NTPEP Committee Work Plan for

Evaluation of Warm Mix Asphalt Technologies and Anti-Strip Additives

NTPEP Designation: [WMA-18-01]
INTRODUCTION

The National Transportation Product Evaluation Program (NTPEP) was established to minimize the amount of duplicative testing of transportation materials performed by AASHTO member states by providing a process where manufacturer/suppliers submit their products to NTPEP for laboratory and field testing. The results of the testing are then shared with member Departments for their use in product quality verification.

This work plan provides the NTPEP member departments information on the Warm Mix Asphalt Technologies testing program. In keeping with the NTPEP philosophy of purely testing materials, no conclusions are provided with the test results. The evaluation of the test results is left up to each member department.

1. SCOPE

1.1 This work plan covers the requirements and testing criteria for the National Transportation Product Evaluation Program (NTPEP) evaluation of Warm Mix Asphalt Technologies and Anti-Strip Additives. The National Transportation Product Evaluation Program (NTPEP) serves the member departments of the American Association of State Highway and Transportation Officials (AASHTO).

1.2 This work plan may involve hazardous materials, operations, and equipment. It does not purport to address all safety problems associated with its use. It is the responsibility of the user of this work plan to establish the appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. REFERENCED DOCUMENTS

2.1 AASHTO Standards:

- AASHTO M 320, Standard Specification for Performance-Graded Asphalt Binder
- AASHTO R15, Standard Practice for Asphalt Additives and Modifiers
- AASHTO T11, Standard Method of Test for Materials Finer Than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing
- AASHTO T 27, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
- AASHTO T 84, Standard Method of Test for Specific Gravity and Absorption of Fine Aggregate
- AASHTO T 85, Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate
- AASHTO T 96, Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- AASHTO T 104, Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
- AASHTO T 164, Standard Method of Test for Quantitative Extraction of Asphalt Binder from Hot Mix Asphalt (HMA)
- AASHTO T 166, Standard Method of Test for Bulk Specific Gravity (Gmb) of Compacted Hot Mix Asphalt (HMA) Using Saturated Surface-Dry Specimens
- AASHTO T 168, Standard Method of Test for Sampling Bituminous Paving Mixtures
- AASHTO T 176, Standard Method of Test for Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test
- AASHTO T 209, Standard Method of Test for Theoretical Maximum Specific Gravity (Gmm) and Density of Hot Mix Asphalt (HMA)
- AASHTO T 255, Standard Method of Test for Total Evaporable Moisture Content of Aggregate by Drying
- AASHTO T 269, Standard Method of Test for Percent Air Voids in Compacted Dense and Open Asphalt Mixtures
- AASHTO T 275, Standard Method of Test for Bulk Specific Gravity (Gmb) of Compacted Hot Mix Asphalt (HMA) Using Paraffin-Coated Specimens
- AASHTO T 283, Standard Method of Test for Resistance of Compacted Hot Mix Asphalt (HMA) to Moisture-Induced Damage
- AASHTO T 304, Standard Method of Test for Uncompacted Void Content of Fine Aggregate
- AASHTO T 312, Standard Method of Test for Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor
- AASHTO T 315, Standard Method of Test for Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)
AASHTO T 324, Standard Method of Test for Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)

AASHTO T 327, Standard Method of Test for Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus

AASHTO T331 Standard Method of Test for Bulk Specific Gravity (Gmb) and Density of Compacted Hot Mix Asphalt (HMA) Using Automatic Vacuum Sealing Method

AASHTO T 335, Standard Method of Test for Determining the Percentage of Fracture in Coarse Aggregate

AASHTO T 350, Multiple Stress Creep Recovery (MSCR) Test of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)

AASHTO R 35, Standard Practice for Superpave Volumetric Design for Hot Mix Asphalt (HMA)

AASHTO PP 60, Standard Practice for Preparation of Cylindrical Performance Test Specimens Using the Superpave Gyratory Compactor (SGC)

2.2 ASTM Standards:

ASTM D 3549, Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens

ASTM D 3625, Standard Practice for Effect of Water on Bituminous-Coated Aggregate Using Boiling Water

ASTM D 4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

ASTM D 5404, Standard Practice for Recovery of Asphalt from Solution Using the Rotary Evaporator


ASTM E 1252, Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis

2.3 Other documents:

TRB Research Results Digest 370 Guidelines for Project Selection and Materials Sampling, Conditioning, and Testing in WMA Research Studies
3. **TERMINOLOGY**

3.1 *Air voids (Va)* – The total volume of small pockets of air between the coated aggregate particles throughout a compacted paving mixture, expressed as a percent of the bulk volume of the compacted paving mixture.

3.2 *Anti-Strip Additives (ASA)* - Anti stripping additives are the chemical compounds, which renders minimum stripping (breaking) of bonds between the aggregate surface and the bitumen. The stripping is attributed to water which gets between the bitumen film and the aggregate surface.

3.3 *Chemically-Processed Warm Mix Asphalt* – Asphalt mixing process which includes technologies that use additives to improve coating, mixture workability, and compaction, as well as adhesion promoters.

3.4 *Foaming-Processed Warm Mix Asphalt* – Asphalt mixing process which includes processes that introduce small amounts of water to hot asphalt, either via a foaming nozzle, damp aggregate, or a mineral filler such as zeolite to reduce viscosity of the binder.

3.5 *LMLC* – Lab mixed, laboratory compacted.

3.6 *Organic-Additive Warm Mix Asphalt* – Asphalt mixing process which includes technologies that use synthetic wax additives specifically engineered to achieve the temperature reduction by reducing viscosity of the binder.

3.7 *PMLC* – Plant mixed, laboratory compacted.

3.8 *Voids in the mineral aggregate (VMA)* – The volume of the intergranular void space between the aggregate particles of a compacted paving mixture that include air voids and the effective binder content, expressed as a percent of the total volume of the specimen.

3.9 *Voids filled with asphalt (VFA)* – The percentage of the VMA filled with binder (the effective binder volume divided by the VMA).

3.10 *Warm Mix Asphalt (WMA)* – Warm mix asphalt refers to asphalt concrete mixtures that are produced at temperatures approximately 50°F (28°C) or less than typically used in the production of hot mix asphalt. The goal with warm mix asphalt is to produce mixtures with similar strength, durability, and performance characteristics as hot mix asphalt using substantially reduced production temperatures.

4. **SUMMARY OF WORK PLAN**

4.1 The WMA and ASA Technologies program operates with capabilities of AASHTO member departments and private testing facilities. Individual Manufacturers/suppliers are assessed a testing fee that covers costs for actual laboratory testing by either state highway agencies or an approved testing facility. A portion of the testing fee is used for maintaining the online data repository and reports that are accessible to all member departments and other end users.

4.2 This document is furnished for the benefit of Manufacturers interested in participating in the program by submitting their products and AASHTO Member Departments that are interested in reviewing and utilizing the data generated through this product evaluation. The testing format has been established to provide the end user with test results which can be used to assess the performance of WMA technologies applied to traditional hot-mix asphalt production.
Manufacturers are encouraged to submit technologies that they believe will perform well and meet the demands of the highway industry.

4.3 This work plan defines the evaluation procedures for WMA and ASA Technologies which will serve as the standard testing protocol for AASHTO’s National Transportation Product Evaluation Program for these products.

4.4 The testing facility will be either a state highway laboratory, university laboratory, or a private entity appropriately equipped and capable of performing the required laboratory tests. All laboratories performing these evaluations shall be contracted through AASHTO NTPEP. AASHTO NTPEP testing programs do not provide pass/fail acceptance criteria.

4.5 Evaluation reports will provide performance data and AASHTO does encourage member departments to take advantage of the program. However, the state highway agency will make the final determination regarding specification compliance and use of the products based on the data that is reported. WMA/ASA technologies may be evaluated by multiple agencies at different facilities, but for every WMA/ASA technology tested, a control material of Hot Mix Asphalt (HMA) with comparable constituents as the WMA/ASA must be tested in the same manner as the WMA/ASA for direct comparison. The constituent materials shall be selected by the testing facility.

5. **SIGNIFICANCE AND USE**

5.1 This work plan utilizes laboratory testing to determine properties and evaluate the performance of WMA and ASA Technologies. Acceptability of each material based upon the data generated as a result of the testing and evaluation in this work plan is the responsibility of the user. Manufacturer’s Participation

5.2 Manufacturers of Technologies for WMA and ASA who elect to participate in the AASHTO NTPEP program must submit a completed NTPEP Product Evaluation Form (PEF) to the attention of the AASHTO NTPEP Coordinator. This process is completed electronically through the NTPEP Data Mine program. For the purposes of this testing program, products intended for any non-highway applications will not be evaluated.

5.3 Under agreement with The American Road & Transportation Builders Association (ARTBA), this committee has two industry representatives. This ensures that industry concerns, experience, and technical knowledge are considered in the testing and evaluation of products, material, and/or devices that are commonly used by the AASHTO Member Departments.

5.4 The evaluation process requires laboratory testing on laboratory mixed, laboratory compacted (LMLC) samples using the same aggregate source(s) (selected by the testing facility) for all technologies and the HMA control mix. The same asphalt binder source (selected by the testing facility) shall be used for all technologies and the HMA control mix, except where a WMA additive must be pre-blended with the binder the WMA supplier shall provide the same binder with and without the additive. The WMA and ASA additive shall be provided by the Manufacturer. When the warm mix technology is dependent on the use of specialized plant equipment or processes, test specimens shall be Plant Mix, Laboratory Compacted (PMLC). Sampling will be conducted at the plant by approved NTPEP representatives. For the purpose of providing a direct comparison between the WMA process and HMA process, samples of asphalt produced at warm mix and hot mix temperatures will be collected at the plant during the same production time frame. Care must be exercised by the producer to insure the component materials...
are as similar as possible between the WMA and HMA products. When a product has demonstrated compliance, it will be deemed “Laboratory Compliant”.

5.5 Test materials shall be labeled with traceable sample numbers to WMA produced.

6. **TEST METHODS**

6.1 The standard tests and methods are detailed in this work plan.

6.2 The Lead State and the NTPEP Evaluation of WMA and ASA Technologies Technical Committee shall address any questions regarding the testing procedures or exceptions to any testing procedure.

7. **TEST REPORT**

7.1 The primary testing facility is responsible for entering data generated in its facility and reviewing any data generated at subcontracted facilities in the NTPEP online database.

7.2 All information noted in the Test Report Section of this work plan shall be included in the test report.

8. **PRODUCT SUBMISSION GUIDELINES**

8.1 This testing program will accept products on a rolling submission cycle.

8.2 The AASHTO NTPEP Coordinator and Lead State will verify receipt of testing fees and all appropriate documentation.

8.3 Once the Manufacturer is notified the technology has been accepted for evaluation, the testing facility will request that the Manufacturer submit clearly marked samples of the products. For technologies that use specialized plant equipment or processes, State Department of Transportation (DOT) representatives will select samples and ship to the testing facility.

8.4 The testing facility shall notify the Lead State and the AASHTO NTPEP Coordinator of receipt of samples for evaluation.

8.5 When the laboratory testing has been started, the Manufacturer is bound by the Non-Interference Policy as detailed in the General Terms and Conditions Section of submittal documents. After this time all written or verbal correspondence between the Manufacturer and the Testing Laboratory or Installation Facility must be done through the Lead State. Any implication of interference from the Manufacturer during the testing and evaluation process will be cause for the evaluation to cease. Any written or verbal communication between the Manufacturer and the Testing Facility or Installation Facility that is not shared with the NTPEP Coordinator or the Lead State will be considered a violation of the Non-Interference Policy.

8.6 Once a Manufacturer has submitted a product and a NTPEP sample ID has been assigned, the Manufacturer and product name will remain the same throughout the reporting cycle.
9. **POLICIES FOR WITHDRAWING MATERIALS FROM NTPEP EVALUATION OF WMA AND ASA TECHNOLOGIES**

9.1 A written or email request to withdraw the product from the evaluation cycle must be received by the NTPEP Coordinator at least five (5) business days before scheduled sampling is to occur. If sampling has occurred, a handling fee of ten (10) percent of the testing fee will be charged in addition to any laboratory test costs that may have been incurred for evaluation. Results released through the NTPEP Data Mine up until the time of withdrawal will be removed. In this event, the material will be listed in the final report with a note that it was withdrawn from the evaluation program.

10. **POLICY FOR REVIEW OF NTPEP REPORTS**

10.1 The NTPEP Information and Operations Guide contains policies for review of reports. A copy of the guide may be viewed and downloaded from the NTPEP website at: www.ntpep.org.

11. **TESTING AND REPORTING REQUIREMENTS**

11.1 The following information defines the laboratory evaluation procedures consisting primarily of AASHTO and ASTM tests for the evaluation of WMA and ASA Technologies. It should be noted that this evaluation program is intended for structural asphalt mixtures; thus, bituminous seals, coatings, preservation, or other experimental materials are not included as part of this work plan. The evaluation procedures included herein will serve as the standard for NTPEP in serving the AASHTO states.

11.2 Results of the laboratory evaluations will be entered directly into the WMA and ASA Technologies module of DataMine.

12. **MATERIAL CRITERIA**

12.1 The study will accept submittals from the following WMA categories:

12.1.1 **Foaming-Processes** include processes that introduce small amounts of water to hot asphalt, either via a foaming nozzle, damp aggregate, or through mineral filler such as zeolite to reduce binder viscosity.

12.1.2 **Chemical-Additives** include technologies that use a combination of emulsification agents, surfactants, polymers, and additives to improve coating, mixture workability, compaction, and adhesion. The chemical additive is used either in the form of emulsion or added to binder prior to or during the mix production process.

12.1.3 **Organic-Additives** include technologies that use synthetic wax additives engineered specifically to achieve the temperature reduction by reducing viscosity of binder.

12.1.4 **Other technologies** – Technologies that do not fit into the above categories, but allow the producers of asphalt pavement material to lower the temperatures at which the material is mixed and placed on the road.

12.2 The evaluation will accept submittals from the following Liquid ASA categories:
12.2.1 **Amine Chemistry** - Organic compound whose functional group containing an N atom with a lone pair of e- and at least one H atom replaced with an alkyl or aryl group (hydrocarbons).

12.2.2 **Phosphate Ester Chemistry** – Liquid additive product of reaction between phosphoric acid and alcohol.

12.2.3 **Other categories** – Other product categories will also be accepted. Documentation of the chemistry of the product will be required.

12.3 Submittals to NTPEP may be limited per Manufacturer per year. A generic material composition description and Material Safety Data Sheet (MSDS) must accompany the submittal for classification purposes. Any additives used in addition to the WMA and ASA technology shall be documented by the manufacturer. The aggregates used will be 100% virgin - no recycled asphalt pavement or shingles will be used.

13. **TESTING FACILITY CRITERIA**

Candidate facilities to be considered for classification as an authorized testing facility for AASHTO NTPEP shall meet the following requirements:

13.1 **Facilities Requirements:**

13.1.1 Provide documentation to demonstrate experience in performing testing of asphalt materials and mixtures.

13.1.2 Provide verification that it has the equipment, facilities, and capability to perform the required testing procedures contained in this work plan. The laboratory shall provide a list of equipment that it uses for testing bituminous materials and mixtures.

13.1.3 Identify its policies regarding qualifications and training of its staff to ensure a high-quality level of performance. This shall include performance reviews of testing proficiencies and Standard Operating Procedures for each testing procedure as detailed in the Quality Control/Quality Assurance portion of this document.

13.1.4 Identify the administrative procedures that have been implemented to ensure a high-quality level of comparative testing results.

13.1.5 Provide verification that the facility is in conformance with Federal and State regulations related to health and safety.

13.1.6 Provide verification that the facility has performed all testing procedures in conformance with requirements of the specified individual test methods. The testing facility shall hold accreditation through the AASHTO Accreditation Program, for the testing performed under this program.

13.1.7 Complete all laboratory testing of the WMA and ASA materials within three (3) months from the date samples are received.

13.2 **Personnel Requirements:**

13.2.1 Provide an organizational chart that identifies the names and positions of management personnel and each person that will be involved in, or associated with, testing and the review of the
AASHTO NTPEP reports. A laboratory Quality Control Manager shall be designated for review of all Standard Operating Procedures and Proficiency evaluations of technicians as described.

13.2.2 Provide resumes or credentials for all persons identified in the organizational chart. It is recommended that the responsible person supervising the laboratory and the staff performing the testing have adequate levels of formal education.

13.3 Quality Control/Quality Assurance:

13.3.1 The laboratory shall identify the procedures being used to ensure a quality level of testing. The process used for quality control should be based upon statistically evaluated conclusions. The conclusions should verify that the laboratory is capable of producing testing results that are accurate and reproducible. The preferred technique for comparative conclusions is to obtain results based on tests performed on identical samples by other laboratories that are statistically evaluated for their comparative similarity. The comparative testing must be performed using the testing procedures required by AASHTO NTPEP.

13.3.2 Testing proficiencies of all technicians shall be evaluated and documented by the laboratory Quality Control Manager. These evaluations shall be performed at six (6)-month intervals unless the technician does not routinely perform the test. In this case, proficiency of the technician shall be evaluated and documented prior to testing of products for this program.

13.4 Testing Capability:

13.4.1 The testing facility shall be comprised of a single entity or the combination of no more than three (3) entities.

13.4.2 When more than one facility is used, a single lead facility shall be responsible for the coordination and oversight of all testing and reporting and for the compilation of the final report. The lead facility is responsible for identifying the tests that will be subcontracted and for providing the qualification, experience, and quality control programs of each of the facilities for review and approval of AASHTO NTPEP. Subcontracted facilities cannot be changed without the approval of AASHTO NTPEP.

14. LABORATORY EVALUATION OF WARM MIX ASPHALT AND ANTI-STRIP ADDITIVES

The intent of this evaluation is, as much as possible, to compare mixes prepared at the same air voids content containing various WMA and ASA technologies to HMA control mixes using the same aggregate and binder to determine relative performance. WMA technologies will be compared to a single control mix while ASA technologies will be compared to two (2) control mixes that only vary in coarse aggregate type. All evaluations of products will be based on manufacturer’s dosage rates. Samples with the WMA additive shall be prepared at the reduced temperature recommended by the manufacturer.

The asphalt binder used in the program for the LMLC samples will be a neat binder, unmodified by polymer or polyphosphoric acid, graded as a PG 64-22.

In the case of a WMA technology which requires pre-blending with the binder, the manufacturer will provide sufficient quantities of the same binder with and without the WMA technology for
sample preparation. Laboratory testing will be performed on LMLC samples prepared by the testing laboratory. In the case of WMA technologies involving specialized plant equipment or processes, the WMA technology producer shall, in the presence of an NTPEP representative, collect plant mixed samples and compact as detailed below to avoid reheating. After completing the mixture preparation, place the loose mix in a shallow, flat pan. Heat the mixture in a forced-draft oven at compaction temperature for not less than one hour and not more than two hours. Every attempt should be made to minimize the amount of time that the material is held at mixing temperature in the oven. Plant mix produced at both warm and hot mix temperatures must be as similar as possible to minimize variability between the two. Samples shall remain in the possession of the NTPEP representative for submission to the testing laboratory.

Conditioning of specimens shall be in accordance with TRB Research Results Digest 370 Guidelines for Project Selection and Materials Sampling, Conditioning, and Testing in WMA Research Studies.

14.1 **Additive Fingerprint using FTIR (WMA & ASA):** Obtain a reference infrared spectrum (FTIR) from a representative WMA or ASA additive sample in accordance with ASTM E1252, with a resolution of at least 4 cm	extsuperscript{-1} and a range of 4000 cm	extsuperscript{-1} to 600 cm	extsuperscript{-1}. The uploaded scan will also include the 1) Manufacturer Name, 2) Product Name, 3) NTPEP Number, 4) Lot Number, 5) Lab ID, and 6) Date. Laboratory project identification may also be included, but is not required. In order to maintain confidentiality of proprietary information, IR scans will be not be published as part of evaluation reports. IR Scans will be password protected and available to NTPEP member states through DataMine.

14.2 **Binder Testing (WMA & ASA):** Determine the continuous grade of the base binder and the warm mix or ASA modified binder per AASHTO M320 and M332. Also report the asphalt binder complex shear modulus G\* in Pascals and phase angle, δ, in degrees at an angular frequency of 10 rads/sec for a minimum of three temperatures as determined by AASHTO T315. Report the binder non-recoverable creep (Jnr) and Creep Recovery (R%) as determined by AASHTO T350.

For technologies which require pre-blending with the binder, sufficient quantities of the additive shall be submitted to the testing laboratory from the manufacturer to prepare the samples.

14.3 **Aggregate Testing (WMA & ASA):** Two aggregate sources (selected by the testing facility – one limestone based, one granite based) shall be used for laboratory sample preparation for all ASA technologies and control (HMA) mixes. A single aggregate source (selected by the testing facility) shall be used for laboratory sample preparation for all WMA technologies and control (HMA) mixes. For technologies using plant processes, samples representing the compared WMA and HMA mixes shall be tested. In the case of WMA produced by specialized plant equipment or processes, Contractor quality control (QC) data shall be submitted by the Manufacturer from aggregate tests conducted prior to production of the test mixtures. Data must be determined for the following aggregate properties: gradation, bulk specific gravity, absorption, stockpile moisture content, coarse aggregate angularity, fine aggregate uncompacted void content, flat and elongated particles, and sand equivalent value. For gradation properties, AASHTO T 27 will be employed, while bulk specific gravity and absorption details will be obtained through AASHTO T 84 and T 85 procedures.

14.4 **Mixture Volumetric Testing (WMA & ASA):** Conduct mixture design verification with 150-mm diameter and 115-mm high SGC specimens at the design number of gyrations (N\textsubscript{design}). Condition all LMLC mixes in accordance with R30 and Appendix X2 of R35.
14.5 **Mixture Performance Testing:** All laboratory test specimens shall be prepared from laboratory mixed materials, except in the case of WMA technologies involving specialized plant equipment or processes, PMLC test specimens shall be prepared.

14.6 **Compactability (WMA & ASA):** All mixes shall meet the recommended compactability criteria stated in AASHTO R35 Appendix X2. Condition all LMLC mixes in accordance with Appendix X2 of R35.

14.7 **Rutting (WMA & ASA):** Hamburg rut testing (AASHTO T 324) shall be conducted on samples conditioned in accordance with AASHTO R30 short term conditioning procedure for mechanical properties. Specimens shall be prepared in accordance with AASHTO PP 60, followed by measurement of bulk specific gravity (AASHTO T 166, T 275 or T331) and calculation of air voids per specimen (AASHTO T 269). Fabricate SGC specimens to the specific height of the plastic insert. No trimming of the specimens is allowed other than trimming along a secant line (or chord) to join together the specimens in the molds. The test temperature shall be 50°C. Air void tolerance of test specimens will be 7.0% +/- 0.2%. 20,000 passes will be run, or until both sets of specimen’s exhibits 15mm of rutting, whichever comes first. The same number of wheel passes will be run on each side during the test, to allow for averaging of wheel path results for reporting. AASHTO T 283 and T 324 tests shall be run on LMLC specimens, except use PMLC samples for technologies that require plant production.

14.8 **Moisture Susceptibility (WMA & ASA):** Bulk mixture test specimens shall be compacted to 4 inch diameter. The amount and type of anti-strip additive included in test mixture shall be recorded and the WMA Appendix to AASHTO R 35 shall be followed for evaluation of moisture sensitivity using AASHTO T 283. All specimens that comprise an average (Control or WMA/ASA) shall be within 0.5% air void range. Each group average of air voids shall be within +/- 0.2% of 7.0%. The WMA and/or ASA group air voids shall be equal to or lower than the control group air voids. Specimens shall be conditioned in accordance with AASHTO R30 long-term conditioning requirements. One (1) freeze/thaw cycle shall be included in the test sequence. AASHTO T 283 and T 324 tests shall be run on LMLC specimens, except use PMLC samples for technologies that require plant production. Photos of the dry and moisture conditioned specimens will be captured and posted as part of the evaluation.

14.9 **Ten Minute Boil Test (ASA):**

14.9.1 Prepare approximately 1000 grams of mineral aggregate passing the ½ inch sieve and retained on the No. 4 sieve.

14.9.2 Heat the mineral aggregate and approximately 1 ¼ quarts of asphalt binder to 300 ± 10°F for 30 minutes.

14.9.3 Prepare 1 can with 100 grams of asphalt binder and appropriate dosage of anti-strip additive stirring thoroughly. Prepare 1 can with 100 grams of asphalt binder only.

14.9.4 Age both the ASA Binder, and the control binder in an oven at 320°F (+/-5F) for 24 hours (+/-2 hours). The can will be covered by a perforated friction lid during the aging process. This is unless the manufacturer recommends a different blending process.

14.9.5 Weigh out 250 grams of hot aggregate in a beaker and add 5% (12.5 grams) of the asphalt binder for the control mix and thoroughly blend. Weigh out 250 grams of hot aggregate in a second beaker and add 5% (12.5 grams) of the asphalt binder with ASA mixture and thoroughly blend.

14.9.6 Complete testing on these samples according to ASTM D 3625.
14.9.7 Photos of the pre and post-test material will be taken and posted as part of the evaluation.

15. SUMMARY OF LABORATORY TESTS:

**Binder:**

<table>
<thead>
<tr>
<th>PROPERTY (WMA &amp; ASA)</th>
<th>STANDARD</th>
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<tbody>
<tr>
<td>Continuous Grade of Asphalt Binder</td>
<td>AASHTO M320, M332, T315 and T350</td>
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<tr>
<td>Continuous Grade of Warm Mix modified asphalt binder</td>
<td>AASHTO M320, M332, T315 and T350</td>
</tr>
<tr>
<td>Continuous Grade of Extracted Binder</td>
<td>AASHTO T164 Method A, M320, M332, T315 and T350</td>
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**Aggregates:**

<table>
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<tr>
<th>PROPERTY</th>
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<tr>
<td>Gradation</td>
<td>AASHTO T 27</td>
</tr>
<tr>
<td>Bulk specific gravity and absorption</td>
<td>AASHTO T 84 and T 85</td>
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<tr>
<td>Flat and elongated or AIMS method</td>
<td>ASTM D 4791 or use state or contractor data</td>
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<tr>
<td>Sand equivalent</td>
<td>AASHTO T 176 or use state or contractor data</td>
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<tr>
<td>Stockpile moisture content</td>
<td>AASHTO T 255 or use state or contractor data</td>
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<tr>
<td>Coarse aggregate angularity</td>
<td>AASHTO T 335 or use state or contractor data</td>
</tr>
<tr>
<td>Fine aggregate uncompacted voids</td>
<td>AASHTO T 304 or use state or contractor data</td>
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<tr>
<td>Geologic type</td>
<td>Use state or contractor data</td>
</tr>
<tr>
<td>Soundness</td>
<td>AASHTO T 104 or use state or contractor data</td>
</tr>
<tr>
<td>LA abrasion or Micro Deval test</td>
<td>AASHTO T 96 or T 327, or use state or contractor data</td>
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**Mixture Volumetric:**

<table>
<thead>
<tr>
<th>PROPERTY (WMA &amp; ASA)</th>
<th>STANDARD</th>
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<tbody>
<tr>
<td>Theoretical maximum specific gravity and density of HMA</td>
<td>AASHTO T 209 or ASTM D 6857</td>
</tr>
<tr>
<td>Preparing and Determining Density of HMA Specimens by Means of Superpave Gyratory Compactor</td>
<td>AASHTO R35 and T 312</td>
</tr>
<tr>
<td>Practice for Superpave Volumetric Design for HMA</td>
<td>AASHTO R35</td>
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**Mixture Performance**

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>STANDARD</th>
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Mixture design verification with 150-mm diameter (WMA & ASA)  
Rutting (WMA & ASA)  
Compactability (WMA & ASA)  
Moisture Susceptibility (WMA & ASA)  
Ten Minute Boil Test (ASA)

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Reference</th>
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<tbody>
<tr>
<td>Mixture design verification with 150-mm diameter (WMA &amp; ASA)</td>
<td>AASHTO M 323</td>
</tr>
<tr>
<td>Rutting (WMA &amp; ASA)</td>
<td>AASHTO T 324</td>
</tr>
<tr>
<td>Compactability (WMA &amp; ASA)</td>
<td>AASHTO R35 Appendix X2, Section 8.3</td>
</tr>
<tr>
<td>Moisture Susceptibility (WMA &amp; ASA)</td>
<td>AASHTO T 283</td>
</tr>
<tr>
<td>Ten Minute Boil Test (ASA)</td>
<td>ASTM D3625</td>
</tr>
</tbody>
</table>

16. TEST REPORT REVIEW AND TEST RESULT APPEALS

16.1 Each NTPEP contract laboratory will submit the DataMine data to the lead state Coordinator and the NTPEP Manager within 20 business days after completion of all testing. Each manufacturer will receive a copy of the portion of the report dealing with their specific products. The manufacturer will review the data and may appeal the results of the testing program in accordance with the AASHTO/NTPEP appeals procedures. Re-testing of the materials will be performed by the NTPEP contract laboratory, and only on the relevant sample and parameter being questioned. No additional sample material will be received for re-testing. Prior to re-test, the manufacturer/supplier making the appeal shall submit a fee to NTPEP to cover the costs of re-testing. The lead state Coordinator and NTPEP Manager will determine if the results of the re-test uphold the appeal. Upon agreement between the organization appealing the test results and the NTPEP Manager, either the original set or re-test set of data shall be published. If the appeal is upheld and the re-test data is published, the re-testing fee shall be reimbursed to the submitting organization.

16.2 Withdrawal of Product after Testing
If after following the review and appeals process the manufacturer chooses to withdraw a product, the results will be published in DataMine but be restricted to registered state users. Manufacturers can resubmit their product in the next test cycle, but previous results will also remain available to registered state users.

17. RESUBMITTAL TESTING FREQUENCY

17.1 Any changes made to WMA or ASA Technologies require re-submittal to NTPEP for evaluation.

17.2 Technologies that have not changed are required to be resubmitted and tested every seven (7) years. A signed certification from the Manufacturer will be required with the seven year re-submittal stating that the technology has not changed since the original submission.

18. TESTING FEES

18.1 Product submittal testing fees are to be paid at time of application. Manufacturers may choose to submit products to be tested as a WMA technology, ASA technology, or both according to the testing fee structure.

18.2 Testing fees are assessed to cover all costs associated with laboratory testing, material installation, field evaluation, administrative costs incurred by the NTPEP lead state, report (electronic) generation and distribution by AASHTO, document preparation, and distribution to AASHTO
member departments. Specific pricing for submission of products may be found at www.ntpep.org.

18.3 Laboratories will be reimbursed for testing performed if a system or technology is withdrawn after testing has begun. If the Manufacturer elects to withdraw initial samples after testing begins and resubmit products, the Manufacturer will be charged additionally for all costs incurred by the laboratory during the initial testing.

19. **KEYWORDS**

DataMine; NTPEP; warm mix asphalt; anti-strip additive; asphalt