



# **Combined State Binder Group**

## Method of Acceptance for Asphalt Binders

January 2006

Iowa Department of Transportation  
Michigan Department of Transportation  
Minnesota Department of Transportation  
Nebraska Department of Roads  
North Dakota Department of Transportation  
South Dakota Department of Transportation  
Wisconsin Department of Transportation

**COMBINED STATE BINDER GROUP  
CERTIFICATION METHOD OF ACCEPTANCE  
FOR ASPHALT BINDERS**

Acceptance of asphalt binder by the **Certification Method** provides for acceptance of these materials for use on Iowa, Michigan, Minnesota, Nebraska, North Dakota, South Dakota, and Wisconsin Department of Transportation/Roads (Department) projects upon the producer's or supplier's certification that the product as furnished to the contractor (or purchasing agency) complies with the pertinent specification and/or contract requirements.

Department projects include: state, county and municipal federal aid and authorized county and municipal state aid projects. In order to provide asphaltic material to Department projects under the **Certification Method**, a supplier<sup>1</sup>, as defined below, shall comply with the following procedures and requirements.

**I. GENERAL REQUIREMENTS**

The supplier shall have laboratory facilities and qualified personnel available to perform all specification tests and maintain an acceptable quality control program. The supplier shall maintain records of all its control testing done in the production of asphaltic materials. These test records shall be available at all times for examination by the Departments' designated representative<sup>2</sup> and for a period of five (5) years after use on a project.

The supplier shall inspect each transport tank prior to loading to insure suitability for loading and freedom from contaminants.

Continuing acceptance of materials under this process is contingent upon satisfactory compliance with procedures and conformance of materials to requirements as determined by test results for source samples and field samples taken by project personnel.

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<sup>1</sup> Supplier-A Supplier shall be defined as one who produces or supplies the final product or makes a blend or modification that alters the properties of the PGAB specified in M320, prior to final shipment to Department projects. A Supplier shall be a refinery, a terminal, secondary storage facility or an HMA producer. 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 conform to the requirements of this document. If one certified supplier sells to another certified supplier and material is delivered directly to a project, the supplier selling the material to the second supplier is responsible for submitting the daily and bi-weekly QC data to the DOT/DOR's as required by the CSBG document section V.B & V.C.

<sup>2</sup>Hereinafter in this document, the usual designated Department Representatives (contact persons) are listed on pages 13 and 14 of this document.

The tolerances as shown in the “Performance Graded Binder and Test Method Tolerances” Table on page 16 are for use by the Department when comparing to supplier data. All data received from the supplier is expected to meet the base specification values shown in the Table, unless it is agreed upon that a bias exists, based on the results of the Combined State Binder Group Quarterly Round Robins.

If an acid modification process or a modifier (as defined in AASHTO M320, Section 5.2), not including additives such as silicone, is used, the supplier shall assign the modifying process with a unique name and type of modification to be provided to the department for tracking and monitoring purposes. If an anti-strip agent is added at the plant, the HMA producer is considered a supplier (see footnote 1, page 1) and must conform to this document’s requirements. Full test results with and without anti-strip in the asphalt binder at the required dosage will be required before production begins.

The department shall be notified of PG grade and/or supplier changes.

## **II. QUALIFYING FOR CERTIFICATION**

Suppliers requesting certified status for supplying material from their individual facilities shall make application in writing to the Department’s representative, who will arrange for and authorize the use of the **Certification Method of Acceptance**. This request should present complete information regarding the supplier's quality control program (control tests, testing frequencies, laboratory facilities, programs for maintaining test and shipment records, etc.).

A supplier’s certification will remain in effect until denied by the certification program authority or until subsequent reapproval following another inspection. A yearly application in writing need not be made.

Department records will be used to provide a quality history of suppliers. If no quality history exists, one may be established by a cooperative, comprehensive sampling and testing program to ensure that quality control practices are effective.

It is intended that facility inspections will be made each spring by the Department. The inspections will include reviewing sampling and testing procedures, quality control, and facility changes. Also, at this time, the identification and inspection of tanks will be done. Suppliers shall designate and identify tanks that will be used for supplying each grade of asphaltic material for Department projects. The Department inspector will verify that the storage and sampling procedures will be adhered to.

Suppliers will have their requests for certification approved by the Department.

The Departments’ Districts/Regions will be notified when suppliers become certified.

The Department inspector shall be permitted to visit asphalt facilities any time during working hours and in the company of appropriate supplier personnel.

Certification of a supplier by one of the Combined State Binder Group members will be accepted by all the member states.

### **III. LOSS OF CERTIFICATION**

Certification will be withdrawn from suppliers when one or more of the following conditions exist.

- A. Inability to consistently supply material meeting specifications as measured by non-compliance for three (3) consecutive job site samples according to Department test results for a specific grade.
- B. Failure to participate in four (4) Combined State Binder Group "Round-Robins" during any one year. Exceptions will be made for equipment failure. Labs will be required to respond with resolution of equipment failure(s), as detailed in Subsection V.D.6.
- C. Failure to respond to notification of outlying labs in writing within the given timeframe, as detailed in Subsection V.D.5.
- D. Lack of maintenance of required records.
- E. Improper documentation of shipments as defined in Section VII.
- F. Failure to maintain a acceptable quality control program.

Decertification of suppliers will be by the Department. Notification will be in writing.

If a supplier loses certification, materials may be accepted, for a 3-month period as defined in section IV qualifying for recertification, according to specific procedures agreed to by the Department and supplier. Procedures may require pre-testing and approval of materials before use and/or increasing the frequency of sampling and testing at the job site (refer to Section VIII.B. of this procedure). The Department's costs for pre-testing and increasing sampling and testing of materials will be paid by the supplier/contractor or their agent unless other arrangements are agreed upon by the Department.

### **IV. QUALIFYING FOR RECERTIFICATION**

If a supplier has lost certification and seeks to be recertified the following is required:

- Fulfill the requirements of Section II, "Qualifying for Certification", of this procedure.
- Submit documentation to the Department's Representative explaining why decertification occurred and the actions the supplier has taken to correct the problems identified by the Department.

A maximum of three-months (of normal production) will be allowed for a supplier to regain certified status under this procedure. If, after that time, the Department determines that the supplier has not attained satisfactory status for certification, material from that source will not be

accepted for use on Department projects. The Departments' district/regions will be notified of this action. Decisions regarding the future qualification for certification of a supplier, affected by the above process, shall be at the Department's discretion.

## V. SAMPLING AND TESTING BY SUPPLIER

### A. Minimum Annual Requirements

1. Prior to the start of the shipping season, adequate testing shall be performed to identify characteristics of tank materials on-hand. Before or at the start of shipping, bi-weekly sample testing (see sub-section V.C.3) shall be completed on a minimum of one sample for each grade of asphaltic material anticipated to be shipped to Department projects.
2. It is intended that facility annual inspections would be made at this time.
3. Participation in Combined State Binder Group "Round Robin" Program will be a requirement, as detailed in Subsection V.D.

This testing will constitute the minimum annual requirements by the Certification method of Acceptance Program for continuation of a supplier certification.

### B. Daily Requirements

1. Sampling. One sample from the tank or blender representing each grade of material shipped to state work. For material shipped from tanks, the sample may be taken from the tank, from the line during loading, or from the loaded transport. Material produced from a blender may be sampled from the line during loading or from the loaded transport.
2. Test required. **Performance graded binder**: penetration, any viscosity measurement or dynamic shear. The dynamic shear will be required if material is modified.
3. Report. Send a record of daily quality control results to the Department central laboratory on an approximate weekly basis.

### C. Bi-Weekly Requirements

1. Sampling. Sample as for B.1.
2. Tests required. All of the tests listed in the attached schedule of tests for **performance graded binder** material.
3. Report. Send report of test results to the Department central laboratory when completed.

#### **D. Combined State Binder Group Quarterly “Round-Robins”**

1. General. WisDOT will send a Combined State Binder Group “Round Robin” PG-Binder sample to each supplier, approximately every three (3) months, with a maximum of four (4) samples annually.
2. Purpose. To provide data about the repeatability and reproducibility of the applicable PG binder test methods.
3. Report. Send a report of test results to the designated WisDOT Representative when completed.
4. Summary. WisDOT will compile a summary report and distribute to all participants. Each supplier’s data will remain confidential.
5. Notification of Outliers. WisDOT will notify “Round-Robin” participants of any tests for which their data was determined to be a statistical outlier. An outlier is defined as that data which is outside of three standard deviations from the average. The determination of outliers is an iterative process. The notification will be contained in a letter attached to the summary report. The participant shall have 30 days to provide WisDOT with a response as to the apparent cause of the outlier. This information will be shared with the other Departments.
6. Equipment Failures. Labs will be required to respond to WisDOT in writing with resolution to equipment failures. This information will be shared with the other Departments.

#### **VI. TEST REPORTS (required by Section V)**

The supplier chief chemist (or other representative) shall certify test reports for samples and submit them to the Department’s Representative. This test information will be evaluated and filed for possible future reference. The reports shall be sent to:

#### **IOWA:**

Iowa Department of Transportation  
Office of Materials  
Attn: John Hinrichsen  
800 Lincoln Way  
Ames, IA 50010-6915  
E-Mail: [john.hinrichsen@dot.iowa.gov](mailto:john.hinrichsen@dot.iowa.gov)

**MICHIGAN:** Michigan Department of Transportation  
Construction and Technology Division  
Secondary Govern. Complex  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48909  
ATTN: Timothy Crook, Bituminous Mixtures and Materials Specialist  
E-Mail: [crookt@michigan.gov](mailto:crookt@michigan.gov)

**MINNESOTA:** Minnesota Department of Transportation  
Office of Materials and Road Research  
1400 Gervais Avenue  
Maplewood, MN 55109  
Attn: Paul Lohmann, Asphalt Certification Specialist  
E-Mail: [paul.lohmann@dot.state.mn.us](mailto:paul.lohmann@dot.state.mn.us)

**NEBRASKA:** Nebraska Department of Roads  
Materials and Tests Division  
1400 NE Hwy 2  
Lincoln, NE 68509-4759  
ATTN: Dale Byre  
E-Mail: [dalebyre@dor.state.ne.us](mailto:dalebyre@dor.state.ne.us)

**NORTH DAKOTA:** North Dakota Department of Transportation  
Materials and Research Division  
300 Airport Road  
Bismarck, ND 58504  
ATTN: Jeff Herman  
E-Mail: [jherman@state.nd.us](mailto:jherman@state.nd.us)

**SOUTH DAKOTA:** South Dakota Department of Transportation  
Materials Laboratory  
104 S. Garfield, Bldg B  
Pierre, SD 57501  
ATTN: Rick Rowen  
E-Mail: [rick.rown@state.sd.us](mailto:rick.rown@state.sd.us)

**WISCONSIN:** Wisconsin Department of Transportation  
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ATTN: Asphalt Certification Specialist  
3502 Kinsman Boulevard  
Madison, WI 53704  
E-Mail: [Richard.barden@dot.state.wi.us](mailto:Richard.barden@dot.state.wi.us)

## **VII. CERTIFICATION OF SHIPMENTS AND DOCUMENTATION**

For each truck shipment a shipping ticket shall be prepared showing the supplier, location, grade of asphaltic material, unique name (as referenced in Section I, paragraph 5, page 2), additives (silicone or anti-strip), truck number, supplier's tank number from which the truck was loaded, average unit weight, quantity, and date and time of loading. A statement certifying that the material complies with Combined State Binder Group requirements and Department Specifications, shall be on or accompany the shipping ticket. The company invoice or manifest form may be used for this purpose.

In addition to the usual contractor's copy of the shipping ticket, a copy (South Dakota DOT to receive two copies) of the shipping ticket containing the certification language for each truck shipment also shall be made available to the project engineer at the job site.

The Department's Representative will furnish a list of certified suppliers to the districts/regions.

Only material shipped from a certified supplier directly to the job site will be accepted as certified material. Material shipped to, and unloaded into, a secondary storage facility and subsequently shipped to state work will **not** be accepted as certified material unless that secondary facility has been certified and is operating in full compliance with these procedures. Modification at HMA plant will not be accepted unless plant is certified as a supplier.

## **VIII. SAMPLES OBTAINED BY THE STATE**

### **A. Refinery/Terminal Samples**

The Department shall have the option to obtain random samples at the source of supply. Samples shall be taken by supplier personnel at the request and under observation of an authorized Department representative. The supplier shall have equipment and facilities available to obtain samples safely.

### **B. Verification Field Samples**

#### **IOWA:**

The supplier or contractor personnel will obtain samples, under the observation of a Department representative, of material at the job site. The sampling rate will be a minimum of one (1) per 40 Mg (45 tons) for each supplier and grade of asphalt binder per contract. For contracts with less than approximately 40 Mg (45 tons) of asphalt, sampling may be waived.

Sampling shall be accomplished in accordance with Iowa Instructional Memorandum (I.M.) 323, "Method of Sampling Asphaltic Materials."

In addition, project personnel will obtain samples as directed by the project engineer to adequately monitor material quality at the plant for alterations made



to the site storage, HMA plant handling process, or if modification is occurring at the HMA plant.

**MICHIGAN:**

Daily Certification Verification (CV) Samples (original samples of asphalt binder taken by the contractor at the asphalt plant before incorporation into the mixture) will be taken and tested in accordance with the specification requirements. These samples are taken to verify that the certified asphalt binder meets the required specifications.

**MINNESOTA:**

The supplier or contractor personnel will obtain samples, under the observation of a Department representative, by random selection from shipments of material at the job site. The samples shall be taken from the first load and subsequently one sample per 900 Mg (1000 tons) for each supplier and grade of asphalt binder per contract. For contracts with less than approximately 23 Mg (25 tons) (one truck transport) of asphalt, sampling may be waived.

Sampling shall be accomplished by taking a one-liter (one-quart) sample of material from a transport in accordance with AASHTO Designation T40.

In addition, project personnel will obtain samples as directed by the project engineer to adequately monitor material quality at the plant for alterations made to the site storage, HMA plant handling process, or if modification is occurring at the HMA plant.

**NEBRASKA:**

The Contractors Certified Sampling Technician will obtain samples, under the observation or assistance of the Department representative, of material at the job site. The sampling rate will be a minimum of one (1) per 3750 tons of Hot Mix Asphalt produced for each supplier and grade of Performance Graded Binder per contract. A minimum of three (3) samples will be taken per project.

One Sample will consist of two (2) one-liter (one-quart) cans of material taken from the line between the storage tank and mixer or from the tank supplying material to the line, at a location at which material sampled is representative of the material in the line to the mixer. Sampling shall be accomplished in accordance with NDR T40.

In addition, project personnel will obtain samples as directed by the project engineer to adequately monitor material quality whenever blending of binders of different grades or binders from different suppliers is taking place. These samples will be taken at the start of production following the blending at locations defined above.

**NORTH DAKOTA:**

NDDOT project personnel will observe the contractor obtain samples from material delivered to the job site. The sampling rate will be a minimum of one sample for every 250 tons (225 Mg) for each supplier and grade of asphalt cement, or fraction thereof. The sample shall be taken randomly within each 250 tons (225 Mg) of material.

A sample will consist of taking two 1-liter (one-quart) samples from the designated transport. The first sample will be used for testing, the second sample will be a check. Both samples will be sent to the NDDOT Central Lab.

Samples will be identified with the following information written on the can:

- Project Number-Field Sample Number
- Manifest Number-PG Grade
- Asphalt Supplier-Date
- Original or Check

Project personnel will also obtain samples as directed by the project engineer at any time extra samples are determined to be necessary.

**SOUTH DAKOTA:**

The supplier or contractor personnel will obtain samples, under the observation of a Department representative, of material at the job site. The sampling rate will be in accordance to the South Dakota Department of Transportation Materials Manual, “Minimum Sample and Test Requirements”, section 1.1C.(3).

The sampling method will be in accordance to SD 301 section 3.2C in the South Dakota Department of Transportation Materials Manual.

In addition, project personnel will obtain samples as directed by the project engineer to adequately monitor material quality at the plant for alterations made to the site storage, HMA plant handling process, or if modification is occurring at the HMA plant.

**WISCONSIN:**

The supplier or contractor personnel will obtain samples, under the observation of a Department representative, by random selection from shipments of material at the job site. The sampling rate will be a minimum of one (1) per 800 Mg (900 tons) for each supplier and grade of asphalt binder, or fraction thereof, per contract. For contracts with less than approximately 23 Mg (25 tons) (one truck transport) of asphalt, sampling may be waived.

Sampling shall be accomplished by taking a one-liter (one-quart) sample of material from a transport in accordance with AASHTO Designation T40.

Preferred sampling method shall be accomplished by taking a one-liter (one-quart) sample of material representing the middle third of the load from a sample valve attached to the transport in accordance with AASHTO Designation T40 section 10 paragraph 10.1.

**Starting in 2006, this will become the required sampling method**

In addition, project personnel will obtain samples as directed by the project engineer to adequately monitor material quality at the plant for alterations made to the site storage, HMA plant handling process, or if modification is occurring at the HMA plant.

**IX. ACCEPTANCE OF ASPHALT BINDER NOT ON THE APPROVED LIST**

It is the intention of the Departments to encourage suppliers to become certified according to this procedure. However, if situations occur where a supplier is not on the Departments' approved list, materials may be accepted for a designated interim period according to specific procedures agreed to by the Department and supplier. Procedures may require pretesting and approval of materials before use and/or increasing the frequency of sampling and testing at the job site (refer to Section VIII.B. of this procedure). The Department's costs for pretesting and increased sampling and testing of materials will be paid by the supplier/contractor or their agent unless other arrangements are agreed upon by the Department.

**X. SAMPLES TESTED BY THE STATE WITH NON-COMPLYING RESULTS**

Should a sample tested by the Department show noncompliance, actions will be taken to investigate the sample failure. The purpose of the investigation(s) will be to quickly obtain information to either substantiate the failure data or to provide conclusive evidence that the reported failure is unreliable. There are two types of samples to be considered: 1) refinery/terminal random samples taken by the supplier under observation of a authorized Department representative at the shipping refinery or terminal, and 2) verification field samples taken under the direction of the Department's project personnel at the job site. The processes to resolve sample failures for each of the two types of samples are as follows:

**A. Refinery/Terminal Samples**

If a sample obtained by a authorized Department representative at a supplier plant shows test results out of specification limits, the process of resolving the sample failure will include the following actions as appropriate:

- 1) The Department will notify the supplier.
- 2) The Department and supplier together will determine the quantity and location(s) of the material in question.
- 3) The Department will retest the sample as determined necessary to confirm or disaffirm the original test result(s).
- 4) If material is in transit to or at Department projects, the district/region(s) will be notified.

- 5) The Department will increase the frequency of sampling at the project site(s) involved.
- 6) The Department will investigate and review all pertinent test data.
- 7) The Department's Representative will collect and compile all information, including any from the supplier and district/region(s), and prepare a report with explanations to resolve the sample problem. A copy of the report will be distributed to the district/region, contractor, and supplier.
- 8) The supplier shall take corrective action, as warranted, and submit an explanation to the Department.
- 9) The Department will determine when the sample is adequately investigated and resolved and the supplier is consistently furnishing specification material.

**B. Verification Field Samples**

If a sample obtained by the Department at a project site shows test results out of specification limits, the process of resolving the sample failure will include the following actions as appropriate:

- 1) The Department will notify the district/region and determine that the information sent with the sample is correct and the sample does indeed fail. The district/region will notify the contractor. The district/region will arrange for project personnel to investigate all aspects of procuring, handling and submitting the sample for testing. The quantity and location of material in question will be determined. The district/region will report findings to the Department's Representative.
- 2) The Department will conduct retesting of the sample as determined necessary to confirm or disaffirm the original test result(s).
- 3) The Department will notify the supplier who will arrange to investigate all aspects of loading, handling and delivery of the material in question. The supplier shall report findings to the Department's Representative.
- 4) The Department will increase the frequency of sampling at the project site.
- 5) The Department's Representative will collect and compile all information from the district/region and supplier investigations and prepare a report. The Department will determine when the sample has been adequately investigated. The report will contain data with an analysis of information and recommendations for the district/region to resolve the sample problem. A copy of the report will be distributed to the district/region, contractor, and supplier.

- 6) The Department will issue the standard report of tests for the sample showing the failing test result(s).
- 7) The district/region will make the final decision for resolving the sample problem. Generally, the district/region will accomplish this with input from the Department Representative, and supplier. The Department's report of investigations (from step 5 above) will be used in the decision making process. The district/region will notify the contractor. Should the decision involve reduced payment for material(s) in question, standard Department practices will be followed and administered by the district/region. The contractor will be notified in writing of reduced payments.
- 8) The supplier shall implement corrective measures suggested by the investigation work and notify the Department of actions taken.
- 9) The Department will implement changes in this procedure determined to be warranted by the investigation work.

## DEPARTMENT REPRESENTATIVES:

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E-Mail: [richard.barden@dot.state.wi.us](mailto:richard.barden@dot.state.wi.us)

Copies of this document can be obtained from:

North Central Superpave Center Home Page: <http://bridge.ecn.purdue.edu/~spave/>

WISDOT's ftp site: <ftp://ftp.dot.state.wi.us/dtid/bhc/quality/general/>

Any Combined State Binder Group representative.

**SCHEDULE OF TESTS  
AS REQUIRED BY AASHTO – M320**

<b><u>TEST</u></b>	<b><u>TEST METHOD</u></b>
<b><u>PERFORMANCE GRADED BINDER</u></b>	
Solubility	AASHTO - T44
Flash Point	AASHTO - T48
Brookfield Viscosity	AASHTO – T316
Dynamic Shear	AASHTO – T315
Rolling Thin Film Oven Test:	AASHTO - T240
a. Mass Loss	
b. Dynamic Shear	AASHTO – T315
Accelerated Aging (PAV)	AASHTO – R28
a. Dynamic Shear	AASHTO – T315
b. Creep Stiffness	AASHTO – T313
Direct Tension	AASHTO – T314
Elastic Recovery	AASHTO – T301

**NOTES:**

1. All testing shall be in accordance with the applicable standard methods of the American Association of State Highway and Transportation Officials (AASHTO) or American Society of Testing and Materials (ASTM).



**EFFECTIVE JANUARY 2006**

PERFORMANCE GRADE	PG 46-			PG 52-				PG 58-				PG 64-				PG 70-				PG 76-				PG 82-																
AVERAGE 7 DAY MAXIMUM PAVEMENT DESIGN TEMP, °C	34	40	46	10	16	22	28	34	40	46	16	22	28	34	40	10	16	22	28	34	40	10	16	22	28	34	40	10	16	22	28	34	10	16	22	28	34			
MINIMUM PAVEMENT DESIGN TEMPERATURE, °C <sup>a</sup>	-34	-40	-46	-10	-16	-22	-28	-34	-40	-46	-16	-22	-28	-34	-40	-10	-16	-22	-28	-34	-40	-10	-16	-22	-28	-34	-40	-10	-16	-22	-28	-34	-10	-16	-22	-28	-34			
<b>TESTS ORIGINAL BINDER</b>	<b>SPEC BASE</b>	<b>SPEC W/TOL</b>	<b>TOL</b>																																					
<b>AASHTO T44 SOLUBILITY % MINIMUM</b>	99.00	98.87	0.13																																					
<b>AASHTO T48 FLASH POINT TEMP, °C, MINIMUM</b>	230	221	9	230							230					230						230						230												
<b>AASHTO T316 VISCOSITY<sup>b</sup> Pa.s MAXIMUM TEST TEMP, °C</b>	3.0	3.2	7.3%																																					
<b>AASHTO T315 DYNAMIC SHEAR<sup>c</sup> G*<math>\sin\delta</math><sup>d</sup>, kPa, MINIMUM TEST TEMP @ 10 rad/sec, °C</b>	1.00	0.93	7%	46							52					58						64					70						76							
<b>TESTS RTFO RESIDUE</b>																																								
<b>AASHTO T240 MASS CHANGE<sup>e</sup>, % MAX</b>	1.00	1.20	20%																																					
<b>AASHTO T315 DYNAMIC SHEAR G*<math>\sin\delta</math><sup>d</sup>, kPa, MINIMUM TEST TEMP @ 10 rad/sec, °C</b>	2.20	1.98	10%	46							52					58						64					70						76							
<b>TESTS PAV RESIDUE</b>																																								
<b>AASHTO R28 PAV AGING TEMP, °C<sup>f</sup></b>				90							90					100						100					100 (110)						100 (110)							
<b>AASHTO T315 DYNAMIC SHEAR G*<math>\sin\delta</math><sup>d</sup>, kPa, MAXIMUM TEST TEMP @ 10 rad/sec, °C</b>	5000	5600	12%	10	7	4	25	22	19	16	13	10	7	25	22	19	16	13	31	28	25	22	19	16	34	31	28	25	22	19	37	34	31	28	25	40	37	34	31	28
<b>AASHTO T313 CREEP STIFFNESS<sup>g</sup> [S] MAXIMUM, MPa m-VALUE, MINIMUM TEST TEMP @ 60s, °C</b>	300	324	8%	-24	-30	-36	0	-6	-12	-18	-24	-30	-36	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	0	-6	-12	-18	-24
<b>AASHTO T314 DIRECT TENSION<sup>g</sup> FAILURE STRAIN, MINIMUM % TEST TEMP @ 1.0 mm/min, °C</b>	1.0	0.8	20%	-24	-30	-36	0	-6	-12	-18	-24	-30	-36	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	0	-6	-12	-18	-24

PG+ Specifications <sup>h</sup>	Spec Base			Spec w/tol			Tol
Temperature Spread <sup>i</sup>	92	98	104	92	98	104	
Elastic Recovery; AASHTO T301 tested at 77°F (RTFO Aged AASHTO T301)	Minimum 65%			Minimum 60%			7.7%
Phase Angle; degrees (Maximum) (Original Binder)	77.0	75.0	73.0	79.0	77.0	75.0	2.6%

- a PAVEMENT TEMPERATURES ARE ESTIMATED FROM AIR TEMPERATURES USING AN ALGORITHM CONTAINED IN THE LTPP BIND PROGRAM, MAY BE PROVIDED BY THE SPECIFYING AGENCY, OR BY FOLLOWING THE PROCEDURES AS OUTLINED IN MP2 AND PP28.
- b THIS REQUIREMENT MAY BE WAIVED AT THE DISCRETION OF THE SPECIFYING AGENCY IF THE SUPPLIER WARRANTS THAT THE ASPHALT BINDER CAN BE ADEQUATELY PUMPED AND MIXED AT TEMPERATURES THAT MEET ALL APPLICABLE SAFETY STANDARDS.
- c FOR QUALITY CONTROL OF UNMODIFIED ASPHALT CEMENT PRODUCTION, MEASUREMENT OF THE VISCOSITY OF THE ORIGINAL ASPHALT CEMENT MAY BE USED TO SUPPLEMENT DYNAMIC SHEAR MEASUREMENTS OF G\* $\sin\delta$  AT TEST TEMPERATURES WHERE THE ASPHALT IS A NEWTONIAN FLUID.
- d G\* $\sin\delta$  = HIGH TEMPERATURE STIFFNESS AND G\* $\sin\delta$  = INTERMEDIATE TEMPERATURE STIFFNESS.
- e THE MASS CHANGE SHALL BE LESS THAN 1.00 PERCENT FOR EITHER A POSITIVE (MASS GAIN) OR A NEGATIVE (MASS LOSS) CHANGE
- f THE PAV AGING TEMPERATURE IS BASED ON SIMULATED CLIMATIC CONDITIONS AND IS ONE OF THREE TEMPERATURES 90°C, 100°C, OR 110°C. NORMALLY THE PAV AGING TEMPERATURE IS 100°C FOR PG 58-XX AND ABOVE. HOWEVER, IN DESERT CLIMATES THE PAV AGING TEMPERATURE FOR PG 70-XX AND ABOVE MAY BE SPECIFIED AS 110°C.
- g IF THE CREEP STIFFNESS IS BELOW 300 MPa, THE DIRECT TENSION TEST IS NOT REQUIRED. IF THE CREEP STIFFNESS IS BETWEEN 300 AND 600 MPa, THE DIRECT TENSION FAILURE STRAIN REQUIREMENT CAN BE USED IN LIEU OF THE CREEP STIFFNESS REQUIREMENT. THE m-VALUE REQUIREMENT MUST BE SATISFIED IN BOTH CASES.
- h BINDERS SIGNIFIED BY PG XX-XXP SHALL BE REQUIRED TO MEET OR EXCEED THE PG+ SPECIFICATIONS IN ADDITION TO M320 SPECIFICATIONS
- i TEMPERATURE SPREAD IS DETERMINED BY SUBTRACTING LOW TEMPERATURE FROM THE HIGH TEMPERATURE (PG 64-28: 64 - (-28) = 92).