

Performance Graded Asphalt Binder Quality Control/Quality Assurance Program

**July 30, 2004
(Revision 13, Modified October 27, 2014)**

Compiled by the
North Carolina Department of Transportation

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Revisions

See the website for the latest revision updates:

Click on <https://connect.ncdot.gov/resources/Materials/Pages/ChemicalLaboratory.aspx> then scroll down to “Resource Type: Programs” and click the document titled Performance Graded Binder QC-QA Program Revisions.

I. GENERAL DESCRIPTION

The Performance Graded Asphalt Binder (PGAB) Quality Control (QC)/Quality Assurance (QA) Program is designed to give Producers/Suppliers [henceforth Producer designates Producer/Supplier] more responsibility for controlling the quality of material they produce and to utilize the QC information they provide in the acceptance process by the North Carolina Department of Transportation (NCDOT). It requires Producers to perform QC sampling, testing and record keeping on materials they ship for use by the NCDOT. In addition, the Producer is required to participate in Independent Assurance (IA) sample activities described in Section III (D). Also, it requires the NCDOT to perform QA verification sampling, testing and record keeping confirming the performance of the Producer's quality control plan. The types of samples and the lot sizes required will be described in detail later in this document.

The word "lot" and "batch" will have the same meaning and are congruous throughout this document. It is the intent of this program that acceptance or rejection of material be based on the total program. Therefore, a comparison of the QC sample, QA verification, and other sample data may be used by the NCDOT for acceptance or rejection of a lot of material.

Participation in this program does not relieve the Producer of the responsibility of complying with all requirements of the *NCDOT Standard Specifications for Roads and Structures*. See Appendix XI for a posting from the Federal Highway Administration.

II. PROGRAM REQUIREMENTS

A. Basic Requirements

There are two basic requirements for Producer's facility approval. The Producer's facility must have an approved in-house QC PGAB plan that meets the requirements of AASHTO R 26 Section 9 and must use an approved laboratory conforming to applicable sections of AASHTO R 18. See Section II (c). References to the word "lot" in AASHTO R 26 or other specification documents and the word "batch" used by NCDOT have the same meaning and are congruous.

B. QC Plan

The program requires that the Producer have a QC plan that meets the requirements of Section 9 of AASHTO R 26 (Standard Practice for Certifying Suppliers of Performance Graded Asphalt Binders). This is a comprehensive standard complete with guidelines. A Northeastern User's Producer's Group (NEAUPG) Model QC plan has been provided as a guide in Appendix I (website). Appendix II contains AASHTO R 26. Appendix III has Section 1020 of the NCDOT Specifications (website).

C. Approved Laboratory

The Program requires all tests associated with the testing of asphalt binder to be conducted at an AASHTO accredited laboratory conforming to the applicable sections of AASHTO R 18 that is qualified in the following procedures in Table 1 below. All equipment used at that laboratory is calibrated and maintained per AASHTO R 18. For information on how to become an accredited laboratory contact AASHTO or visit their website at <http://www.transportation.org/> .

<i>TABLE 1</i>	<i>Required Tests</i>
<u>Test Description</u>	<u>Test Method Reference</u>
Flash Point (Cleveland Open Cup)(Degrees Centigrade)	AASHTO T 48
Rotational Viscosity @ 135 C (Pa-s)	AASHTO T 316
Rotational Viscosity @ 165 C (Pa-s)	AASHTO T 316
Original Binder: G*/sin delta (kPa)	AASHTO T 315
Rolling Thin Film Oven Test (RTFO)	AASHTO T 240
Mass Change after RTFO (%)	AASHTO T 240
RTFO Residue: G*/sin delta (kPa)	AASHTO T 315
Pressure Aging Vessel (PAV)	AASHTO R 28
Pressure Aging Vessel (PAV) Residue: G*/sin delta (kPa)	AASHTO T 315
Bending Beam Rheometer (BBR) Creep Stiffness (Mpa)	AASHTO T 313
Bending Beam Rheometer (BBR) Slope -m value	AASHTO T 313
Direct Tension (DTT) Failure strain (%)	AASHTO T 314
High End Temperature True Grade (°C)	AASHTO T 315

D. Plant Approval Process

The approval process requires the Producer to write the State Materials Engineer at NCDOT, 1801 Blue Ridge Road, Raleigh, NC 27607, requesting that the plant be considered for acceptance into the program. It must identify the specific products that are to be produced. Two copies of the Producer's written QC plan must be submitted with the request for approval.

The NCDOT will review the Producer's written QC plan and if it is approved, an on-site inspection will be scheduled. This on-site inspection will verify that the Producer's QC plan has been implemented and is being followed. If either the Producer's QC plan or laboratory does not meet NCDOT requirements, the Producer will be informed of the deficiencies in writing. Once the deficiencies have been addressed, the Producer may again request approval in writing to the State Materials Engineer.

E. Certification for Participation in the QC/QA Program

If the NCDOT has approved the Producer's written QC plan and the on-site inspection confirms that the initial program requirements have been met, NCDOT will certify the Producer for participation in the program. At the end of the year, and each subsequent year, NCDOT will approve participation for the upcoming year once a letter certifying/updating the Producer's QC plan for the coming year has been received and any necessary inspections are made. Any time changes are made documentation in the form of a letter from the Producer shall be provided to the Materials and Tests Unit. Random inspections may be conducted at any time by NCDOT to verify compliance with the program requirements. Failure to perform all of the program requirements may result in a Producer being removed from the Program.

F. Statement of Remediation

In the event that material not meeting specification is shipped, the NCDOT will be immediately notified and pavements (if any) constructed from the material may be rejected and removed from the site unless otherwise permitted by the Engineer in accordance with Article 105-3 of the Standard Specifications, CONFORMITY WITH PLANS AND SPECIFICATIONS.

III. SAMPLING AND TESTING PROCEDURES

A. Producer's QC

The Producer's QC samples are used by the Producer to monitor the quality of material being produced and shipped. Materials will be sampled in accordance with AASHTO T-40, Sampling Bituminous Materials, except that samples may be taken from a single valve near

the bottom of the tank. Upon acceptance into this program, the Producer's technically competent sampling personnel will be evaluated and inspected on sampling procedures by NCDOT initially and then subsequent 60 month intervals. A certificate will be issued by NCDOT to the person evaluated. In the event Producer's personnel are discharged from duty or leave, the Producer shall contact the NCDOT Asphalt Inspector to schedule an evaluation of any new employee(s) hired. See Appendix V, Sampling Procedures and Appendix IX, Technician Training and Evaluation Record.

1. Sampling for QC

The following protocol will certify that the materials tested meet NCDOT specifications.

In accordance with AASHTO T-40, Sampling Bituminous Materials, except that samples may be taken from a single valve near the bottom of the tank, the Producers' facility's technically competent personnel [as described in their QC plan] will take two-1 quart samples in an appropriate sealed container of each batch and PGAB grade available on any given day. A Producer Sampling Log and Lab Results form shall be filled in and filed onsite and available for inspection at any time.

Requirements for the Producer Sampling Log and Lab Results form are in Appendix VIII.

- One sample, henceforth designated as "A", is for the Producer's AASHTO M-320 QC tests performed on site or at the accredited lab. "A" has a unique NCDOT Batch number.
- The other sample designated and labeled "B" is to be stored in an appropriate temperature controlled storage room at the facility that is kept between 40 degrees

F (4.4 degrees C) and 100 degrees F (37.8 degrees C). These samples may be tested by the NCDOT in case of dispute.

- “B” has the SAME Batch number as “A”.
- The NCDOT will monitor the “B” samples and will instruct the competent person when to discard the “B” samples. The discard interval will be no less than 90 days after the sampling date.

The QC samples taken by the Producer are to be identified with the following information on the sample container. The Producer will furnish and affix a label to each container itself, not on the lid, with the following information to identify the material.

1. Sampled By: _____
2. Date / Time Taken __/__/__:__ am/pm
3. NCDOT#QC-xxxxxxx _____
4. Facility:AT- _____
5. Tank/Car#: _____
6. Grade: _____ Rep. Qty. _____
7. ID: ____ (A=Prod/Supp, B=Retain)
8. “By providing this data under my signature, I attest to the accuracy and validity of the data contained on this form and certify that no deliberate misrepresentation of data, in any manner, has occurred.”
9. Sampler’s Signature: _____

In general, this is similar to the information that is on NCDOT’s self-adhesive labels [Appendix IV] that will be used on the sample container for the QA verification sample identification. For more information on sequential batch numbers to be used for sample identification see section III (B).

2. Accessibility to Facility and Random Visits by NCDOT

The above sampling rate does not preclude the NCDOT from taking additional random samples. Materials and work areas shall be accessible. The procedures and times of inspection shall be agreed upon by the NCDOT and the Producers' technically competent person who shall accommodate the NCDOT for said purpose.

3. Producer's Test Report

See [Appendix VII](#) that has a list of the minimum required information to be included on a PGAB test report. [Table 1](#) in Section II (C) contains the required tests. High End Temperature True Grade is required and any material that does not meet the required grading shall be noted on the test report as "DOES NOT MEET TRUE GRADING: Product not acceptable for use per the North Carolina Performance Graded Asphalt Binder Quality Control/Quality Assurance Program." Samples are to be tested at the rate set forth in the Producer QC Plan. Test results are to be submitted to the NCDOT by means described in III (B)(2). Test reports shall also indicate the corrective action taken to resolve product failures. No information on a test report shall contain whiteout used to neither obscure original information nor shall pencil be used anywhere on the report. If corrections are needed unused information should be x-ed or lined out with only one X or line and then initialed. If a corrected report is sent out after the original report it shall have the words "Corrected Report" clearly written on it. Falsification of test results, documentation of observations, records of inspection, adjustments to the process, discarding of samples and/or test results, or any other deliberate misrepresentation of the facts will result in revocation of the certified technician's authority to certify PGAB test results or reports for NCDOT.

4. Consequences of Falsification of Test Results

No payment will be made for all tonnage represented by the falsified test(s) results or documentation. In addition, state and/or federal authorities may also pursue legal action.

5. Notification of Product Failure

This subject is addressed in Section 2.1 of any Producer's QC plan on file at NCDOT.

6. Standard Specifications

The Producer is to perform all sampling and testing in accordance with current specifications and procedures referenced in the *NCDOT Standard Specifications for Roads and Structures*.

B. Sample Identification and Record Keeping for All Producer Material

It is critical that care be taken to properly label samples and record test data accurately.

NCDOT will furnish each producer a series of sequential numbers. Producer's QC material will then be identified with the sequential Batch numbers (e.g., NCDOT#QC-1200146, QC-1200147, etc). Skipping numbers when identifying material to be certified by the Producer will not be permitted as this will create confusion in this process.

1. Bill of Lading Requirements

An example Bill of Lading must be included with the QC Plan. The delivery ticket or bill of lading information below is extracted from the North Carolina Department of Transportation Standard Specifications for Roads and Structures Section 1020-1, Delivery and Acceptance of Asphalt Materials which describes the transporting requirements. The Bill of Lading or delivery ticket will have a minimum of the following information on it.

1. Name of Producer/Supplier and location
2. A statement that the material has been tested and meets AASHTO specifications or is being provided by an approved supplier under Approved Supplier Certification (ASC)
3. The grade of the binder material.
4. The rotational viscosity in Pascal-Seconds (Pa-S) at 135 and 165°C
5. The recommended laboratory mixing and compaction temperature (degrees C for the PGAB)
6. Delivery ticket number
7. Date and time loaded (mm/dd/yyyy AM:PM)
8. Date and time shipped (mm/dd/yyyy AM:PM)
9. State project or purchase order number
10. NCDOT assigned batch number
11. Destination
12. Name of consignee
13. Trailer or car number
14. Producer's or Supplier's storage tank and batch number
15. Quantity loaded in tons or gallons (metric tons or liters)
16. Specific gravity or pounds per gallon (kg/L) at 60 degrees F (15.6 degrees C)
17. Loading temperature
18. Net gallons at 60 degrees F (15.6 degrees C)
19. Brand, grade and percentage or quantity of anti-strip additive
20. Stamp, write, print or attach the NCDOT Supplier's and NCDOT Transporter's Certification to the delivery ticket as described in Section 1020, Delivery and Acceptance of Asphalt Materials. For the latest issues of certifications, see the Materials and Tests Chemical Laboratory website. Click on <https://connect.ncdot.gov/resources/Materials/Pages/ChemicalLaboratory.aspx> then scroll down to "Resource Type: Forms" and click the document titled Asphalt Materials Bill of Lading Standard Attachment.

Other information may be added as deemed necessary.

2. Retention and Reporting of Data

- QC producer test data, Certificate of Analysis (COA) and Certificate of Compliance (COC) test data is to be retained by the Producer for at least three (3) years and made available for review to the NCDOT and Federal Highway Administration (FHWA) upon request. Bill of Lading and Loading affidavits are to be retained by the Producer for at least 6 months and made available to the NCDOT upon request. See Appendix VII that has a list of the minimum required information to be included on a PGAB test report or COA. Quality Control COA's or COC's and/or PGAB test reports shall include the NCDOT Batch number identification and shall be faxed to the NCDOT at 919-733-8742 with a cover sheet to the attention of Mr. K. L. Croft or emailed to kcroft@ncdot.gov and crcolgate@ncdot.gov .
- Submission of certified test data to the NCDOT shall also be done by populating the spreadsheet shown in [Appendix XII](#). No header changes to the spreadsheet are permitted. Email this data to the above email address with the subject line "PGAB data-AT xx". No signature is required on this spreadsheet but the data will be cross-checked with the certified test data received from Producers.

C. Quality Assurance (QA) and Sampling and QC/QA Results Evaluation

The QA samples taken by the NCDOT Inspector from the Materials and Tests Unit or other qualified individual are used by the NCDOT to accept the quality of material being produced and shipped. Materials will be sampled in accordance with AASHTO T-40, Sampling Bituminous Materials, except that samples may be taken from a single valve near the bottom of the tank.

1. Verification Sampling by QA Personnel

In accordance with AASHTO T-40, Sampling Bituminous Materials, except that samples may be taken from a single valve near the bottom of the tank, the NCDOT shall take verification samples, random and independent of QC samples, of PGAB at the rate of one – 1 quart samples at random once each two months or 20,000 tons (4,620,000 gallons) per grade per lot whichever is less until three consecutive results comply with the program requirements. The Producer may draw a sample at the same time as a duplicate to hold for possible future testing, *but it should never be used as a required QC sample as it is not taken at random.* NCDOT will affix a label to each container itself, not on the lid, to identify the material. An example of the label is in Appendix IV.

- The sample is for NCDOT and has the same batch number as the last QC sample taken by the producer.

Upon return to the laboratory NCDOT will record the sample information on a HiCAMS Sample Card Record (See Appendix VIII) and assign the HiCAMS number. The QA verification sample will be tested by the NCDOT in accordance with AASHTO M 320.

2. Accessibility to Facility

The above sampling rate in III (C)(1) does not preclude the NCDOT from taking additional random samples. Materials and work areas shall be accessible to the NCDOT.

The procedures and times of inspection shall be coordinated by the NCDOT and the Producers' technically competent person who shall accommodate the NCDOT for said purpose.

3. QC Sample and QA Verification Sample Results Evaluation

The following are definitions that may/may not be industry standard but will be used by the NCDOT in this program.

- Batch – a representative quantity of PGAB that has an NCDOT Batch number assigned to it.
- Set of QC results - all the QC test results for one grade of PGAB during the QA inspection interval of 2 months or 6 months as described in this section.
- Verification – sample taken for verification of Quality Control’s testing.
- Acceptance Limits – a statistical low and high number, either representing a specification, is a three deviation numerical range of values determined by the applicable test method.
- High End Temperature True Grade - high temperature grading result determined from DSR-original, DSR-RTFO, DSR-PAV pass/fail temperature results.

For each batch of a grade tested over the QC or QA inspection interval, the set of results for a PGAB sample grade must classify as that PGAB grade per the High End Temperature True Grade test to limit the risk to DOT on projects. In the event of recognition of the material grading at a level beyond the high temperature grade, the AMRL lab shall contact the terminal personnel immediately to avoid shipments. The responsible AMRL lab MUST PLACE A COMMENT on the test report that states, “DOES NOT MEET TRUE GRADING: Product not acceptable for use per the North Carolina Performance Graded Asphalt Binder Quality Control/Quality Assurance Program.”

After three consecutive two-month intervals of acceptable results with no internal or DOT/Producer investigations pending, the QA verification sample frequency may be reduced to a minimum of once per six months, provided that there are enough data points for NCDOT to achieve a sound statistical analysis.

4. **Table 2 – Acceptance Limits of QC-QA Samples – All Producers - FOR INVESTIGATION USE REFERENCE BY NCDOT**

Note for Table 2: Acceptance limit values subject to change.

See the website for the latest updates: Click on <https://connect.ncdot.gov/resources/Materials/Pages/ChemicalLaboratory.aspx> then scroll down to “Resource Type: Programs” and click the document titled Performance Graded Binder QC-QA Program Table 2 Acceptance Limits.

5. Corrective Action and Investigation by the Producer and NCDOT on QC and QA Verification Samples

a. Deviation from Acceptance Limits Requirements but Sample is Acceptable

For deviations from the acceptance limits in Table 2 where the sample meets grading specifications, the NCDOT will notify the Authorized Quality Control (QC)

Representative described in the Producer’s QC Plan. The NCDOT will allow no more than sixty calendar days for the Producer to submit documentation that will complete the investigation. After that period, action may be taken which could include removal from the approved list. The investigation will include but is not limited to a review of the sampling procedures, the equipment used in the production and the testing of the material, the test results and the testing procedures of the technician. If the cause is determined to be improper sampling or testing procedures by the Producer the following will occur.

- The appropriate approved individual will be notified.
- If corrective action is not taken, the individual's approval may be revoked.

If the cause is determined to be in the Producer's testing equipment or handling of the material, the following will occur.

- The Producer is to take corrective action.

- If corrective action is not taken, the Producer's approval to provide material to NCDOT may be revoked.

The Producer will document the corrective action taken with a copy sent to NCDOT. Test reports shall also indicate the corrective action taken to resolve product failure if applicable. If the cause is determined to be in the NCDOT's sampling or testing procedures, or equipment, the NCDOT will take corrective action. Both parties may be required to repeat the tests on the retained sample(s) and if they are then in range of method acceptance limits the results are reported. If the deviation is still not acceptable, both parties will review results and the above investigation will be performed again to determine the cause of the discrepancy. Once the investigation concludes and any corrective action implemented, normal testing procedures are resumed.

b. Deviation from Acceptance Limits Requirement and Sample Fails by One or Both Labs

For deviations from the acceptance limits in Table 2 where AASHTO's grading specifications are not met by one or both of the accredited testing facilities, the Producer will stop shipment and immediately notify the NCDOT within 24 hours or the NCDOT will notify the Producer to stop shipment. At this point, an investigation involving the Authorized Quality Control (QC) Representative described in the Producer's QC Plan and the NCDOT will attempt to resolve the problem. One or both parties will repeat the tests on the retained sample and if they are then in range of method acceptance limits the results are reported and shipment resumes. If any of the tests still fail from either lab, both parties will conduct an investigation that will

include but is not limited to review of the sampling procedures, the equipment used in the production and the testing of the material, the test results and the testing procedures of the technician. If the cause is determined to be improper sampling or testing procedures by the Producer the following will occur.

- The appropriate approved individual will be notified.
- If corrective action is not taken, the individual's approval may be revoked.

If the cause is determined to be in the Producer's testing equipment or handling of the material, the following will occur.

- The Producer is to take corrective action.
- If corrective action is not taken, the Producer's approval to provide material to the NCDOT may be revoked.

The corrective action taken will be documented by the Producer and with a copy sent to the NCDOT. Test reports shall also indicate the corrective action taken to resolve product failure. If the cause is determined to be in the NCDOT's sampling or testing procedures, or equipment, the NCDOT will take corrective action. If the investigation above fails to determine the cause then the third referee sample retained by NCDOT will be sent to a mutually acceptable AASHTO accredited laboratory for third party analysis.

- Responsibility for payment to the third party lab belongs to the Producer unless results show that NCDOT's results were beyond the acceptance limits (Table 2)
- If the third party's results indicate failing material from the referee sample, shipments from that batch will be discontinued and/or rejected.

Quality Assurance verification sample testing will be resumed at a one-month interval until three consecutive lots meet the grading specification and acceptance limit criteria in Table 2. Once the investigation concludes and any corrective action implemented, normal testing procedures are resumed.

c. Consequences of Providing Failing Material to NCDOT

If the material fails to meet AASHTO's grading specifications for any test performed, the material is not acceptable and will be subject to Section II (F) of this written program.

D. Independent Assurance (IA) – Comparative

1. Comparative Sampling for IA

The IA – comparative-sampling protocol evaluates the qualified sampling and testing personnel and testing equipment. The Producer is to take samples for EACH of the accredited labs that they use for certifying PGAB. In accordance with AASHTO T-40, Sampling Bituminous Materials, except that samples may be taken from a single valve near the bottom of the tank, the Producers' facility's technically competent personnel [as described in their QC Plan] will take Independent Assurance (IA) comparison samples of PGAB at the rate of two – 1 quart comparative samples at random twice each year of performance graded asphalt binder. More than one "A" sample may be taken depending on the number of laboratories being evaluated. Only one "B" sample is needed for NCDOT. For example, if there are five accredited labs used by a producer, there needs to be six samples taken (five for the producer's use, one for NCDOT). Samples are to be taken at the same time (back to back) and do not need to be physically split from a one- (1) gallon container. A Producer Sampling Log and Lab Results form shall be filled in

and filed onsite and available for inspection at any time. The IA samples taken by the Producer are to be identified with the following information on the sample container. The Producer will furnish and affix a label to each container itself, not on the lid, with the following information to identify the material.

1. Sampled By: _____
2. Date/Time Taken __/__/____: __am/pm
3. NCDOT#IANC-xxxxxxx _____
4. Facility:AT- _____
5. Tank/Car#: _____
6. Grade: _____ Rep. Qty. _____
7. ID: ____ (A=Prod/Supp,B=DOT)
8. “By providing this data under my signature, I attest to the accuracy and validity of the data contained on this form and certify that no deliberate misrepresentation of data, in any manner, has occurred.”
9. Sampler’s Signature: _____

In general, this label is similar to the information that is on NCDOT’s self-adhesive labels [Appendix IV] that will be used on the sample containers for the QA verification sample identification. For more information on sequential batch numbers to be used for sample identification see section III (B).

- Samples designated with an “A” are always the Producer’s. “A” has a unique NCDOT Batch number. Each of the Producer’s accredited labs receives an “A” sample. The sequence “A1, A2, A3, ...” may be used.
- “B” is for NCDOT and has the same batch number as “A”. A HiCAMS number will be assigned at the QA laboratory.

The NCDOT batch number will be assigned by the Producer from their sequential list.

Then the Producer will send sample “B” to the NCDOT. The Producer’s IA sample results can serve as that month’s grade certification. The sample will be tested by the NCDOT and by the Producer’s designated AASHTO accredited laboratory in accordance

with AASHTO M 320. Reporting of the IA test results by the Producer to DOT shall be in accordance with Section III(A)(3) and Appendix VII.

2. IA – Comparative Sample Results Evaluation

The following are definitions that may/may not be industry standard but will be used by the NCDOT in this program.

- Batch – a representative quantity of PGAB that has an NCDOT Batch number assigned to it.
- Set of IA results - all the IA test results for one grade of PGAB during the inspection interval of twice per year as described in this section.
- Verification – sample taken for verification of Quality Control’s testing.

For the batch of a grade tested by the Producer over the inspection interval, the set of IA results are compared to the corresponding NCDOT IA sample to precision statements in Table 3.

3. Table 3 – Acceptable Range of Two Test Results

<u><i>TABLE 3</i></u>		<i>Acceptable Range of Two Test Results</i>
Condition:	(D2S%) *	Test Method Reference:
<i>Multilaboratory Precision:</i>		
Rotational Viscosity (Pa-s)	12.1	AASHTO T 316
Original Binder: G*/sin delta (kPa)	17.0	AASHTO T 315
RTFO/TFO Residue: G*/sin delta (kPa)	22.2	AASHTO T 315
PAV Residue: G*/sin delta (kPa)	40.2	AASHTO T 315
BBR Creep Stiffness (Mpa)	17.8	AASHTO T 313
BBR Slope -m value	6.8	AASHTO T 313

Note: * D2S% values subject to change and is defined as the difference between two individual test results expressed as a percent of average.

4. Corrective Action and Investigation by the Producer and NCDOT on IA – Comparative Samples

a. Deviation from Precision Requirement in Table 3

For deviations from the precision statements in Table 3, the NCDOT will notify the Authorized Quality Control (QC) Representative described in the Producer's QC Plan. IANC samples will be resampled by the Producer in accordance with Section III (D)(1) except NCDOT receives 4 (FOUR) IA samples. Both parties will repeat testing and if they are in range of method reproducibility limits, results are reported. If the reproducibility is not acceptable from the second set of test results, then a retain from NCDOT will be sent to a mutually acceptable AASHTO accredited laboratory. If the results from the referee (third lab) are not within the reproducibility in Table 3 when compared to the highest and lowest of the three lab values, an investigation will be made to determine the cause of the discrepancy. The NCDOT will allow no more than sixty calendar days for the Producer to submit documentation that will complete the investigation. After that period, action may be taken which could include removal from the approved list. The investigation will include but is not limited to a review of the sampling procedures, the equipment used in the production and the testing of the material, the test results, and the testing procedures of the technician. If the cause is determined to be improper sampling or testing procedures by the Producer or the NCDOT, the appropriate approved individual will be notified. If the problem continues, the individual's approval may be revoked. If the cause is determined to be in the Producer's testing equipment or handling of the material, the Producer is to take corrective action. If this problem continues, the Producer's approval to provide material to NCDOT may be revoked. The Producer will document the corrective

action taken with a copy sent to NCDOT. Test reports shall also indicate the corrective action taken. If the cause is determined to be in the NCDOT's sampling and testing equipment, the NCDOT will take corrective action.

- Responsibility for payment to the third party lab belongs to the Producer unless results show that NCDOT's results were beyond the reproducibility limits (Table 3)

If the third party's results indicate failing material from the referee sample, shipments from that batch will be discontinued and/or rejected. Once the investigation concludes and any corrective action implemented, normal testing procedures are resumed.

IV. Product Identification Procedures

In addition to the identification required by the applicable AASHTO specifications, the Producer's QC Plan, and by the NCDOT Standard Specifications, the PGAB Bill of Lading shall be marked as having been produced as a participant of this program. All Bills of Lading are required to have NCDOT sequential batch numbers that will fulfill this marking requirement. HiCAM's numbers are not required on bills of lading.

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Appendix I: Example Model Performance Graded Binder Quality Control Plan

See the website for the latest updates:

Click on <https://connect.ncdot.gov/resources/Materials/Pages/ChemicalLaboratory.aspx> then scroll down to “Resource Type: Plans” and click the document titled Performance Graded Binder QC-QA - NEAUPG Model Plan.

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Appendix II: AASHTO R 26, Certifying Suppliers of Performance Graded Binders

Standard Recommended Practice for

Certifying Suppliers of Performance-Graded Asphalt Binders

AASHTO Designation: R 26-01



1. SCOPE

- 1.1. This standard specifies requirements and procedures for a certification system that shall be applicable to all suppliers of performance-graded asphalt binder (PGAB). The requirements and procedures shall apply to materials that meet the requirements of M 320, Section 5, Materials and Manufacture, and which are manufactured at refineries, mixed at terminals, in-line blended, or modified at the hot-mix asphalt (HMA) plant.
- 1.2. This standard may involve hazardous materials, operations, and equipment. It does not purport to address all of the safety problems associated with this use. The user of this standard shall be responsible for appropriate safety and health practices.

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- M 320, Performance-Graded Asphalt Binder
 - R 29, Grading or Verifying the Performance Grade of an Asphalt Binder
 - T 40, Sampling Bituminous Materials
- 2.2. *ASTM Standards:*
- D 8, Definitions of Terms Relating to Materials for Roads and Pavements
 - D 3665, Random Sampling of Construction Materials

3. TERMINOLOGY

- 3.1. *AAP*—AASHTO Accreditation Program.
- 3.2. *asphalt binder*—an asphalt based cement that is produced from petroleum residue either with or without the addition of nonparticulate organic modifiers.
- 3.3. *ASC*—Approved Supplier Certification.
- 3.4. *AS*—Approved Supplier.
- 3.5. *PGAB*—Performance-Graded Asphalt Binder.
- 3.6. *supplier*—a *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 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 supplier and must provide the certification. If any modifications are made to the PGAB at the terminal, the terminal shall be the 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 supplier and must provide the certification.

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.

- 3.7. *agency*—agency shall be defined as a state highway agency or other agency responsible for the final acceptance of the PGAB.
- 3.8. *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.
- 3.9. *quality control testing*—the quality control testing shall be described in the supplier's quality control plan. The supplier's quality control plan shall be approved by the agency.

Note 2—Definitions for many terms common to asphalt binder are found in ASTM D 8.

4. SIGNIFICANCE AND USE

- 4.1. This standard specifies procedures for minimizing disruption of PGAB shipments. This is accomplished by a certification system which evaluates quality control and specification compliance tests performed by the supplier on samples obtained prior to shipment.
- 4.2. The number of PGAB available under M 320 may require construction of additional storage facilities if the procedure of "sample and hold while testing" is followed exclusively. The addition of new storage capacity at a facility may be infeasible at some locations. Standardization of procedures that allow shipment under an approved supplier certification provides the flexibility needed to use existing facilities and to limit the shipment disruptions.
- 4.3. This standard provides information on the following activities:
- 4.3.1. General requirements that the supplier shall satisfy to be given approved-supplier status;
- 4.3.2. Minimum requirements that shall be included in a supplier's quality control plan;
- 4.3.3. General requirements that the agency shall satisfy before certification;
- 4.3.4. Procedure for shipping PGAB under an ASC system;
- 4.3.5. Procedure for agency monitoring of an ASC system at the shipping facility; and
- 4.3.6. Procedure for field sampling and testing of PGAB shipped under an ASC system.

5. HAZARDS

- 5.1. The safety requirements of the field and/or laboratory organization and/or OSHA shall be observed.

6. SAMPLING

- 6.1. All test samples required by this standard shall be obtained in accordance with T 40 and ASTM D 3665. The use of a random sampling procedure is mandatory to the establishment of a valid certification program.

7. TESTING REQUIREMENTS

- 7.1. Testing required for this standard shall be performed by a laboratory currently accredited by the AAP. Any satellite laboratory of a supplier that performs required testing under this standard shall be identified in the AS quality control plan (Section 9) and shall be approved by the agency.

Note 3—Cost of this inspection shall be borne by the source of data. 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.

8. SUPPLIER REQUIREMENTS

- 8.1. The supplier shall submit a written request to the agency for authorization to ship PGAB under the ASC system and shall list the PGAB to which the request applies.
- 8.2. The supplier shall allow the agency to visit the production and/or shipping site to observe the supplier's quality control activities, to inspect the facilities and to obtain samples for test.
- 8.3. The supplier shall submit to the agency for approval a complete quality control plan, which complies with the requirements of Section 9.
- 8.4. The supplier shall follow the procedures described in the approved quality control plan.
- 8.5. The supplier shall establish a continuing test record for each test required on each PGAB included in the written request prepared to satisfy the requirements of Section 8.1.
- 8.6. The supplier shall forward to the agency the initial series of test data for each performance grade included in the written request prepared to satisfy the requirements of Section 8.1. The supplier shall also obtain and provide a split sample for the agency if requested.
- 8.7. The supplier shall submit to the agency all reports required by this standard 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/One minute intervals: _____
Average: _____ cP X .001 =
Note: 1cP = 0.001 Pa*s

Rolling Thin Film Oven Residue:

Time in oven: _____ (+85 minutes) 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 Hours) 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 minute: 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:	_____	_____	_____	_____	_____

Figure 1—Sample Worksheet

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 hours @ 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
 Failure Strain, Min 1.0%: %
 Test Temp @ 1.0 mm/min., °C °C

Figure 2—Performance-Graded Binder Test Results According to M 320

- 8.8. The supplier shall have a satisfactory record of compliance with governing specifications. Judgments by the agency concerning this requirement shall be based on the test results furnished by the supplier and satisfactory results when the monitoring and field tests are compared with supplier tests.

9. SUPPLIER QUALITY CONTROL PLAN—MINIMUM REQUIREMENTS

- 9.1. The supplier's quality control plan shall identify the following:
- 9.1.1. Facility type (refinery, terminal, in-line blending or HMA plant);
 - 9.1.2. Facility location;
 - 9.1.3. Name and telephone number of the person responsible for quality control at the facility;
 - 9.1.4. The quality control tests to be performed on each PGAB; and
 - 9.1.5. Name and location of the laboratory performing quality control tests on the PGAB that is shipped.
- 9.2. The supplier'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 supplier shall (1) immediately notify the agency of the shipment in question, (2) identify the material, (3) cease shipment until material complies with the specification, (4) notify the agency 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 agency shall have final authority in the decision on specification compliance.
- 9.3. The supplier's quality control plan shall describe method and frequency for initial testing, quality control testing and specification compliance testing.
- 9.3.1. *Initial 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 (see Note 4). The supplier and the agency shall agree on a lot size. The agency must approve any change to a lot size.
- Note 4**—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.
- 9.3.2. *Reduced Frequency of Testing for Specification Compliance*—If approved by the agency, the frequency of testing for specification compliance may be decreased 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 agency, 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.
- 9.3.3. *Minimum Frequency*—Specification compliance testing shall be run at the minimum frequency required by the agency for each PGAB that is supplied.

- 9.3.4. *Quality Control Testing for Guiding Manufacturer*—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 manufacturer, if approved by the agency. The use of non-M 320 tests does not preclude the need to meet M 320 specifications or to run complete M 320 tests according to the guidelines in Section 9.3.
- 9.4. The supplier's quality control plan shall include a statement that the supplier will prepare monthly summary reports for all quality control and specification compliance tests performed during that period and will submit them to the agency on request.
- 9.5. The supplier 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 supplier's records and will be made available to the agency on request.
- 9.6. The supplier shall submit a written request to the agency 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 supplier 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 determined under the requirements of Section 8.
- 9.6.1. The supplier, 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 9.3 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 supplier shall keep a record of the proportions, based on mass or other indicators. The supplier and agency shall agree on the frequency for recording the proportions. (See Section 3.6.)
- Note 5**—For additives that do not meet the requirements of Section 5, M 320, the supplier may submit a written request to the agency 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 supplier 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, determined under the requirements of Section 8.
- 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 agency. Supplier and agency shall therefore agree on the test methods to be used. The agency 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 supplier 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 solid additive and the binder to be added at the HMA plant, (2) the supplier shall keep a record of the proportions, based on mass or other indicators and (3) the supplier and agency shall agree on the frequency for recording the proportions.

Note 6—Reclaimed Asphalt Pavement (RAP)—The HMA producer may submit a written request to the agency 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 cement 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 agency shall agree on the frequency for recording the proportions. The agency 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.

10. AGENCY REQUIREMENTS

- 10.1. The agency shall verify that the supplier's quality control plan is adequate. The agency may visit the shipping site when required.
- 10.2. The agency shall notify the supplier that the supplier's application for AS status has been granted. The notification shall include a list of the PGAB covered.
- 10.3. The agency shall verify that the supplier's primary testing laboratory is currently AASHTO accredited.
- 10.4. The agency may perform split sample testing in accordance with Section 12.
- 10.5. The agency may perform quality assurance sampling and testing in accordance with Section 13.
- 10.6. The agency shall authorize shipment of each listed PGAB under the ASC system only after all ASC system requirements have been satisfied.
- 10.7. The agency shall inspect the operations of the supplier's facility related to the PGAB shipments when required.
- 10.8. The agency shall notify the supplier when split sample data versus supplier sample data does not compare within the limits established in Sections 12 and 13.
Note 7—The supplier 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 agency or by the HMA producer until the test results are available. If the test results are disputed, the agency and supplier shall agree upon a test procedure for the referee sample.

11. REQUIREMENTS FOR SHIPPING PGAB BY AN APPROVED SUPPLIER

- 11.1. The supplier's quality control plan as approved by the agency shall be implemented. (See Section 9.)

- 11.2. The supplier shall make PGAB shipments covered by the certification as dictated by shipping schedules.
- 11.3. Each shipment shall be accompanied by two copies of the bill of lading, which shall include (1) the name and location of the 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 8**—On any invoice or Bill of Lading, it is recommended that metric tons be used as the primary unit of measurement.
- 11.4. If the specification compliance test results do not conform to PGAB specifications, the supplier shall remove the non-compliant material from the shipping queue as outlined in Section 9.2.
- 11.5. Based on the agency's split sample testing on the referee sample (see Note 7), price adjustment may be made for material that does not comply to the specified PGAB requirements. The price adjustment shall be determined by the agency. If problems with the PGAB recur at the HMA plant, the agency may suspend use of the PGAB until the cause for noncompliance with specifications can be identified and corrected.

12. SPLIT SAMPLE TESTING

- 12.1. The agency may test split samples that are obtained at random from the supplier's facility.
- Note 9**—Split samples will be obtained from the same general points in the supplier's shipping process that the 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.
- 12.2. The agency shall determine the frequency of split sample testing.
- 12.3. If the split sample data and the supplier test data are not within the test tolerance specified (see Section 15), 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 supplier and agency.

13. FIELD SAMPLING

- 13.1. The agency or HMA producer may design the field-sampling plan to accomplish the intended purpose.
- Note 10**—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.
- 13.2. The agency may obtain samples from the field facility on a random basis for the purpose of quality assurance.
- 13.3. The agency shall determine a minimum frequency of field sampling that shall be adequate to satisfy the purpose for which the field samples are taken.

- 13.4. If the field test data are not within tolerance, the agency shall immediately notify the approved supplier 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.
- 13.5. If the PGAB fails to comply with the specification, the supplier 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 supplier or HMA producer shall delay the project work pending corrective action.

14. REPORT AND DATA SHEETS

- 14.1. *Supplier Reports*—The supplier shall prepare the reports described in Sections 8.1, 8.3, 8.6, 8.7, 9.2, 9.4, 9.5, 11.2, and 11.3.
- 14.2. *Agency Reports*—The supplier may request copies of the split sample test results and field test data.

15. KEYWORDS

- 15.1. Approved Supplier (AS); Approved Supplier Certification (ASC); certification system; certified shipments; Performance-Graded Asphalt Binder (PGAB) Certification.

Appendix III: NCDOT Section 1020

See the website for the latest updates:

Click on <https://connect.ncdot.gov/resources/Specifications/Pages/default.aspx> then scroll down to select the latest Standard Specifications and Provisions heading.

APPENDIX IV: Example Label for Sample Identification



SAMPLED BY: _____
DATE/TIME TAKEN __/__/_____:__am/pm
NCDOT# QA- _____
FACILITY: AT- _____
TK/CAR#: _____
GRADE: _____ REP. QTY. _____
ID: _____ (A=Prod/Supp,B=Retain)
****PG BINDER**** HiCAMS # _____

“By providing this data under my signature, I attest to the accuracy and validity of the data contained on this form and certify that no deliberate misrepresentation of test results, in any manner, has occurred.”

SAMPLER's Signature: _____

The Batch number will be designated as “NCDOT#QA-xxxxxxx” or “NCDOT#QC-xxxxxxx” or “NCDOT#IANC-xxxxxxx” on the label.

Appendix V: Sampling Procedures

In order to reduce the number of variables that affect the correlation between QC and QA verification samples and IA comparative samples, it is important that all samples be obtained following procedures outlined in the *Standard Specifications*, or as outlined in this program.

Each Producer will describe in detail the particular sampling and testing procedures used at the facility in the Producer's QC plan including the qualifications of sampling and testing personnel.

Samples taken by NCDOT during facility visits will be taken in the same manner as the QC or IA samples taken at the plant.

Appendix VI: Testing Procedures

The following is a partial reference list of common test names used in this manual and their corresponding ASTM or AASHTO designations. This list is not intended to be all inclusive, nor is it intended to be a list of all tests required for certification of the products and materials produced using this program.

QC Tests

<i>Test Description</i>	<i>Test Method Reference</i>
Flash Point (Cleveland Open Cup)(Degrees Centigrade)	AASHTO T 48
Rotational Viscosity @ 135 C (Pa-s)	AASHTO T 316
Rotational Viscosity @ 165 C (Pa-s)	AASHTO T 316
Original Binder: G*/sin delta (kPa)	AASHTO T 315
Rolling Thin Film Oven Test (RTFO)	AASHTO T 240
Mass Change after RTFO (%)	AASHTO T 240
RTFO Residue: G*/sin delta (kPa)	AASHTO T 315
Pressure Aging Vessel (PAV)	AASHTO R 28
Pressure Aging Vessel (PAV) Residue: G*/sin delta (kPa)	AASHTO T 315
Bending Beam Rheometer (BBR) Creep Stiffness (Mpa)	AASHTO T 313
Bending Beam Rheometer (BBR) Slope -m value	AASHTO T 313
Direct Tension (DTT) Failure strain (%)	AASHTO T 314
High End Temperature True Grade (°C)	AASHTO T 315

QA Verification Tests

<i>Test Description</i>	<i>Test Method Reference</i>
Rotational Viscosity @ 135 C (Pa-s)	AASHTO T 316
Rotational Viscosity @ 165 C (Pa-s)	AASHTO T 316
Original Binder: G*/sin delta (kPa)	AASHTO T 315
Rolling Thin Film Oven Test (RTFO)	AASHTO T 240
Mass Change after RTFO (%)	AASHTO T 240
RTFO Residue: G*/sin delta (kPa)	AASHTO T 315
Pressure Aging Vessel (PAV)	AASHTO R 28
Pressure Aging Vessel (PAV) Residue: G*/sin delta (kPa)	AASHTO T 315
Bending Beam Rheometer (BBR) Creep Stiffness (Mpa)	AASHTO T 313
Bending Beam Rheometer (BBR) Slope -m value	AASHTO T 313
Direct Tension (DTT) Failure strain (%)	AASHTO T 314
High End Temperature True Grade (°C)	AASHTO T 315

Appendix VI: Testing Procedures (Continued)

Independent Assurance (IA) Tests

<i>Test Description</i>	<i>Test Method Reference</i>
Rotational Viscosity @ 135 C (Pa-s)	AASHTO T 316
Rotational Viscosity @ 165 C (Pa-s)	AASHTO T 316
Original Binder: G*/sin delta (kPa)	AASHTO T 315
Rolling Thin Film Oven Test (RTFO)	AASHTO T 240
Mass Change after RTFO (%)	AASHTO T 240
RTFO Residue: G*/sin delta (kPa)	AASHTO T 315
Pressure Aging Vessel (PAV)	AASHTO R 28
Pressure Aging Vessel (PAV) Residue: G*/sin delta (kPa)	AASHTO T 315
Bending Beam Rheometer (BBR) Creep Stiffness (Mpa)	AASHTO T 313
Bending Beam Rheometer (BBR) Slope -m value	AASHTO T 313
High End Temperature True Grade (°C)	AASHTO T 315

Appendix VII: QC and QA Verification Test Report Forms

Each Producer will submit copies to NCDOT of all final QC and QA verification test report forms, COA's, and COC's used with the Producer's QC plan or with this QC/QA plan.

Test reports, including IA, shall contain at a minimum the following information:

- A. Certifying statement with signature on the test report or COC/COA. This statement must read as follows:
“By providing this data under my signature, I attest to the accuracy and validity of the data contained on this form and certify that no deliberate misrepresentation of test results, in any manner, has occurred.”
- B. Name and address of the testing laboratory.
- C. The facility or terminal who owns the sample.
- D. Unique report identification number and/or title and the date issued.
- E. Identification of the NCDOT QC or QA verification North Carolina batch number.
- F. Description, identification, and condition of the test sample.
- G. Date and time the sample was taken.
- H. Sampled By.
- I. Tank or car number.
- J. Grade of asphalt that is being tested.
- K. Date of receipt of the test sample.
- L. Date(s) of test completion.
- M. Identification of the standard test method used and a notation of all known deviations from the test method.
- N. Test results and other pertinent data required by the standard test method.
- O. Identification of any test results obtained by a subcontractor and the name of the subcontractor.
- P. Name of the person(s) accepting technical responsibility for the test report.
- Q. Technician's name
- R. Signature.
- S. Certifying statement that the material meets AASHTO specifications.

T. Certifying statement that the material DOES NOT MEET TRUE GRADING when a high temperature true grade is performed and is out of range. See Section III (C)(3).

Appendix VIII: HiCAMS Sample Card Record and Requirements for Producer Sampling Log and Lab Report

I. NC DOT HiCAMS Sample Card

* Required Field † May Be Required Based on Material		HICAMS #: <input style="width: 100px;" type="text"/>
* Material: _____		<input type="checkbox"/> Metric <input type="checkbox"/> English
† Sample Owner: _____	† Contract #: _____	
* Testing Category: _____	Field ID: _____	
Check Sample? Y N (circle One)	Proj/Po/Wo#: _____	
† Related Sample ID: _____	Line Item #: _____	
† Corr. Sample ID: _____	RE: _____	
# of Pieces: _____	* Rep. Qty: _____	
* To Be Used In: _____		
Comment:		
* Sampled Date: _____		* Sampled By: _____
* Sample From: _____	Truck/ Container #: _____	
Structure Number: _____	Route Desc: _____	
Route Type: I US NC SR (circle one)	Alignment: _____	
Route Number: _____	* Location: _____	Offset Dist.: _____
Map Number: _____	* Sta. From: + _____	Sta. To: + _____
County: _____	Coastal Plain: Y N (circle one)	
† Producer/Supplier: _____	† Plant ID#: _____	<input type="checkbox"/> Approved <input type="checkbox"/> Other
† Brand Name: _____	Shelf Life Date: _____	
† Date Produced: _____	† Asphalt Mix/ JMF ID: _____	
† Concrete Mix: _____		
† Alternate ID# Type:	Prefix	Range: Description of Items:
_____	_____	_____
_____	_____	_____
_____	_____	_____
Please use reverse side for test data, comments, and additional information. Check here if more on reverse <input type="checkbox"/>		

II. Requirements for Producer Sampling Log and Lab Report

The minimum information required is as follows:

1. Terminal name and location
2. Tank Number.

Appendix VIII: HiCAMS Sample Card Record and Requirements for Producer Sampling Log and Lab Report
(Continued)

3. Performance Grade
4. Date
5. Time
6. NCDOT QC- or NCDOT IA-
7. Flashpoint
8. Rotational Viscosity @135C
9. DSR on Original @ required Temperature(s).
10. DSR Temperature
11. Mass Loss Percent
12. DSR on RTFO @ required temperature(s).
13. DSR on PAV @ required temperature(s).
14. Pass/Fail Temperature (High End Grade)..
15. BBR on PAV @ required temperature(s).

Optional Fields Below:

16. Specific Gravity @ 60F
17. Elastic Recovery
18. Direct Tension @ required temperature(s).
19. Absolute Viscosity @ 140F
20. Penetration 2hr or 4 hr
21. Terminal / Refinery Lot No.

APPENDIX X: Producer Acceptance Limits for PGAB Test Methods

This is an EXAMPLE ONLY of typical producer specific acceptance limits.

Type/Item/ Grade:	Facility Name	Upper and Lower Limit of Test Values	Result
PG 64-22	XYZ (#999)	Upper AL of RV @ 135 C (275F)[Pa-sec]:	3.00
PG 64-22	XYZ (#999)	Lower AL of RV @ 135 C (275F)[Pa-sec] :	0.367
PG 64-22	XYZ (#999)	Upper AL of DSR Original @ 64 C [kPa]:	2.35
PG 64-22	XYZ (#999)	Lower AL of DSR Original @ 64 C [kPa]:	1.00
PG 64-22	XYZ (#999)	Upper AL of DSR RTFO @ 64 C [kPa]:	7.34
PG 64-22	XYZ (#999)	Lower AL of DSR RTFO @ 64 C [kPa]:	2.20
PG 64-22	XYZ (#999)	Upper AL of DSR PAV @ 25 C [kPa]:	5000
PG 64-22	XYZ (#999)	Lower AL of DSR PAV @ 25 C [kPa]:	1360
PG 64-22	XYZ (#999)	Upper AL of BBR @ -12 C,S [MPa]:	300
PG 64-22	XYZ (#999)	Lower AL of BBR @ -12 C,S [MPa]:	68
PG 64-22	XYZ (#999)	Upper AL of BBR @ -12 C, m-value:	0.394
PG 64-22	XYZ (#999)	Lower Al of BBR @ -12 C, m-value:	0.300

APPENDIX XI: Federal Highway Administration Poster
(NEXT SHEET)

U. S. Department
of Transportation
**Federal Highway
Administration**

NOTICE

The highway construction underway at this location is a Federal or Federal-aid project and is subject to applicable State and Federal laws, including title 18, United States code, Section 1020, which reads as follows:

“Whoever, being an office, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or the cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the costs thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction of any highway or related project submitted for approval to the Secretary of Transportation; or

“Whoever knowingly makes any false statement, false representation, false report, or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

“Whoever knowingly makes any false statement or false representation as to a material fact in any statement, certificate, or report submitted pursuant to the provisions of the Federal-aid Road Act approved July 11, 1916 (39 Stat. 355), as amended and supplemented.

“Shall be fined not more that \$10,000 or imprisoned not more than five years, or both.”

Any person having reason to believe this statute is being violated should report the same to the agency representative(s) named below.

(Federal-aid project only)

**State Highway
Department
Len Sanderson, PE
919-733-7384**

(Both Federal and Federal-aid projects)

**Federal Highway
Administration
John Sullivan, PE
919-856-4346**

APPENDIX XII: Spreadsheet for PGAB Test Data for Submitting to NCDOT

Sampled Date	Test Completed Date	ID No.:	Test Comment	Sample Status	Material Description	Type/Item/Grade:	Sampled By	Sample From	Sample Location Details	Facility Name	Producer Name	RV @ 135 C (275F)[Pa-sec] :
5/18/2004	5/24/2004	QC-1600001	EXAMPLE	Meets Specs	Asphalt Binder, PG 70	PG 70-22	Doe, John	Tank	67	XYZ, NC (#16)	XYZ	0.563
QC-												

RV @ 165 C (329F)[Pa-sec] :	DSR Original @ 58 C [kPa]:	DSR Original @ 64 C [kPa]:	DSR Original @ 70 C [kPa]:	DSR Original @ 76 C [kPa]:	DSR RTFO @ 58 C [kPa]:	DSR RTFO @ 64 C [kPa]:	DSR RTFO @ 70 C [kPa]:	DSR RTFO @ 76 C [kPa]:	DSR PAV @ 31 C [kPa]:	DSR PAV @ 28 C [kPa]:	DSR PAV @ 25 C [kPa]:	DSR PAV @ 22 C [kPa]:	DSR PAV @ 19 C [kPa]:	DSR PAV @ 16 C [kPa]:
			1.56	0.76			3.63	1.74		2768.0	4084.0	5964.0		

DSR PAV @ 13 C [kPa]:	BBR @ -12 C,S [MPa]:	BBR @ -12 C, m-value:	BBR @ -18 C,S [MPa]:	BBR @ -18 C, m-value:	BBR @ -24 C,S [MPa]:	BBR @ -24 C, m-value:	DTT @ -12 C, Strain [%]:	DTT @ -18 C, Strain [%]:	DTT @ -24 C, Strain [%]:	Jnr @ 3.2 [1/kPa]:	Percent Loss/Gain @ 163 C:	High End Temp True Grade [°C]:	Reported By:	Tested By
	223.0	0.303								0.3567	0.111	75.5	J. Doe	J. Doe

Note: Spreadsheets will be submitted by email in Excel format to the QC Administrator of each Producer for distribution.

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