



South Carolina  
Department of Transportation

**MEMORANDUM**

**TO:** Rick Werts, Director of Traffic Engineering  
Jim Feda, Director of Maintenance  
Milt Fletcher, Materials and Research Engineer  
Edwin Eargle, Preconstruction Support Engineer  
Lee Floyd, Bridge Maintenance Engineer

**FROM:** C. R. Eleazer, Construction Engineer *CR. Eleazer*

**DATE:** August 18, 2009

**RE:** Supplemental Technical Specification entitled, "**Warm Mix Asphalt (WMA)**" dated September 1, 2009

Attached is a copy of the above Supplemental Technical Specification.

This Supplemental Technical Specification will be implemented for projects beginning with the **September 2009 Highway Letting** utilizing the new 2007 Standard Specification and shall only be used on State funded projects.

**Attachment**

CRE:mag

cc:

Federal Highway Administration  
Attn: Mr. David Law

M. T. Brunson, DEA Dist. 1  
P. M. Brooks, DEA Dist. 2  
S. Gwinn, DEA Dist. 3  
F. S. Bland, DEA Dist. 4

D. L. Townsend, DEA Dist. 5  
R. T. Clark, DEA Dist. 6  
J. A. H. Woodrum, DEA Dist. 7  
Attn: J. Kendall - Letting Preparation Manager  
Attn: M. Zwanka - Office of Materials & Research

File:Con/CRE



**Warm Mix Asphalt (WMA)****SCDOT Designation: SC-M-408 (09/09)**

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**1. SCOPE**

- 1.1 This is a preliminary specification intended for use in placing Warm Mix Asphalt (WMA) on state-funded projects only. WMA is a relatively new technology that is being considered by the Department and research is underway to study the materials, construction techniques, testing, and long-term performance of WMA in Department work. This specification will allow WMA to be used in the interim and is anticipated to be updated as research progresses.

This work consists of an asphalt mixture composed of mineral aggregate, aggregate screening, natural sand, asphalt binder, and hydrated lime mixed in an accepted asphalt hot mix plant. The mixtures will be produced in an asphalt plant that has been equipped with a foaming system or using a terminally blended chemical additive to produce Warm Mix Asphalt (WMA). All foaming asphalt plants and additives used for this type of technology must be accepted by the Asphalt Materials Engineer (AME) prior to production of this product. The asphalt mixes must be placed on a prepared surface in accordance with these Supplemental Specifications, applicable sections of the Standard Specifications, other appropriate Special Provisions and in conformity with the plans.

*Manuscript*  
8/18/09

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**2. REFERENCED DOCUMENTS**

- 2.1 SCDOT Standard Specifications
- 2.1.1 Division 300, Division 400, SC-M-401, SC-M-402, and SC-M-407
- 2.2 AASHTO Standards
- 2.2.1 AASHTO M303 and M320
- 2.3 SCDOT Test Methods
- 2.3.1 SC-T-70, SC-T-75, SC-T-80, and SC-T-84

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**3. MATERIALS**

- 3.1 Aggregate: Ensure that aggregates used in the production of Warm Mix Asphalt (WMA) meet the requirements found in the 2007 Standard Specifications section 401.2.2 and in SC-M-407 without exception.
- 3.2 Asphalt Binder: Ensure that the binder is a neat asphalt binder that complies with the requirements of the SCDOT Standard Specifications section 401.2.1.1 using only PG64-22. Chemical additive used in the production of the WMA will be blended with the PG Binder at the asphalt terminal only. PG Binders that have

been modified with chemical additives must be heat and storage stable and continue to meet AASHTO M 320.

- 3.3 Additives: Ensure that hydrated lime is incorporated into all mixes and meets the requirements of AASHTO M 303 Type 1. Ensure that the hydrated lime is blended with the damp aggregate at a rate of 1.0% +/- 0.1 % by weight of dry aggregate. Ensure that blending of the hydrated lime is accomplished according to subsection 401.2.1.3. Liquid Anti-Strip Agents (LASA) will not be permitted.

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**4. MIX DESIGN**

- 4.1 Warm mix designs utilize the same asphalt binder grade, aggregate and RAP sources, and material gradations as identically-formulated hot mix asphalt (HMA), although it may be in an HMA Contractor's benefit to provide additional equipment in their mix design laboratories to establish or simulate the foaming process to set optimum binder content and volumetric properties used in material acceptance. WMA mix designs utilizing a chemical additive will use asphalt that has been pre-blended from the asphalt terminal to establish mix design volumetric properties. Chemical manufacturers will provide documentation of proper mixing and compaction temperatures to produce and compact WMA mixtures. Ensure that WMA mixtures comply with SC-M-402.

Design WMA job mix formulas in accordance with SC-T-80. Ensure that all designs are accepted by the Materials and Research Engineer prior to use on SCDOT work. Ensure that mix designs are prepared in a laboratory approved by the AME and by technicians certified as a SCDOT Level 2S, HMA Job Mix Technician. Ensure that technicians are trained on the use of foaming equipment if necessary to provide mix designs that will comply with all specifications herein and in the applicable Standard Specifications, Supplemental Specifications, and Special Provisions.

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**5. WMA SYSTEMS**

- 5.1 Ensure that the WMA systems utilize a water injection system or an accepted chemical additive for the purpose of foaming the asphalt binder and lowering the asphalt mixture temperature. Use foaming equipment or a chemical additive that is compatible with the asphalt plant and acceptable to the AME in producing WMA, and ensure that asphalt plant conforms to SC-M-401.

Ensure that the burner in the aggregate dryer is properly adjusted so that there is not any burner fuel in the WMA.

5.2 Water Injection Foaming Systems

- 5.2.1 Ensure that injection equipment is tied into the computer in the plant control room so that metering of the injected water can be continuously monitored by the plant operator.

- 5.2.2 Ensure that injection systems have variable water injection that is automatically controlled by the plant production rate. Do not allow water injection system to exceed 2.0% water by weight of asphalt binder.

- 5.2.3 Ensure that the water injection rate cannot be manually overridden by the plant operator once established in the plant's computer.

- 5.2.4 Ensure that if the injection equipment stops water flow or when a control or equipment failure in the injection system occurs, the computer system immediately notifies the plant operator and all WMA production is stopped until the water injection system is repaired and checked.
- 5.2.5 Ensure that the water injects into the asphalt binder flow before the asphalt binder spray makes contact with aggregate. Do not allow water to come in contact with aggregate prior to binder spray.
- 5.2.6 Ensure that the injection equipment includes water storage and a pump control that is tied into the injection computer controls.
- 5.2.7 Ensure that the water flow alarm is installed in the control room to indicate a shortage of water in the storage tank, or a disruption in the water flow equipment.
- 5.2.8 Provide an additional asphalt binder sampling valve at the injection equipment to sample binder prior to the spray system.
- 5.2.9 Heat and prepare the materials in a manner that produces a warm mixture that, when discharged, is at a mixture temperature is maintained from 220 °F - 285°F. Use SC-T-84 to measure mix temperature at the plant and on the road.
- 5.3 WMA Chemical Additives
  - 5.3.1 Ensure that the chemical additive has been pre-blended at the asphalt terminal and has been documented on the Bill of Lading (BOL) coming from the asphalt supplier. Ensure that the percent chemical additive added to the PG 64-22 is printed on the BOL. Store the asphalt in a storage tank without any contamination from previous loads of virgin PG 64-22. Label asphalt storage tanks noting the addition of WMA chemical additives.
  - 5.3.2 Mead Westvaco Corporation's product Evotherm 3G® or an equivalent product must be accepted by the AME prior to use as a chemical additive in WMA.

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## 6. QUALITY CONTROL

- 6.1 Foaming Systems
  - 6.1.1 Provide the AME, at least 30 days prior to starting production, a QC Plan to document the manufacturer's established water injection target rate for foaming systems, and produce an outline with acceptable variations for production for their WMA systems. Provide in the QC Plan a target production temperature for the asphalt plant and acknowledge that the mixture will remain within 220 °F - 285°F at all times. Use SC-T-84 to measure the mix temperature at the plant and on the road.
- 6.2 Chemical Additives
  - 6.2.1 Provide the AME, at least 30 days prior to starting production, a QC Plan to document the manufacturer's suggestions for production for their WMA chemical additives. Provide in the QC Plan a target production temperature for the asphalt plant and acknowledge that the mixture will remain within 220 °F - 270°F at all times. Use SC-T-84 to measure the mix temperature at the plant and on the road.

- 6.3 Ensure that laboratory compaction ranges are established in the QC Plan used for making gyratory specimens for mix acceptance.
- 6.4 Ensure that all WMA samples taken for field determination of binder content are dried to constant weight prior to running SC-T-75 as outlined in the WMA QC Plan.
- 6.5 Perform Indirect Tensile Strength (ITS) testing using SC-T-70 at least one time during the first day's production, then at least once every 5 days thereafter. Forward the results by fax or e-mail to the District Asphalt Manager (DAM) and the AME immediately upon completion. Failure to comply with test specifications will cause the AME or DAM to immediately suspend production. Redesign the job mix formula for any WMA which fails to meet Tensile Strength Ratio (TSR) field requirements.

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**7. CONSTRUCTION**

- 7.1 Seasonal and Ambient Air Temperatures: Ensure that ambient air temperatures during placement of WMA follow the requirements set forth in subsection 401.4.4 of the Standard Specifications without exception.
- 7.2 Failure to comply with WMA mix temperature requirements as stated in the Contractors QC plan will result in no other mixes being produced from the same plant during WMA production as directed by the AME.

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**8. FIELD ACCEPTANCE**

- 8.1 During the production and quality control of WMA, make all necessary provisions to ensure that plant unit operations comply with SCDOT specifications regarding the production of HMA as stipulated in Division 310 and Division 401.

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**9. MEASUREMENT**

- 9.1 Measure and accept WMA mixtures by the ton placed.

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**10. PAYMENT**

- 10.1 WMA Mixtures will be paid for at the contract unit price which will be for full compensation for furnishing all materials, equipment, and labor. Payment will be made under:

Item No.	Pay Item	Unit
	WMA Base Course Type B	TON
	WMA Intermediate Course Type C	TON
	WMA Surface Course Type C	TON
	WMA Surface Course Type D	TON