}$  and total voids @  $N_{Design}$ , gradation, or asphalt content, as required in Subsection 907-411.02.3.8 and determined by the Engineer satisfactory to remain in place will be paid for in accordance with the following pay factors times the contract unit price per ton.

**Pay Factor for Mixture Quality \***

Item	Produced in Warning Bands	Produced Outside JMF Limits (Allowed to Remain in Place)
Gradation	0.90	0.75
Asphalt Content	0.85	0.75
Total Voids @ $N_{Design}$	0.70	0.50
$V_{be}$ @ $N_{Design}$	0.90	0.75

\* The minimum single payment will apply.

**907-411.02.4.4--Acceptance Procedure for Density.** The density requirement for UTAP shall be roll to refusal. Refusal is defined as the number of roller passes to maximize the in-place unit weight of the mixture. On the first day of production and every three production days thereafter, a 500-foot test strip shall be evaluated to determine the required number of roller passes. Three random sites within the test strip shall be selected and monitored with the nuclear density gauge to determine refusal.

**907-411.02.4.5--Acceptance Procedure for Pavement Smoothness.** Prior to placement of UTAP, the Contractor shall determine the existing surface profile at no additional cost to the State. The finished UTAP lift shall have a profile index no greater than that of the existing surface.

**907-411.02.5--Computerized Profilograph.** The computerized profilograph shall meet the applicable requirements of Subsection 401.02.6.6 with the following exceptions.

Delete the bump/dip requirements in the last paragraph of Subsection 401.02.6.6.1 on page 256.

Delete the sixth and seventh sentences of Subsection 401.02.6.6.3 on page 256.

**907-411.02.6--Surface Correction.** In the event surface correction is needed it shall be accomplished by removal and replacement in accordance with Subsection 403.03.4. All such corrections shall be at no additional cost to the State.

The finished pavement surface will be measured for riding quality.

**907-411.02.7--Nuclear Gauges.** Nuclear gauges shall meet the requirements of Subsection 401.02.7.

**907-411.03--Construction Requirements.** Mississippi DOT has adopted the “Hot-Mix Asphalt Paving Handbook” as the guideline for acceptable UTAP construction practices.

**907-411.03.1--Weather Limitations.** The mixture shall not be placed when weather conditions prevent the proper handling and finishing or the surface on which it is to be placed is wet or frozen. At the time of placement, the air and pavement surface temperature limitations shall be equal to or exceed 55°F for UHMA and 40°F for UWMA, regardless of the compacted lift thickness.

When paving operations are discontinued because of rain, the mixture in transit shall be protected until the rain ceases. The surface on which the mixture is to be placed shall be swept to remove as much moisture as possible and the mixture may then be placed subject to removal and replacement at no additional cost to the State if contract requirements are not met.

**907-411.03.2--Tack Coat.** Tack coat shall meet the requirements of Subsection 401.03.1.2.

**907-411.03.3--Bituminous Mixing Plants.** Bituminous mixing plants shall meet the applicable requirements of Subsection 410.03.2.

**907-411.03.4--Hauling Equipment.** Hauling equipment shall meet the requirements of Subsection 401.03.3.

**907-411.03.5--Bituminous Pavers.** Bituminous pavers shall meet the requirements of Subsection 401.03.4.

**907-411.03.6--Rollers.** All rollers shall meet the requirements of Subsection 401.03.5.

**907-411.03.7--Preparation of Grade.** The foundation upon which UTAP pavement is to be placed shall be prepared in accordance with Subsection 401.03.6.

**907-411.03.8--Preparation of Mixture.** The temperature of the mixture, when discharged from the mixer, shall not exceed 340°F for UHMA and 280°F for UWMA.

**907-411.03.9--Spreading and Finishing.** Spreading and finishing of UTAP shall be in accordance with Subsection 401.03.10.

**907-411.03.10--Joints.** Joints shall be constructed in accordance with Subsection 401.03.12.

**907-411.04--Method of Measurement.** Ultra-thin asphalt pavement, of the type specified, will be measured by the ton.

Bituminous Tack Coat for the ultra-thin asphalt pavement shall be measured by the gallon as in accordance with the provisions of Subsections 109.01 and 410.04.

**907-411-05--Basis of Payment.** Ultra-thin asphalt pavement, measured as prescribed above, will be paid for at the contract unit price per ton, which price shall be full compensation for completing the work.

Bituminous Tack Coat, measured as prescribed above, will be paid for at the contract unit price per gallon, which price shall be full compensation for completing the work.

Payment will be made under the following items:

- |  |              |
|--|--------------|
| 907-411-A: Ultra Thin Asphalt Pavement, Type | -per ton     |
| 907-411-B: Bituminous Tack Coat              | - per gallon |