



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

December 15, 2004

Addendum No. 2

RE: Contract ID: C201336
WBS # 39548.3.1
F. A. # IMS-77-1 (165) 25
Mecklenburg County (I-4756)
I-77 From NC-73 (Sam Furr Road)
To the Iredell County Line.

December 21, 2004 Letting

To Whom It May Concern:

Reference is made to the proposal form furnished to you on the above-mentioned project.

The following revision has been made to the proposal form:

On Page Nos. 42 thru 49, the entire project special provision entitled "Ultra-Thin Bonded Wearing Course" is being replaced. Please void Page Nos. 42 thru 49 in your proposal and staple the revised Page Nos. 42 thru 49-A thereto.

Sincerely,

A handwritten signature in black ink, appearing to read "R. A. Garris".

R. A. Garris, PE
Contract Officer

RAG/jag/pa
Attachments

cc: Mr. W. S. Varnedoe, PE
Mr. S. D. DeWitt, PE
Mr. E. C. Powell, PE
Mr. B. G. Payne, PE
Ms. D. M. Barbour, PE
Mr. Art McMillan, PE
Mr. J. V. Barbour, PE
Mr. Mark Staley (2)
Mr. Ayden Flowers
Mr. R. E. Davenport, Jr., PE
Ms. Marsha Byrd
Ms. Taylor Mishoe
Project File (2)

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LOCATION:
CENTURY CENTER COMPLEX
BUILDING B - ENTRANCE B 15
1020 BIRCH RIDGE DRIVE
RALEIGH NC

ULTRA-THIN BONDED WEARING COURSE:

11-01-2004

DESCRIPTION:

The work covered by this specification consists of the production and placement of an Ultra-thin Bonded Wearing Course (UBWC) and shall include the application of a warm Polymer-Modified Emulsion Membrane (PMEM) followed immediately with an Ultra-thin Bonded Wearing Course hot mix asphalt overlay. The polymer-modified emulsion membrane shall be spray applied immediately prior to the application of the hot mix asphalt overlay so as to produce a homogeneous wearing surface that can be opened to traffic immediately after rolling and upon sufficient cooling.

MATERIALS:

AGGREGATE:

A. General Requirements For Aggregate:

All aggregates, both coarse and fine, shall meet the applicable requirements of Section 1005 and Section 1012 of the Standard Specifications, except as modified herein.

Aggregates produced from crystalline limestone, crystalline-dolomitic limestone, or marble shall not be used in the production of Ultra-thin Bonded Wearing Course. Reclaimed asphalt pavement materials shall not be used in the production of Ultra-thin Bonded Wearing Course. Reclaimed asphalt shingle material, up to 6% by weight of total mix, may be used, subject to approval by the Engineer. Documentation that the asphalt binder grade meets the requirements may be required.

B. Coarse Aggregate:

Coarse aggregates used shall be from approved sources and shall meet the requirements of Table 1005-1 of the Standard Specifications, except as modified herein or unless otherwise approved by the Engineer.

Coarse aggregates, such as crushed gravel, limestone, dolomite, sandstone, granite, chert, traprock, ore tailings, slag, or other similar materials, or blends of two or more of the above may be acceptable. When coarse aggregates for these mixes are from more than one source or of more than one type of material, they shall be proportioned and blended to provide a uniform mixture, subject to approval by the Engineer. The coarse aggregates selected should be those typically used for high performance surfaces. Coarse aggregates should meet the skid resistance criteria as set forth by the Department and have a history of successful use in surface mixes for the intended traffic level.

Coarse aggregate material retained above the No. 4 sieve shall be from approved sources and shall meet the requirements listed in Table 1 below.

<u>TABLE 1 - COARSE AGGREGATE – PROPERTIES</u>		
Tests	Method	Limit
Los Angeles abrasion value, % loss	AASHTO T 96	35 max
Soundness, % loss, Sodium Sulfate	AASHTO T 104	15 max
Flat & Elongated Ratio, 5:1, + No 4 (4.75 mm)	ASTM D 4791	10 % max
% Crushed, single face	ASTM D 5821	100 min
% Crushed, two or more mechanically crushed faces	ASTM D 5821	85 min
Micro-Deval, % loss	AASHTO TP 58-02	18 max

C. Fine Aggregate:

The fine aggregate passing the No. 4 sieve shall be from approved sources and shall meet the requirements of Table 2 below.

<u>TABLE 2 - FINE AGGREGATE – PROPERTIES</u>		
Tests	Method	Limit
Sand Equivalent	AASHTO T 176	45 min
Uncompacted Void Content	AASHTO T 304	40 min

D. Mineral Filler:

When needed, hydrated lime, certain classes of fly ash, baghouse fines and Type 1 Portland Cement are acceptable as mineral filler. Mineral filler shall conform to the requirements of AASHTO M 17.

POLYMER-MODIFIED EMULSION MEMBRANE:

The Polymer-Modified Emulsion Membrane shall be a styrene-butadiene block co-polymer (SBS) modified asphalt emulsion. The purpose of the membrane is to form a water impermeable seal at the existing pavement surface and to bond the new hot mix to the existing surface. Polymer modification of the base asphalt shall be completed prior to emulsification. The emulsion shall be smooth and homogeneous and conform to the following requirements:

<u>Test On Emulsion</u>	<u>Method</u>	<u>Min.</u>	<u>Max.</u>
Viscosity @ 77°F, SSF	AASHTO T 59	20	100
Sieve Test, %	AASHTO T 59		0.1
24-Hour Storage Stability, % ⁽¹⁾	AASHTO T 59		1
Residue from Distillation @ 400°F, % ⁽²⁾	AASHTO T 59	63	

Oil portion from distillation			
ml of oil per 100 g emulsion			2
Demulsibility	AASHTO T 59	60	
35 ml, 0.02 N CaCl ₂ or			
35 ml, 0.8 % dioctyl sodium sulfosuccinate			

Test On Residue From Distillation

Solubility in TCE, % ⁽³⁾	AASHTO T 44	97.5	
Elastic Recovery, 50°F,			
20 cm elongation % ⁽⁴⁾	AASHTO T 301	60	
Penetration @ 77°F, 100 g, 5 sec, dmm	AASHTO T 49	60	150

- (1) After standing undisturbed for 24 hours, the surface shall show no white, milky colored substance, but shall be a smooth homogeneous color throughout.
- (2) AASHTO T-59 with modifications to include a 400°F ± 10°F maximum temperature to be held for a period of 15 minutes.
- (3) ASTM D 5546, Test Method for Solubility of Polymer-Modified Asphalt Materials in 1,1,1-Trichloroethane may be substituted where polymers block the filter in Method D 2042.
- (4) ASTM D 6084, Standard Test Method for Elastic Recovery of Bituminous Materials by Ductilometer with exception that the elongation is 20 cm and the test temperature is 50°F.

ASPHALT BINDER FOR PLANT MIX, GRADE PG 70-28:

Asphalt binder shall conform to the requirements of Section 620 and Section 1020 of the Standard Specification except as modified herein. The asphalt binder shall be a polymer modified Performance Graded PG 70-28, conforming to the requirements of AASHTO M 320 and as specified below, unless otherwise approved by the engineer. The asphalt binder shall be compatible with the PMEM and existing pavement. Modification to the binder shall be done with SBS, SB, or SBR polymer. Air blown asphalt is not permitted. Modification, testing, and certification of the asphalt binder shall be performed prior to delivery to the asphalt plant. Actual test results will be available to the Engineer prior to use.

In addition to the requirements of AASHTO M 320, the PG 70-28 asphalt binder shall meet the following criteria:

<u>Test on Binder</u>	<u>Method</u>		
Separation of Polymer, %	ASTM D5892	Report	10
<u>Tests On Residue From RTFO Test</u>			
Elastic Recovery, %	ASTM D 6084	Minimum	60

ANTI-STRIP ADDITIVE:

Anti-strip Additive shall meet the requirements of Articles 1020-8 or Article 1012-1(E) and shall be used in accordance with Article 620-3 of the Standard Specifications.

COMPOSITION OF MIX:

The ultra-thin bonded wearing course shall be composed of a mixture of coarse and fine aggregate, asphalt binder, mineral filler, and other additives when required. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the grading and physical requirements of TABLE 3 of these specifications for the specified mix type. The mix design and optimum asphalt content shall be performed in accordance with the "Ultra-thin Bonded Wearing Course Mix Design Guidelines" on file with the Department's Materials & Test Unit. Copies are available upon request. Materials which will not produce a mixture within the mix design criteria required by these specifications will be rejected, unless otherwise approved by the Engineer.

At least 10 days prior to start of asphalt mix production, the Contractor shall submit in writing a mix design and proposed job mix formula (JMF) targets for each required mix type and combination of aggregates to the Engineer for review and approval. The mix design and proposed job mix formula targets shall be submitted on forms and in a format approved by the Department and applicable requirements of Article 610-3 of the Standard Specifications.

The job mix formula target values will be established within the mix design criteria specified in TABLE 3 for the particular type mixture to be produced. The formula for each mixture will indicate the blend percentage of each aggregate fraction to be used, a single percentage of combined aggregate passing each required sieve size, the percentage and grade of asphalt binder (by weight of total mixture) to be incorporated into the mixture, the percentage of anti-strip additive to be added to the asphalt binder, and the temperature at which the mixture is to be discharged from the plant.

The Contractor shall have on hand at the asphalt plant the approved mix design and job mix formula issued by the Department, prior to beginning the work.

The job mix formula for each mixture shall remain in effect until modified in writing by the Engineer, provided the results of QMS tests performed on material currently being produced conform with specification requirements.

Should a change in sources of aggregate materials to be made, a new mix design and job mix formula will be required before the new mixture is produced.

When unsatisfactory results or other conditions make it necessary, the Engineer may establish a new job mix formula.

The Contractor shall determine and certify compatibility of all asphalt emulsion, asphalt binder, and aggregate components.

TABLE 3 – MIXTURE DESIGN CRITERIA				
Gradation Design Criteria (% Passing by Weight)				
SIEVES		1/2 in. Type A	3/8 in. Type B	1/4Type C
ASTM	mm			
3/4 inch	19.0	100		
1/2 inch	12.5	85 - 100	100	
3/8 inch	9.5	60 - 80	85 - 100	100
#4	4.75	28 - 38	28 - 42	40 - 55
#8	2.36	19 - 32	19 - 32	22 - 32
#16	1.18	15 - 23	15 - 23	15 - 25
#30	0.600	10 - 18	10 - 18	10 - 18
#50	0.300	8 - 13	8 - 13	8 - 13
#100	0.150	6 - 10	6 - 10	6 - 10
#200	0.075	4.0 - 7.0	4.0 - 7.0	4.0 - 7.0
MIX DESIGN CRITERIA				
Asphalt Content, %		4.6 - 5.6	4.6 - 5.8	5.0 - 5.8
Draindown Test, AASHTO T 305		0.1% max		
Moisture Sensitivity, AASHTO T 283*		80% min		
Application Rate, lb/ yd ²		90	70	50
Approximate Application Depth, in. (mm)		3/4 (19)	5/8 (16)	1/2(12.5)
Asphalt PG Grade, AASHTO M 320		PG 70-28	PG 70-28	PG 70-28

NOTE: *Specimens for T-283 testing are to be compacted using the Superpave gyratory compactor. The mixtures are to be compacted using 100 gyrations to achieve specimens approximately 95 mm in height. Mixture and compaction temperatures as recommended by the binder supplier.

CONSTRUCTION DETAILS:

A. Equipment:

The contractor shall use a paver designed and built for the purpose of applying Ultra-thin Bonded Wearing Course and approved by the Department. The paver shall be a self-priming paving machine capable of spraying the Polymer-Modified Emulsion Membrane, applying the hot asphalt concrete overlay and screeding the surface of the mat to the required profile and cross-section in one pass at any rate between 30 to 92 ft/minute (10-30 m/minute). The paving machine shall incorporate a receiving hopper, feed conveyor, storage tank for Polymer-Modified

Emulsion Membrane material, Polymer-Modified Emulsion Membrane emulsion single variable-width spray bar and a variable width, heated, vibratory-tamping bar screed. The screed shall have the ability to be crowned at the center both positively and negatively and have vertically and horizontally adjustable extensions to accommodate the desired pavement profile and widths. The sprayer system shall be capable of accurately and continuously monitoring the rate of spray and providing a uniform application across the entire width to be overlaid.

Compaction of the wearing course shall be performed with a steel double drum asphalt roller(s) with a minimum weight of 10 tons. Roller(s) shall be well maintained, in reliable operating condition and be equipped with functioning water system and scrapers to prevent adhesion of the fresh mix onto the roller drums. Adequate roller units shall be supplied so the compaction will be accomplished promptly following the placement of the material.

Requests for approval of equipment shall be made to the State Pavement Construction Engineer or his Representative prior to the start of any work. All other required equipment and tools shall be approved by the Engineer. All equipment and tools shall be maintained in satisfactory working condition at all times.

B. Surface Preparation:

The following items will be performed prior to the commencement of paving operations and paid for under the appropriate item numbers when included in the contract.

1. Manhole covers, drains, grates catch basins and other such utility structures shall be protected and covered with plastic or building felt prior to paving and also shall be clearly referenced for location and adjustment after paving.
2. Thermoplastic traffic markings symbols, characters, or other markings greater than $\frac{1}{4}$ inch in thickness on the existing pavement shall be removed.
3. Pavement cracks and joints greater than $\frac{1}{4}$ inch (6.3 mm) wide shall be cleaned and completely filled, leaving no more than a 2 inch overband and no thicker than $\frac{1}{4}$ inch over the existing pavement. The sealant will be applied per manufacturer's recommendation and approved by the Engineer.
4. Surface irregularities greater than 1" (25 mm) deep shall be filled with a material approved by the Engineer.
5. The entire pavement surface to be overlaid shall be thoroughly cleaned, giving specific attention to accumulated mud and debris. Pressurized water and/or vacuum systems may be required to ensure a clean surface.

C. Application of Ultra-thin Bonded Wearing Course:

Ultra-thin Bonded Wearing Course shall not be placed between October 31 and April 1. The pavement surface temperature shall be not less than 50°F (10°C) at the time of placement. The Ultra-thin Bonded Wearing Course shall not be placed on a wet pavement. A damp pavement surface is acceptable for placement if it is free of standing water and favorable weather conditions are expected to follow.

The Ultra-thin Bonded Wearing Course mixture shall be applied at the rate per square yard as shown in TABLE 3 for the mix type shown in the plans or typical sections, or as directed by the Engineer.

The Polymer-Modified Emulsion Membrane shall be sprayed at a temperature of 140 - 180°F (60-80°C). The sprayer system shall accurately and continuously monitor the rate of spray and provide a uniform application across the entire width to be overlaid. The rate of application (typically 0.15 to 0.25 gal/yd²) shall be determined by the mix design and current pavement condition for the specified project. The rate of application shall be approved by the Engineer prior to beginning work.

No wheel or other part of the paving machine shall come in contact with the Polymer-Modified Emulsion Membrane before the hot mix asphalt concrete wearing course is applied. The application of the HMA shall follow the spray of the Polymer-Modified Emulsion Membrane by no more than 3 seconds.

The hot asphalt concrete wearing course shall be placed over the full width of the polymer-modified emulsion membrane. The hot mix asphalt concrete shall be applied at a temperature of 300 - 330°F (150-165°C) or as approved by the engineer and shall be spread over the polymer-modified emulsion membrane immediately after the application of the membrane. The temperature of the mix at the asphalt plant shall be within ±15°F (±8°C) of the JMF temperature. The temperature of the mix immediately prior to discharge from the hauling vehicle shall be within +15°F (+8°C) to -25°F (-14°C) of the JMF temperature.

Note:

Because of the minimal depth of the hot mix asphalt concrete being placed, it may be damaged if opened to traffic too quickly. Therefore, the new pavement shall not be opened to traffic until the rolling operation is complete and the material has cooled sufficiently to resist damage. The cooling time will be brief due to the minimal depth of the mat.

D. Compaction:

Compaction of the wearing course shall consist of a minimum of two passes with a steel double drum asphalt roller before the material temperature has fallen below 185°F (85°C). At no time shall the roller or rollers be allowed to remain stationary on the freshly placed asphalt concrete. Compaction shall immediately follow the placement of Ultra-thin Bonded Wearing Course. A release agent (added to the water system) may be required to prevent adhesion of the fresh mix to the roller drum and wheels. Compaction shall be done in the static mode.

QUALITY MANAGEMENT SYSTEM FOR ASPHALT PAVEMENTS:

The Ultrathin Hot Mix Asphalt shall be produced in accordance with the applicable provisions of Section 609 of the Project Special Provisions titled "QMS for ASPHALT PAVEMENTS: (OGAFC, PADC, and ULTRATHIN VERSION)" included herein.

METHOD OF MEASUREMENT:

The quantity of Ultra-thin Hot Mix Asphalt, Type _____ to be paid for will be the actual number of tons of mixture which has been incorporated into the completed and accepted work. The hot mix asphalt pavement will be measured by being weighed in trucks on certified platform scales or other certified weighing devices.

The quantity of Application of Ultra-thin Hot Mix Asphalt to be paid for will be the actual number of square yards of mixture placement which has been completed and accepted. In measuring this quantity, the length will be the actual length constructed, measured along the surface. The width will be the width required by the plans or directed by the Engineer.

The quantity of "Asphalt Binder for Plant Mix, Grade PG 70-28" will be measured in accordance with Section 620-4 of the Standard Specification.

BASIS OF PAYMENT:

The quantity of ultrathin hot mix asphalt, measured as provided above, will be paid for at the contract unit price per ton for "Ultrathin Hot Mix Asphalt, Type _____".

The above price and payment shall include but not be limited to all labor, materials and equipment necessary to produce and deliver the mix, including binder and non-strip additive (if necessary). The unit price bid per ton for Ultrathin Hot Mix Asphalt shall include the asphalt binder. There will be no adjustment of payments due the Contractor due to asphalt binder base price fluctuation.

The quantity of application of ultrathin hot mix asphalt, measured as provided above, will be paid for at the contract unit price per square yard for "Application of Ultrathin Hot Mix Asphalt".

The above prices and payments shall include but not be limited to all traffic control, labor, materials, including the polymer modified asphalt emulsion, equipment necessary to produce and deliver the mix, including anti-strip additive (if necessary), equipment necessary to apply and compact the mix, and maintaining the ultrathin bonded wearing course until final acceptance of the project.

Providing QMS for asphalt pavements will be in accordance with the project special provision entitled "QMS for ASPHALT PAVEMENTS: (OGAFC, PADC, and ULTRATHIN VERSION)" included elsewhere in this provision form.

Payment will be made under :

Ultrathin Hot Mix Asphalt, Type A.....	Ton
Ultrathin Hot Mix Asphalt, Type B	Ton
Ultrathin Hot Mix Asphalt, Type C	Ton
Application of Ultrathin Hot Mix Asphalt.....	Square Yard

QUALITY MANAGEMENT SYSTEM FOR ASPHALT PAVEMENTS: 2-22-00
(OGAFC, PADC, AND ULTRATHIN HMA VERSION)

609-1 DESCRIPTION

The work covered by this provision consists of the production and construction of Open Graded Asphalt Friction Course, Permeable Asphalt Drainage Course, and/or Ultrathin Hot Mix Asphalt Concrete Wearing Surface, in accordance with a quality management system as described in these specifications. All provisions of Division 6 of the Standard Specifications, except as modified herein, shall apply.

609-2 DESCRIPTION OF RESPONSIBILITIES

(A) Quality Control:

The Contractor shall provide and conduct a quality control program. A quality control program is defined as all activities, including mix design when applicable, process control inspection, sampling and testing, and necessary adjustments in the process that are related to production of a pavement which meets all requirements of the specifications.