

**DRAFT**  
**New England Regional QC Binder Plan Program**

**Objective: Implement an asphalt binder supplier program for the New England Departments of Transportation.**

**Scope: The QC asphalt binder program will incorporate elements of AASHTO R 26 and R 38 any other requirements deemed necessary by the New England state DOT'S.**

## **1. Quality Control Requirements**

### **Section 1.1**

Each asphalt binder supplier shall have a QC system in place to ensure the quality of its products. Quality control procedures must provide adequate assurance to agencies that the products purchased will meet relevant AASHTO, ASTM, and industry standards. The following minimum requirements for asphalt binder supplier QC shall be satisfied.

*Quality System Manual*—Each asphalt binder supplier shall establish and maintain a QSM. The QSM is a general document intended to outline the overall internal QC operating procedures of the asphalt binder supplier. A QSM documents the asphalt binder supplier's policies for achieving quality and the assignment of responsibility and accountability for QC within the asphalt binder supplier organization. It also describes the minimum QC requirements expected of other asphalt binder suppliers or material suppliers from whom the asphalt binder supplier obtains constituent materials incorporated in each manufactured product.

Guidelines for the preparation of QSM may be available from industry organizations that administer manufacturing facility certification programs. In addition, ISO 10013 contains guidelines on the development and preparation of QSM. However, each asphalt binder supplier QSM shall meet the format and content requirements outlined below.

*QSM Format*—The asphalt binder supplier's QSM may be maintained in an electronic format. However, one or more copies of the QSM must be maintained by the asphalt binder supplier's QC manager in a printed and bound format (three-ring or other). The QSM shall be available to all of the asphalt binder supplier's employees. Each document in the QSM shall indicate its preparation date, and all pages of the QSM shall be numbered. If a document is revised, the date of the revision shall be indicated on the document and recorded in a table of revisions.

It is the intent of this standard practice that the QSM shall address each of the items outlined below, except as agreed upon by the agency. The QSM shall be formatted to provide numbered sections for each item, in the order listed below, except as otherwise approved by the agency.

### **Section 1.2**

The standard QSM items are as follows:

#### **1.2.1 Asphalt binder supplier's quality statement;**

- Written policy or mission statement
- Facility location and telephone number
- Facility type (refinery, terminal, in-line blending, or HMA plant)
- Name and telephone number of the person responsible for quality control at the facility

- Asphalt binder materials produced

#### 1.2.2 Applicable specifications (AASHTO, ASTM, other);

##### *AASHTO Standards:*

- M 320, Performance-Graded Asphalt Binder
- M332, Standard Specification for Performance-Graded Asphalt Binder Using Multiple Stress Creep Recovery (MSCR) Test
- R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- R 28, Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV)
- R 29, Grading or Verifying the Performance Grade (PG) of an Asphalt Binder
- R 38, Standard Practice for Quality Assurance of Standard Manufactured Materials
- R 66, Sampling Asphalt Materials
- T 48, Flash and Fire Points by Cleveland Open Cup
- T 313, Determining the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR)
- T 315, Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)
- T 316, Viscosity Determination of Asphalt Binder Using Rotational Viscometer
- T 350, Standard Method of Test for Multiple Stress Creep Recovery (MSCR) Test of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)

##### *ASTM Standards:*

- D8, Standard Terminology Relating to Materials for Roads and Pavements
- D3665, Standard Practice for Random Sampling of Construction Materials
- E4, Standard Practices for Force Verification of Testing Machines
- E105, Standard Practice for Probability Sampling of Materials

##### *Other Documents:*

- ISO 10013:2001, Guidelines for Quality Management System Documentation (optional)

### 1.2.3 QC system roles and responsibilities;

*QC Organization* - an organizational chart for the company shall be provided in the QSM. The organizational chart should indicate a clear separation between the QC personnel and production personnel. *QC Manager*—the asphalt binder supplier shall have a QC manager who has the overall responsibility for implementing the requirements of the QSM. In addition, the asphalt binder supplier shall designate an individual with equivalent experience and qualifications to serve in the QC manager's absence. These individuals must have direct access to top management. The QC manager shall review the QC system established to satisfy the requirements of this practice at least annually, or when changes in the asphalt binder process occur, or whenever production processes describe a trend toward reduced quality.

- *QC Technicians*—the asphalt binder supplier shall maintain a sufficient number of QC technicians to perform QC sampling, testing, and inspection, independent of production personnel. The technicians performing QC testing must be familiar with the tests they perform and have sufficient authority to assure that corrective actions are carried out when necessary. The QSM shall indicate the line of authority of QC technicians, which must demonstrate their authority to require corrective action. The QSM shall designate the qualified QC technicians at each production facility and laboratory involved in the production or testing of a product.
- *QC Personnel Qualification Requirements*—the QSM shall contain a description of the specific knowledge, skills, qualifications, and certifications required for all personnel in the QC organization. All asphalt binder supplier QC sampling, testing, and inspection personnel shall be qualified through NETTCP and/or Asphalt Institute. The QSM shall describe in detail the particular qualification/certification program requirements the asphalt binder supplier will use to qualify QC personnel. Qualification/certification programs used shall include:
  1. Training in AASHTO, ASTM, or asphalt binder supplier test procedures,
  2. Demonstration of proficiency in each required test, and
  3. Demonstration of ability to properly document test results.
  4. The program shall also include periodic evaluations of each QC technician's ability to satisfactorily perform the required tests. The training shall include the operation of equipment, procedures to be used, calculations required, and reporting. Retraining shall be provided when an applicable method is revised. Technician training will be documented and the records pertaining to qualification/certification will be available for review.
- *Production Personnel Responsibilities Concerning Quality*—The QSM shall describe the specific training provided to production personnel and the operating procedures implemented by these personnel to ensure the required quality of all standard manufactured materials produced.

### 1.2.4 QC Laboratories-Testing Equipment;

- Each asphalt binder supplier will maintain its own laboratory to perform QC testing. If required by the agency, the asphalt binder supplier will designate an alternate laboratory to serve a backup capacity.

- The QSM shall include the addresses and telephone numbers of all laboratories used by the asphalt binder supplier for QC testing. For each laboratory, the QSM shall include a contact person's name, telephone number, and e-mail address.
- All asphalt binder supplier QC laboratories shall be qualified to perform the specific QC testing by a laboratory currently accredited by the AASHTO Accreditation Program (AAP). Any satellite laboratory of an asphalt binder supplier that performs required testing under this standard shall be identified in the quality control plan and shall be approved by the agency.

Satellite laboratories may be inspected by the source's primary AMRL inspected laboratory staff. A copy of the report of the satellite laboratory inspection shall be provided with the test report, if requested.

- The laboratory shall maintain current versions of all AASHTO, ASTM, and asphalt binder supplier test procedures for all tests performed and copies maintained in the QSM.
- The QSM shall contain an inventory of the major sampling, testing, and calibration equipment associated with any tests required to meet the QSM standards. The QSM shall assign a unique identification number to each piece of testing equipment. The inventory shall include for each piece of major equipment: the name, date placed in service, asphalt binder supplier, model, and serial number.
- **Note**—Major equipment includes all equipment that is normally amortized by an asphalt binder supplier, such as physical or chemical testing machines, balances, ovens, microscopes, computing equipment dedicated to testing, etc. Equipment such as chairs, desks, and file cabinets should be excluded. Major equipment does not include expendable items such as miscellaneous glassware, sieves, molds, etc.
- The QSM shall contain a list giving a general description of testing equipment for performing tests that require calibration or verification. For each item listed, it shall include the interval of calibration or verification, a reference to the calibration or verification procedure used, and the location of calibration and verification records. When standard calibration procedures are used, the standard shall be referenced (e.g., compression machine, ASTM E 4). When the procedure used has been prepared by the asphalt binder supplier, the in-house designation shall be referenced. It shall be indicated whether the calibration is performed by an outside organization.

A copy of the asphalt binder supplier's instructions for use and calibration must be maintained on file. A reference to where the testing equipment inventory is located is acceptable if it is not included in the QSM.

- The QSM shall describe the methods for ensuring that the calibration and verification procedures are performed for all required equipment at the specified intervals. It shall include the name of individual(s) responsible for ensuring that calibration and verification activities are performed and that procedures for handling new equipment, equipment removed from service, and out-of-calibration or defective equipment are followed. The QSM shall identify the individual(s) responsible for maintaining equipment calibration and verification records, describe the distribution of equipment calibration and verification records to management, and identify the location of resulting records.

- The testing equipment shall be calibrated/verified in accordance with R 18. Testing equipment not described in R 18 shall be calibrated/verified in accordance with the asphalt binder supplier's recommendations at least once every 12 months by an appropriately qualified person. All laboratory equipment shall be properly maintained.
- The laboratory shall maintain records of all DOT reviews and actions taken to resolve any noted deficiencies. Records of equipment calibration and verification will be maintained and available to the DOT upon request.

#### 1.2.5 Laboratory accreditation or qualification

- All asphalt binder supplier QC laboratories shall be qualified to perform the specific QC testing required for the Performance Graded Asphalt Binder (PGAB) through an appropriate laboratory accreditation or qualification program. Laboratory accreditation or qualification must be attained through organizations or programs within one of the following three categories:

*Category I*—National laboratory accreditation programs,

Examples of national laboratory accreditation programs (Category I) that address some standard manufactured materials include:

- AASHTO Accreditation Program (AAP)
- National Cooperation for Laboratory Accreditation (NACLA)
- American Association for Laboratory Accreditation (A2LA)
- National Voluntary Laboratory Accreditation Program (NVLAP)

#### 1.2.6 Preproduction materials control

- The QSM shall list the specific types of constituent materials used for production of PGAB asphalt. All sources of supply of asphalt binder or other constituent materials including all additives shall be identified in the QSM.
- All constituent materials should be visually inspected, as appropriate, prior to their use in the production of PGAB asphalt. QC procedures for visual inspection of constituent materials shall be included in the QSM.
- QSM shall contain a description of the specification requirements for any asphalt binder or constituent materials received. The QSM shall contain a description of the certification and test reports delivered by the supplier(s) of the asphalt binder or constituent materials and the location of these records. Any asphalt binder or constituent materials that are not accepted by the asphalt binder supplier on the basis of a COA shall be tested and approved by the asphalt binder supplier prior to production of the PGAB material.
- The QSM must include QC testing of the constituent materials used in the production of PGAB process and must contain a statement that no raw materials will be used unless they have been tested and meet all AASHTO/ASTM requirements or have been shipped with a COC stating conformance with all

requirements. For material having only a COC, at least one random sample must be taken from each lot of constituent materials received for preproduction QC testing to verify conformance with the specified requirements.

- All PGAB, asphalt or constituent materials should be properly stored to prevent damage, contamination, or other physical or chemical alteration. QC procedures for adequate storage of constituent materials shall be described in the QSM.

#### 1.2.7 QC During Production of PGAB:

- The QSM shall describe the procedure and frequencies for inspection and selection of PGAB samples during production. PGAB lot sizes shall be established to ensure adequate QC inspection sampling and testing for the PGAB materials they represent. The lot size may be established by the asphalt binder supplier based on production-run quantities or other criteria that ensure the PGAB being evaluated within a lot is from the same material population.
- QC inspection, sampling, and testing of each lot shall be established using one of the two following approaches (The DOT shall specify which system is to be used by the asphalt binder supplier):
  - Nonstatistical lot system, or
  - Statistically based lot and subplot system.
- .
- Under a nonstatistical lot system, the asphalt binder supplier must provide a minimum frequency of QC inspection, sampling, and testing as specified by the DOT. However, a minimum of one random sample shall be tested per lot. Lot sizes and QC inspection, sampling, and testing frequencies for each lot shall be identified in the asphalt binder supplier's QSM.
- Under a statistically based lot and subplot system, each lot will be divided into a number of equally sized sublots. The use of a statistically valid sampling procedure is recommended to provide meaningful QC sampling and testing. When a statistically based system is used, the asphalt binder supplier should select a minimum of three to five sublots per lot to ensure that the statistical sample obtained provides a meaningful representation of the lot. One random QC sample is obtained and tested from each subplot. QC inspection should also be provided for each subplot. Lot and subplot sizes shall be identified in the asphalt binder supplier's QSM when a statistically based lot and subplot system is used.

**Note**—ASTM E105 describes procedures for determining statistically valid sample sizes and frequencies.

- All standard manufactured materials should be visually inspected during production to ensure that the product meets the established requirements for quality. The QSM shall include QC procedures and documentation for visual inspection of each lot.
- All asphalt binder supplier QC sampling and testing utilized in issuing a COA representing a given lot shall be performed using random sampling techniques. Random sampling should be performed in

accordance with ASTM D3665. All random QC sample locations shall be properly documented. Procedures for performing and documenting QC random sampling shall be included in the QSM.

- Nonrandom selective sampling may also be performed as necessary by the asphalt binder supplier to assist in controlling the production process or to assist in isolating apparent nonconforming material. Procedures for determining and documenting QC selective sampling locations shall be fully described in the QSM.
- Each sample selected for QC inspection and testing (including all random and selective samples) shall be designated with a sample control number for record keeping and traceability. The test report for each sample shall identify the plant, date, work shift, storage tank, lot/sublot designation, and sample number. The QSM shall outline the QC sample identification system.
- The QSM shall contain a description of the QC tests and verification processes utilized throughout the PGAB process to ensure that the end product will meet the required quality level and quality limits (specification limits and engineering limits). Relevant test methods for any QC testing must be defined. Test methods should normally include AASHTO, ASTM, or other recognized industry standards. The specific quality characteristics that the test methods are being used to assess shall also be identified.
- The use of some surrogate test methods may be appropriate as part of the asphalt binder supplier's QC system. Asphalt binder supplier-developed tests shall only be used if there is no AASHTO or ASTM test method. The QSM shall include all asphalt binder supplier-developed test procedures used in QC testing. All sampling and testing methods (standard and surrogate) shall be included in the QSM.
- Storage practices prior to testing should ensure that all QC samples are kept in a suitable location that protects them from damage and provides the proper environment for curing the material or maintaining the required material properties. It is recommended practice for all QC samples to be split prior to testing, in accordance with relevant sampling and testing procedures. The split-sample portion of material not used for initial testing should be retained in the original sample storage device with proper identification. The split samples should be stored in an appropriate "sample storage room" at the QC laboratory that performed the initial testing for a reasonable period (e.g., 30 to 60 days) acceptable to the agency. The QSM shall describe the procedures used for proper QC sample storage and retention.
- Standard inspection report forms (IRFs) and standard test report forms (TRFs) should be used to record all QC inspection sampling and testing information. The QSM shall contain descriptions and examples of the IRFs and TRFs used by the asphalt binder supplier. The QSM shall identify the individual(s) responsible for maintaining inspection and test records and reports, shall describe the distribution of reports, and shall identify the location of resulting records. The QC IRFs and TRFs must be maintained and available for review for a minimum of three years.
- The QSM shall contain a description of the procedures used to identify and document products that do not conform to specification requirements. The identification of nonconformances may occur at any level of inspection or testing. Therefore, action at each level shall be based on standard policies described within the QSM. The QSM shall contain provisions for resolving nonconforming products or test results. Materials in a subplot that are identified as visibly deficient or that yield QC test results indicating potentially deficient material should be isolated from the lot. In the latter case, a

statistically valid procedure shall be used for sampling and testing the remaining material in the subplot. The material should either be rejected (if determined to be visibly deficient) or further evaluated through selective sampling plus additional random sampling (a minimum of three random samples is recommended) and testing to ensure sufficient data are available to make a final disposition on the affected subplot.

- Material in the subplot evaluated through this subsequent testing that is determined to be out-of-specification shall be labeled as defective. All nonconforming material shall be segregated in the inventory and corrected, if possible, or discarded. Procedures for marking and subsequent correcting or discarding of nonspecification material identified shall be fully described in the QSM.

#### 1.2.8 Postproduction QC Activities

- The QSM shall describe a method for permanently marking the PGAB product in accordance with the requirements of any relevant AASHTO or ASTM standards. The QSM shall describe procedures for product handling, storage, and shipping to ensure that these processes will not adversely affect the PGAB material composition, characteristics, or product quality.
- All asphalt binder supplier QC inspection, sampling, and testing will be documented on standard forms developed by the asphalt binder supplier or as requested by the DOT. All inspections will be documented on standard IRFs developed by the asphalt binder supplier. TRFs shall indicate the action taken to resolve nonconforming test results. The asphalt binder supplier shall maintain a complete list of documentation used to support the QSM and its processes.
- At a minimum, the following documentation shall be maintained:
  - Records of QC personnel qualifications and related training,
  - QC laboratory accreditation or qualification,
  - Testing equipment identification and verification/calibration records,
  - Incoming constituent material COCs and inspection and testing results,
  - In-process QC inspection and testing results,
  - Nonconforming material identification and disposition, and
  - Physical product dimensions or other characteristics related to DOT acceptance.
- The QSM shall describe in detail the retention of all QC testing and inspection reports. They shall be available to the DOT upon request. Certification and test results shall be kept on file for a period of not less than three years following shipment and delivery. The QC inspection and testing reports will be identified in such a way that the results for the PGAB product can be traced to the individual subplot and lot they represent.
- —Each asphalt binder supplier will prepare for each lot of standard manufactured materials a standard COA form that meets the requirements of the agency. The COA shall include all necessary information to properly identify the material (e.g., pay item number, material number, lot number, subplot numbers) represented by the COA.
- The DOT may conduct an audit of an asphalt binder supplier facility including the QSM. The DOT may elect to have an independent auditing organization conduct the audit in lieu of the DOT. Such quality audits shall be performed on an annual or other periodic basis as established by the DOT. The quality audit shall assess the asphalt binder supplier's compliance with each of the following QSM requirements, as a minimum:



- Asphalt binder supplier's quality statement,
  - Plant facility and products,
  - Terms and definitions,
  - Applicable specifications,
  - Quality system roles and responsibilities,
  - QC laboratories,
  - Preproduction materials control,
  - QC during production of standard manufactured materials, and
  - Postproduction QC activities.
- The audit findings shall be discussed with the QC manager, production manager, and top management and shall be documented in a quality audit report. Corrective actions will be taken as necessary and documented in a report prepared by the QC manager. The quality audit report shall be available for review by the agency.

## **Part 2. Minimum Asphalt Binder Supplier Quality Control Plan Requirements**

The following conditions will apply to an annual submission by an asphalt binder supplier (ABS) for approval to supply PGAB product to specific DOT agencies. The ABS shall submit a written request to the DOT for authorization to ship PGAB and shall list the PGAB to which the request applies.

**Section 2.1.** The ABS's quality control plan shall identify the following:

- Facility type (refinery, terminal, in-line blending, or HMA plant);
  - Facility location;
  - Name and telephone number of the person responsible for quality control at the facility;
  - The quality control tests to be performed on each PGAB; and
  - Name and location of the laboratory performing quality control tests on the PGAB that is shipped.
- The ABS's quality control plan shall include a declaration stating that if a test result indicates that a shipment of PGAB is not in compliance with the purchase specifications, the asphalt binder supplier shall (1) immediately notify the DOT of the shipment in question; (2) identify the material; (3) cease shipment until material complies with the specification; (4) notify the DOT prior to resuming shipment; and (5) implement any mutually agreed-upon procedures for the disposition of the material. In the event a mutual agreement is not obtained, the specifying DOT shall have final authority in the decision on specification compliance.

**Section 2.2** The ABS's quality control plan shall describe method and frequency for initial testing, quality control testing, and specification compliance testing.

- For each grade of PGAB to be supplied, specification compliance testing (complete M 320 testing) shall be performed for at least three consecutive lots. A lot may be a fixed batch of material or a specified quantity in a continuous operation per QSM. The asphalt binder supplier and the DOT shall agree on a lot size. The DOT must approve any change to a lot size.
- **Note**—If a batch operation is used to manufacture the PGAB, a tank may be defined as a lot. Lot size would be the amount of material batched into the tank. If a continuous process (in-line blending or a

shipment from “live” tanks) is used to manufacture the PGAB, lot size may be obtained at random during the production for continuous operations. Lot size shall depend on the production method used and the quantity of the PGAB produced.

- The DOT may approve to decrease the frequency of testing for specification compliance, if the individual M 320 test result for every sample of the initial testing is within specification by at least the tolerance of the test method for each of the required test methods. With the approval of the DOT, the frequency of testing may be further reduced as long as the individual test results continue to meet the tolerance criterion. If the tolerance criterion is not met, every lot will continue to be tested for the individual M 320 property until three consecutive lots comply with the tolerance criterion.
- Specification compliance testing shall be run at the minimum frequency required by the DOT for each PGAB that is supplied.
- At least two M 320 tests shall be used for monitoring high- and low-temperature properties of the PGAB. Non-M 320 tests may be used for guiding the ABS, if approved by the DOT. The use of non-M 320 tests does not preclude the need to meet M 320 specifications or to run complete M 320 tests.
- The ABS’s quality control plan shall include a statement that the asphalt binder supplier will prepare monthly summary reports for all quality control and specification compliance tests performed during that period and will submit them to the DOT on request.
- The ABS shall have a satisfactory record of compliance with governing specifications. Judgments by the DOT concerning this requirement shall be based on the test results furnished by the ABS and satisfactory results when the monitoring and field tests are compared with asphalt binder supplier tests.
- The ABS quality control plan shall provide an outline of the procedure to be followed for checking transport vehicles before loading to prevent contamination of shipments. The outline shall include a statement that the transport vehicle inspection report, signed by the responsible inspector, shall be maintained in the ABS’s records, and will be made available to the DOT on request.

### **Section 2.3.** The addition of additives to PGAB products

- The ABS shall submit a written request to the DOT for authorization to use in-line blending of additives that meet Section 5 of M 320 at the HMA plant to produce PGAB. With the request, the ABS shall submit (1) a sample of the additives; (2) a sample of the base binder materials; (3) a notice of the proportions that will be used; and (4) the M 320 test results for the base binder material and for the blended binder material.
- The ABS, if an HMA producer, shall submit a detailed plan for QC at the HMA plant. The QC plan shall conform to the procedure established in Section 2 with the following modifications: (1) the initial testing shall be conducted on the modified binder that is sampled beyond the in-line blending point, and (2) the asphalt binder supplier shall keep a record of the proportions, based on mass or other indicators. The asphalt binder supplier and DOT shall agree on the frequency for recording the proportions.
- **Note** For additives that do **not** meet the requirements of Section 5, M 320, the ABS may submit a written request to the DOT for authorization to use solid additives that are to be added directly to the

mix at the asphalt batch plant or the drum mix plant. With the request, the ABS shall submit (1) a sample of the additives; (2) a sample of the base binder materials; (3) a notice of the proportions that will be used; and (4) the M 320 test results for the base binder material and for the blended binder material, as applicable under M 320.

- **Only additives approved by the DOT will be allowed.**
- M 320 and the test procedures may not be applicable for some of the solid additives because of their size range after blending with the base binder or other characteristics of the modifier. If the binder fails to meet any of the criteria under Section 5 of M 320, acceptance of the binder shall be at the discretion of the DOT. The ABS and DOT shall therefore agree on the test methods to be used. The DOT may allow the use of M 320 tests or may require testing of the resultant HMA using selected test procedures to assure the level of performance expected.
- The asphalt binder supplier shall submit a detailed plan for QC at the HMA plant. The QC plan shall conform to the procedure established in Section 2 with the following modifications: (1) initial testing shall be conducted on a laboratory blend of the solid additive and the binder to be added at the HMA plant; (2) the asphalt binder supplier shall keep a record of the proportions, based on mass or other indicators; and (3) the asphalt binder supplier and DOT shall agree on the frequency for recording the proportions.

**Note—Reclaimed Asphalt Pavement (RAP)**—The HMA producer may submit a written request to the DOT for authorization to add RAP to the mix at the HMA plant to meet the PGAB specified. With the request, the HMA producer shall submit (1) a sample of the RAP; (2) a sample of the base binder materials; (3) a notice of the proportions that will be used; and (4) the M 320 test results for the base binder material and for the blended binder material determined under the requirements of Section 8.

The HMA producer shall submit a detailed plan for QC at the HMA plant. The QC plan shall conform to the procedure established in Section 9.3 with the following modifications: (1) initial testing shall be conducted on a laboratory blend of the asphalt binder extracted from the RAP sample, any addition of additive, and the binder material that is to be added at the HMA plant; (2) the HMA producer shall keep a record of the proportions, based on mass or other indicators; and (3) the HMA producer and DOT shall agree on the frequency for recording the proportions.

The DOT may waive the requirement for testing the laboratory-blended binder and may use other guidelines for selecting the performance grade of the new binder relative to the amount of RAP used.

- The ABS shall submit to the DOT all reports required in a form approved by the agency. A sample of an acceptable worksheet and standard report form is shown in Figures 1 and 2.

SAMPLE ID: \_\_\_\_\_

*Rotational Viscosity:*

Test Temperature: 135°C C Spindle #: \_\_\_\_\_ Speed: 20 RPM

Three Readings/1-min intervals: \_\_\_\_\_

Average: \_\_\_\_\_ cP X 0.001 =

Note: 1cP = 0.001 Pa\*s

*Rolling Thin-Film Oven Residue:*

Time in oven: \_\_\_\_\_ (+85 min) Time out of oven: \_\_\_\_\_

Bottle number \_\_\_\_\_

Weight of bottle and asphalt: \_\_\_\_\_ G \_\_\_\_\_ g

Weight of bottle: \_\_\_\_\_ G \_\_\_\_\_ g

Weight of asphalt before heating: \_\_\_\_\_ G \_\_\_\_\_ g

Asphalt and bottle after heating: \_\_\_\_\_ G \_\_\_\_\_ g

Mass loss (-) or gain (+): \_\_\_\_\_ G \_\_\_\_\_ g

Percent loss (-) or gain (+): \_\_\_\_\_ % \_\_\_\_\_ %

Average percent loss or gain  %

*Pressure Aging Vessel Residue:*

Time in: \_\_\_\_\_ (+20 h) Time out: \_\_\_\_\_

Aging test temperature, nearest 0.1°C: \_\_\_\_\_

Maximum and minimum aging temperature recorded, nearest 0.1°C:

Max: \_\_\_\_\_

Min: \_\_\_\_\_

Total time during aging that temperature was outside the specified range, nearest 0.1 min: \_\_\_\_\_ N/A

Total aging time, hours and minutes: \_\_\_\_\_

*Bending Beam Rheometer:*

Sample ID:	_____	_____	_____	_____	_____
Time poured:	_____	_____	_____	_____	_____
Time trimmed:	_____	_____	_____	_____	_____
Time in bath:	_____	_____	_____	_____	_____
Time tested:	_____	_____	_____	_____	_____

*Direct Tension Time:*

Sample ID:	_____	_____	_____	_____	_____
Time poured:	_____	_____	_____	_____	_____
Time trimmed:	_____	_____	_____	_____	_____
Time in chamber:	_____	_____	_____	_____	_____
Time tested:	_____	_____	_____	_____	_____

Fig. 1

Project:	<input type="text"/>	Supplier:	<input type="text"/>
Sample:	<input type="text"/>	Comments/requests:	<input type="text"/>
Tech:	<input type="text"/>		
Date:	<input type="text"/>	Performance grade:	<input type="text"/>

*Original Binder*

Flash Point Temp (T 48):  
 Min 230°C  °C

Rotational Viscosity (T 316):  
 Max 3 Pa•s @ 135°C  Pa•s

Dynamic Shear (T 315):  
 G\*/sin (delta), min 1.00 kPa:  kPa  
 Test temp @ 10 rad/s, °C:  °C

*RTFO Residue*

Percent Change, (1.00% max loss):  %

Dynamic Shear (T 315):  
 G\*/sin (delta), min 2.20 kPa:  kPa  
 Test temp @ 10 rad/s, °C:  °C

*PAV Residue*

(R 28), 20 h @ 2.07 MPa

Dynamic Shear (T 315):  
 G\*/sin (delta), Max 5000 kPa:  kPa  
 Test temp @ 10 rad/s, °C:  °C

Creep Stiffness (T 313):  
 S, Max 300 Mpa  MPa  
 Test temp @ 60 s, °C  °C  
 m-value, Min 0.300

Direct Tension (T 314):  
 Failure strain, Min 1.0%:  %  
 Test temp @ 1.0 mm/min, °C  °C

Fig. 2

## Section 2.4. DOT Requirements

- The DOT shall verify that the ABS's quality control plan is adequate. The DOT may visit the shipping site when required.
- The DOT shall notify the ABS that the asphalt binder supplier's application for approved supplier (AS) status has been granted. The notification shall include a list of the PGAB covered.
- The DOT shall verify that the ABS's primary testing laboratory is currently AASHTO accredited.
- The DOT may perform split sample testing in accordance with Section 6.
- The DOT may perform quality assurance sampling and testing in accordance with Section 6.
- The DOT shall authorize shipment of each listed PGAB under the system only after all ASC system requirements have been satisfied.
- The DOT shall inspect the operations of the ABS's facility related to the PGAB shipments when required.
- The DOT shall notify the ABS when split sample data versus asphalt binder supplier sample data do not compare within the limits established in Section 6.
- **Note**—The ABS and/or the HMA producer may take a split sample for comparison purposes. If a split sample is taken, a third sample shall be taken as a referee. The referee sample shall be retained either by the DOT or by the HMA producer until the test results are available. If the test results are disputed, the DOT and ABS shall agree on a test procedure for the referee sample.

## Section 2.5 ABS Requirements

- The ABS shall submit a written request to the DOT for authorization to ship PGAB and shall list the PGAB to which the request applies.
- The ABS shall allow the DOT to visit the production and/or shipping site to observe the asphalt binder supplier's quality control activities, to inspect the facilities, and to obtain samples for test.
- The ABS shall submit to the DOT for approval a complete quality control plan, which complies with the requirements of Part 2.
- The ABS shall follow the procedures described in the approved quality control plan.
- The ABS shall establish a continuing test record for each test required on each PGAB included in the written request to the DOT for authorization to ship PGAB.
- The ABS shall forward to the DOT the initial series of test data for each performance grade included in the written request to the DOT for authorization to ship PGAB. The asphalt binder supplier shall also obtain and provide a split sample for the DOT, if requested.

- The ABS shall submit to the DOT all reports required by Part 2 in a form approved by the DOT. A sample of an acceptable worksheet and standard report form is shown in Figures and 2.
- The ABS shall have a satisfactory record of compliance with governing specifications. Judgments by the DOT concerning this requirement shall be based on the test results furnished by the ABS and satisfactory results when the monitoring and field tests are compared with ABS tests.
- The asphalt binder supplier shall make PGAB shipments covered by the certification as dictated by shipping schedules.
- Each shipment shall be accompanied by two copies of the bill of lading, which shall include (1) the name and location of the asphalt binder supplier; (2) the performance grade of material; (3) the quantity of material shipped; (4) the date of shipment; (5) a statement certifying the material meets specification requirements; and (6) a statement certifying that the transport vehicle was inspected before loading and was found acceptable for the material shipped.  
**Note** —On any invoice or bill of lading, it is recommended that tons be used as the primary unit of measurement.
- If the specification compliance test results do not conform to PGAB specifications, the ABS shall remove the noncompliant material from the shipping queue as outlined in Section 11.
- Based on the agency's split sample testing on the referee sample (Section 4), price adjustment may be made for material that does not comply with the specified PGAB requirements. The price adjustment shall be determined by the agency. If problems with the PGAB recur at the HMA plant, the DOT may suspend use of the PGAB until the cause for noncompliance with specifications can be identified and corrected.

## Section 2.6. Sample Testing

- The DOT may elect test split samples that are obtained at random from the ABS's facility.  
**Note**—Split samples will be obtained from the same general points in the asphalt binder supplier's shipping process from which the asphalt binder supplier's samples are taken, for example, from a storage tank at the refinery, from a holding tank at a terminal, or from a loading line downstream from the blending operation of an in-line blending process.
- The DOT shall determine the frequency of split sample testing.
- If the split sample data and the asphalt binder supplier test data are not within the test tolerance specified, an immediate investigation shall be conducted to determine the reason for the difference between the data. Unless available facts indicate otherwise, the investigation shall include a review of sampling and testing procedures of both asphalt binder supplier and agency.
- The DOT or HMA producer may take field samples may be taken for several different purposes: to determine the type and magnitude of any changes in the properties of the PGAB during transportation and storage; to determine that the material received in the field is the material ordered; or to verify that the quality control/quality assurance system is performing as intended.
- The DOT may obtain samples from the field facility on a random basis for the purpose of quality assurance.

- The DOT shall determine a minimum frequency of field sampling that shall be adequate to satisfy the purpose for which the field samples are taken.
- If the field test data are not within tolerance, the DOT shall immediately notify the approved ABS and HMA producer. Unless available facts indicate otherwise, an investigation shall be conducted that shall include a review of quality control and sampling and testing procedures for field sampling and split sampling. When the differences are not readily resolved, all facts available to identify the problem shall be used to decide on an appropriate course of corrective action.
- If the PGAB fails to comply with the specification, the ABS or HMA producer shall immediately investigate the possibility of contamination in transport vehicles, field storage tanks, pumps, lines, and at handling facilities. If the cause is determined, correction shall be made promptly. If field test data show a serious departure from the specifications, the ABS or HMA producer shall delay the project work pending corrective action.

## Section 2.7. Terminology

*Relevant Terms and Definitions*—The terms and definitions included below are provided to ensure standard application of terminology relevant to the QA of transportation construction materials, including standard manufactured materials. Where terms or definitions in this standard practice differ from the above-referenced documents, the terms included herein shall replace those contained in the above-referenced documents.

1. *AAP*—AASHTO accreditation program.
2. *ABS-asphalt binder supplier*—shall be defined as one who produces the final product or who makes the blend or modification that alters the properties of the PGAB specified in M 320. A asphalt binder supplier shall be a refinery, a terminal, or an HMA producer. If no modification is made to the PGAB after its initial production at the refinery, the refinery shall be the asphalt binder supplier and must provide the certification. If any modifications are made to the PGAB at the terminal, the terminal shall be the asphalt binder supplier and must provide certification. If any modification, blending, or blending of PGAB from different sources is made at the HMA plant, the HMA producer shall be the asphalt binder supplier and must provide the certification.
3. *acceptance*—all factors used by the DOT (i.e., sampling, testing, and inspection) to evaluate the degree of compliance with contract requirements and to determine the corresponding value for a given product.
4. *accredited laboratories*—laboratories that are recognized by a formal accrediting body as meeting quality system requirements, including demonstrated competence to perform standard test procedures.
5. *agency*—any organization, constituted under federal, state, or municipal laws, that is responsible for administering contracts for highway or transportation construction.
6. *AS*—approved asphalt binder supplier.



7. *asphalt binder*—an asphalt-based cement that is produced from petroleum residue either with or without the addition of nonparticulate organic modifiers.

**Note 1**—Various refining techniques can produce equivalent PGAB; however, these asphalts may be incompatible with each other. Users shall consider compatibility before combining asphalts from different sources.

**Note 2**—Definitions for many terms common to asphalt binder are found in ASTM D8.

8. *calibration*—a systematic process used to standardize measurement instruments or test equipment by determining any deviation from an established reference or standard. A correction or adjustment of the instrument or equipment may be required based on the amount of deviation from the standard.
9. *certified personnel*—personnel who are recognized by a formal certifying body as qualified to perform sampling, testing, inspection, or related procedures.
10. *control chart*—also called “statistical control chart.” A graphical plot of QC measurements or test values used to identify variation in a production or placement process due to either chance causes or assignable causes.
11. *control chart limits*—also called “action limits.” Statistically derived boundaries applied to a control chart for controlling material production or placement. [Control chart limits are expressed as the upper control limit (UCL) and the lower control limit (LCL). When values of the material characteristics fall within these limits, the process is “under control.” When values fall outside the limits, there is an indication that some assignable cause is present causing the process to be “out of control.”]
12. *dispute resolution*—the procedure used to resolve conflicts resulting from discrepancies between the agency’s and contractor’s results of sufficient magnitude to impact payment.
13. *engineering limits*—the absolute limiting value(s) placed on a quality characteristic beyond which the test result for an individual sample is considered to be unacceptable. [Engineering limits are established to identify material that does not provide the minimum required engineering properties. They usually have an upper engineering limit (UEL), a lower engineering limit (LEL), or both. The engineering limits may be the same as the specification limits.]
14. *fabricated structural materials*—major structural items produced specifically for an individual construction project by a material fabricator. [They are generally characterized by one or more of the following conditions: (a) The production process for the material occurs under controlled conditions at an established fabricator plant typically located within state or in another state; (b) The material properties are stable and have no potential for alteration under proper transportation from the fabricator to the project site; (c) The materials arrive at the project site in a solid state and require little or no additional work after installation.]
15. *fabricator*—a company that produces fabricated structural materials (e.g., precast/prestressed concrete structural elements, fabricated structural steel) for either the prime contractor or a subcontractor.
16. *lot*—a specific quantity of material from a single source that is assumed to be produced or placed by the same controlled process.

17. *manufacturer*—a company that manufactures and supplies standard manufactured materials for either the prime contractor, a subcontractor, or a fabricator.
18. *PGAB*—performance-graded asphalt binder.
19. *population*—a collection of all possible individuals, objects, or items that possess some common specified characteristic(s) that can be measured.
20. *prime (general) contractor*—the company that has the primary construction contract for an DOT project and that assumes overall responsibility for completing the work.
21. *producer*—a company that produces and supplies project-produced materials (e.g., aggregates, HMA, PCC) for either the prime contractor or a subcontractor.
22. *project-produced materials*—major items produced directly for an individual construction project either by a contractor or by a material producer. [They are generally characterized by one or more of the following conditions: (a) The production process for the material occurs either at the project site or at a production plant located in close proximity to the project site; (b) The material properties are subject to potential contamination or segregation during transportation from the plant to the project site; (c) The materials arrive and are placed at the project site in a nonsolid or loose mixture state requiring subsequent mixing, compaction, finishing, or curing.]
23. *qualified laboratories*—laboratories that are capable as defined by appropriate programs established or recognized by each agency. [Accredited laboratories are considered “qualified.” However, a “qualified laboratory” need not be accredited.]
24. *qualified personnel*—personnel who are capable as defined by appropriate programs established or recognized by each agency.
25. *quality*—(1) the degree of excellence of a product or service; (2) the degree to which a product or service satisfies the needs of a specific customer; (3) the degree to which a product or service conforms with a given requirement; or (4) conformance to requirements.
26. *quality assurance (QA)*—(1) all those planned and systematic actions necessary to provide confidence that a product or facility will perform satisfactorily in service; or (2) ensuring the quality of a product is what it should be. [The two primary elements of a QA program for standard manufactured materials include QC by the manufacturer and acceptance by the agency. Additional elements of a QA program for standard manufactured materials include qualified personnel, qualified laboratories, and dispute resolution procedures.]
27. *quality characteristics*—a product characteristic that is measured through testing, either for QC purposes or for conformance with acceptance requirements. [Quality characteristics are specific material properties or product requirements that are evaluated by QC and acceptance testing. Quality characteristics are normally selected because they: (a) relate to initial and long-term performance; (b) are quantifiable or measurable; and (c) can be measured with good repeatability.]

28. *quality control (QC)*—the system used by a contractor party to monitor, assess, and adjust its production or placement processes to ensure that the final product will meet the specified level of quality. [QC includes sampling, testing, inspection, evaluation, and corrective action (when required) to maintain continuous control of a production or placement process.]
29. *quality control testing*—the quality control testing shall be described in the asphalt binder supplier’s quality control plan. The asphalt binder supplier’s quality control plan shall be approved by the agency.
30. *quality measure*—any one of several mathematical tools used to quantify the level of quality of an individual quality characteristic. [Application of a quality measure to a set of test data provides an overall numeric representation of quality for a specific quality characteristic. Typical quality measures used in QA are selected because they quantify the average quality, the variability, or both. Examples of quality measures that may be used include: mean, standard deviation, percent defective (PD), percent within limits (PWL), average absolute deviation (AAD), moving average, and conformal index (CI). PWL and PD are the quality measures recommended for use in QA specifications.]
31. *quality system manual (QSM)*—a written document that describes the overall QC operating procedures of a contractor party (e.g., prime contractor, subcontractor, producer, fabricator, manufacturer). [A manufacturer’s QSM documents the internal policies for achieving quality and the assignment of responsibility and accountability for QC within the manufacturer’s organization. It may also describe the minimum QC requirements expected of upper- or lower-tier contractor parties who supply constituent materials or who are involved in handling or processing of the manufacturer’s products.]
32. *random sampling*—a sampling procedure whereby each sample obtained from the lot has an equal probability of being selected.
33. *run chart*—also called “music bar chart.” A control chart that presents individual measurements or test values for a specific quality characteristic on a vertical axis and the individual sample numbers (in consecutive order) on a horizontal axis. [Run charts plot individual sample values ( $n = 1$ ) and usually check the measurements or test results against the specification limits or engineering limits.]
34. *sample*—(1) also called “material sample.” A small quantity of material or measurement obtained from a subplot or lot. [A sample can refer to either a point of inspection (i.e., visual examination or physical measurement) or an individual material sample obtained for testing. A sample may be composed of one or more increments of equal size that have been obtained from the sampling location and combined]; or (2) also called “statistical sample.” All of the samples obtained from a lot that provide information that may be used to quantify the quality of the entire lot. [The context in which the word “sample” is used determines its meaning. For example, “obtain a sample here” would mean obtain a physical quantity of material from a specific location; while “the sample size equaled nine” means that a total of nine individual material samples were obtained in a random manner and thus comprised the statistical sample of size  $n = 9$ . Each sample is included in the overall statistical sample for a given lot.]
35. *specification compliance testing*—complete testing in accordance with the M 320 specification requirements. The procedure for verification of PGAB as described in R 29 shall be followed.
36. *specification limits*—the statistically based limiting value(s) placed on a quality characteristic that are applied with a particular quality measure (such as PWL) to evaluate the quality of a lot. [Specification limits are

usually composed of an upper specification limit (USL), a lower specification limit (LSL), or both. It is important to recognize that because specification limits are statistical limits, individual sample test results may fall beyond the USL or LSL and still be included in the acceptance determination. The specification limits will ultimately be used for computation of quality levels (e.g., PWL), which will be used in calculating pay factors for a lot.]

37. *standard manufactured materials*—standard items that are produced routinely (i.e., not for a specific project) by a manufacturer. [They are generally characterized by one or more of the following conditions: (a) the materials are normally mass-produced under highly controlled and largely automated manufacturing conditions; (b) the material properties are stable and have no potential for alteration under proper transportation from the manufacturer to the project site; (c) the materials arrive at the project site in a solid, finished state and require only installation.]
38. *stratified random sampling*—a sampling procedure whereby samples are randomly obtained from each subplot.
39. *subcontractor*—a company that is responsible for field placement or installation of an individual item of work under contract to the prime contractor.
40. *subgroup*—a set ( $n > 1$ ) of QC sample values from within a lot, the mean or range of which are plotted on a control chart.
41. *subplot*—a subplot is a subdivision of a lot.
42. *target value*—the value that is placed on a quality characteristic that represents the mean of the expected distribution of the specified population.
43. *validation*—the mathematical comparison of two independently obtained sets of data (e.g., DOT acceptance data versus manufacturer QC data) to determine whether it can be assumed they came from the same population.

## **Section 2.8. Report & Data Submittals**

**(TBD based on feedback from DOTs)**

## APPENDIXES

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### X1.MODEL QSM OUTLINE

#### X1.1.*Asphalt binder supplier's Quality Statement:*

X1.1.1.Written Policy or Mission Statement

#### X1.2.*Manufacturing Facility and Products:*

X1.2.1.Facility Address, Telephone Number, and E-mail Contacts

X1.2.2.Standard Manufactured Materials Produced

#### X1.3.*Terms and Definitions*

#### X1.4.*Applicable Specifications (AASHTO, ASTM, Other)*

#### X1.5.*QC System Roles and Responsibilities:*

X1.5.1.QC Organization

X1.5.2.QC Manager

X1.5.3.QC Technicians

X1.5.4.QC Personnel Qualification Requirements

X1.5.5.Production Personnel Responsibilities for Quality

#### X1.6.*QC Laboratories:*

X1.6.1.Laboratory Addresses, Telephone Numbers, and E-mail Contacts

X1.6.2.Laboratory Accreditation or Qualification

X1.6.3.Testing Equipment

#### X1.7.*Preproduction Materials Control:*

X1.7.1.Constituent Material Types and Sources of Supply

X1.7.2.Visual Inspection of Constituent Materials

X1.7.3.Control and Testing of Constituent Materials Properties

X1.7.4.Constituent Materials Storage

#### X1.8.*Quality Control During Production of Standard Manufactured Materials:*

X1.8.1.Lot and Sublot Sizes

X1.8.2.QC Visual Inspection

X1.8.3.Random Sampling Plan

X1.8.4.Selective Sampling

X1.8.5.Sample Identification System

X1.9.*Standard QC Sampling and Testing Methods (AASHTO, ASTM, Other):*

X1.9.1.Asphalt binder supplier Developed Test Procedures

X1.9.2.QC Sample Storage and Retention Procedures

X1.9.3.QC Inspection and Test Result Reporting

X1.9.4.Use of Control Charts

X1.9.5.Statistical Analysis of Test Results

X1.9.6.Resolution of Nonconforming Inspection and Test Results

X1.10.*Postproduction QC Activities:*

X1.10.1.Marking, Storage, Shipping, and Handling of Standard Manufactured Materials

X1.10.2.QC Records

X1.10.3.Retention of Inspection and Test Results and Product Traceability

X1.10.4.Issuance of Materials COC

X1.11.*Quality Audit of the Manufacturing Facility*