Supplemental Technical Specification for **April 1, 2011**

Warm Mix Asphalt (WMA)

SCDOT Designation: SC-M-408 (04/11)

1. SCOPE

1.1 This is a specification intended for use in placing Warm Mix Asphalt (WMA) on primary and secondary routes with ADT less than 10,000 and truck volumes less than 15 percent.

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 a SCDOT qualified asphalt plant that has been equipped with a foaming system or uses additives listed on Qualified Product List No. 77 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 Manager 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. WMA will use the same acceptance criteria for conventional hot mix asphalt mixes.

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

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. Additives used in the production of the WMA may be pre-blended with the PG Binder at the asphalt terminal or introduced into the plantwith other metering equipment as stated in section 5.6. PG binders that have chemical additives added at the terminal or at the asphalt plant must be heat and storage stable and continue to meet AASHTO M 320.

3.3 Anti-Strip Additives: Ensure that hydrated lime is incorporated into all mixes and meets the requirements of AASHTO M 303 Type 1 regardless of mix type. 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.

3.4 Water: Ensure that potable water is used in water injection systems for foaming the asphalt binder.

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 a 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. WMA mix designs utilizing additives will use asphalt that may be pre-blended from the asphalt terminal or may be introduced by adding the correct dosage of additives to establish mix design volumetric properties. Additional equipment may be required by the WMA additive manufacturer in the design process to ensure the proper dosage and to achieve a homogenous mixture. Additive 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 Asphalt Materials Manager and by technicians certified as a SCDOT Level 2, 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, andSpecial Provisions.

5. FIELD REQUIRMENTS

5.1 Ensure that all WMA Systems or Additives used are listed on QPLNo. 77. WMA foaming systems and additives are used to allow lower asphalt mix temperature. Use foaming equipment or an additive that is compatible with the asphalt plant and acceptable to the Asphalt Materials Manager in producing WMA, and ensure that asphalt plant conforms to SC-M-401 after any modification. Ensure that the burner in the aggregate dryer is properly adjusted so that there is no burner fuel in the WMA.

5.2 Ensure that on any WMA foaming system, or when any new metering equipment is installed on a contractors plant, that a trial run is done so all plant controls and metering equipment can be verified to be working accurately prior to production. Prior to full production of WMA mixtures for the Department, the contractor's quality control manager will be responsible for verifying that all acceptance properties are within job mixtolerances as well as tensile strength ratio requirements during the trial run.

5.3 Ensure that all WMA mixtures are stored a maximum of 8 hours in a separate storage silo from conventional HMA mixtures. Extended overnight storage of WMA mixtures will notbe permitted.

5.4 Ensure that only one WMA foaming system or WMA additive is used during a day of production of WMA mixtures.

5.5 **Water Injection Foaming Systems**

5.5.1 The use of a water injection system is not permitted on an asphalt batch plant.

5.5.2 Ensure that the foaming system manufacturer can provide technical assistance to the WMA producer by having a representative on site in the event of issues arising during use of the system within 24 hours of identifying problem.

5.5.3 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.

5.5.4 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.

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

5.5.6 Ensure that in the event of control or equipment failure in the injection system occurs or if the injection equipment stops water flow the computer system immediately notifies the plant operator and all WMA production is stopped until the water injection system is repaired and checked by the contractor's quality control manager before WMA production resumes.

5.5.7 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.

5.5.8 Ensure that the injection equipment includes water storage and a pump control that is tied into the injection computer controls.

5.5.9 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.

5.5.10 Provide an additional asphalt binder sampling valve at the injection equipment to sample binder prior to the spray system.

5.5.11 Heat and prepare the materials in a manner that produces a warm mixture that, when discharged, is at a mixture temperature that can be maintained from **220ºF F - 285ºF (no exceptions).** Use SC-T-84 to measure mix temperature at the asphalt plant and on the road in the delivery trucks.

5.6 **WMA Additives**

5.6.1 Ensure that if the additive has been pre-blended at theasphalt terminal, it has been documented on the Bill of Lading (BOL) coming from the binder supplier. Ensure that the percent additive added to the PG 64-22 is printed on the BOL. Store the binder in a storage tank without any contamination from previous loads of virgin PG 64-22. Label binder storage tanks noting the addition of WMA additives. All other WMA additives must be clearly identified at the asphalt plant and the WMA producer must have all documentation for the additives readily available for review at the asphalt plant.

5.6.2 Ensure that the WMA additive and or metering equipment manufacturer can provide technical assistance to the WMA producer by having a representative on site in the event of issues arising during use of the system within 24 hours of identifying problem.

5.6.3 Ensure that the additive metering equipment is tied into the computer in the plant control roomso that metering of the non-terminally blended additives can be continuously monitored by the plant operator.

5.6.4 Ensure that metering systems can vary the amount of additives introduced into the asphalt plant and are automatically controlled by the plant production rate. Do not allow the WMA additive rate to go outside of the manufacturer's recommendations as stated in the WMA QC Plan, as stated in section 6. The recommendations should include a target dosage for the additives and upper and lower tolerance limits.

5.6.5 Ensure that if the additive equipment stops flow or if a control or equipment failure in occurs, the computer system immediately notifies the plant operator and all WMA production is stopped until the system is repaired and checked.

5.6.6 Heat and prepare the materials in a manner that produces a warm mixture that, when discharged, is at a mixture temperature that can be maintained from **220 ºF - 285ºF (no exceptions).** Use SC-T-84 to measure mix temperature at the asphalt plant and on the road in the delivery trucks.

6. QUALITY CONTROL

6.1 Provide the Asphalt Materials Manager, at least 30 days prior to starting production, a QC Plan to document the manufacturer's suggestions for target production rates when using water injection equipment in foaming systems or when usingchemical additives, and produce an outline with acceptable variationsthe asphalt plant and acknowledge that the mixture will remain within 220 ºF- 285ºF at all times.

6.2 Ensure that laboratory compaction ranges are established in the QC Plan used for making gyratory specimens for mix acceptance.

6.3 Ensure that all WMA samples taken for field determination of binder content are dried to constant weight if necessary prior to running SC-T-75as outlined in the WMA QCPlan.

6.4 When using Intermediate Type C, Surface Type CM or Surface Type C mix types, 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 30 days thereafter. Forward the results by e-mail to the Asphalt Materials Manager immediately upon completion. Failure to comply with Section 401.2.3.4 of the standard specifications will cause Asphalt Materials Manager to immediately suspend production. Redesign will be required for any job mix formula which fails to meet Tensile Strength Ratio (TSR) field requirements.

7. CONSTRUCTION

7.1 Seasonal and Ambient Air Temperatures: Ensure that ambient air temperatures and seasonal restrictions 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 section 6.1 and the Contractors QC plan will result in mix being rejected as directed by the Asphalt Materials Manager.

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.

9. MEASUREMENT

9.1 Measure and accept WMA mixtures by the ton or square yard placed.

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
4110320	WMA Base Course Type B	TON
41103XX	WMA Base Course Type C	TON
41103XX	WMA Base Course Type D	TON
411XXX	WMA Shoulder Widening Course	TON
4112330	WMA Intermediate Course Type C	TON
4113XX	WMA Surface Course Type CM	TON
4113340	WMA Surface Course Type C	TON
4113350	WMA Surface Course Type D	TON
4113XX	WMA Surface Course Type E	TON
4113XX	WMA Preventative Maintenance Course	SY