

## PERFORMANCE GRADED BINDER

Section 503 in the Standard Specifications is amended to include Performance Graded Binders.

Section 1029 in the Standard Specifications is void and superseded by the following:

### I. Description

The Performance Graded Binder to be used on this project shall be PG Binder supplied by a Certified Supplier.

### II. Certified Supplier

A supplier must be certified by the Nebraska Department of Roads to be allowed to supply Performance Graded Binder in Nebraska. To be considered certified by the NDR, a supplier must participate in one or more of the following PG Binder groups.

1. AASHTO Materials Reference Laboratory (AMRL)
2. Western Cooperative Testing Group (WCTG)
3. Combined States Binder Group (CSBG)

The supplier must also maintain and follow the requirements of the group or groups in which they participate in, to maintain certification by the Nebraska Department of Roads. In addition, active participation is required to maintain certification by the Department. Active participation will include submitting of round robin sample results, along with meeting other requirements of the group or groups.

A certified supplier may be asked to supply to the Department, past round robin results, laboratory inspection reports, reasons for and investigative reports on out lying results, quality control testing, and/or technician training and proficiency testing reports.

The binder supplier agrees to inspection of their plant or terminal without notice anytime during production or supplying of material to the Department. The inspection may also include the supplier's laboratory.

A certified supplier can voluntarily submit samples of binders proposed for use to the Materials and Research Bituminous Laboratory for quality and verification testing.

### III. Supplier Certification

A supplier may request certification by contacting the Nebraska Department of Roads, Materials and Research Division, Flexible Pavement Engineer at (402) 479-3839. A temporary certification may be issued for a period of up to one year. Split sample testing will be required prior to receiving a temporary certification. Split sample testing will be done on all grades of binder that the supplier intends to supply during the temporary certification. The supplier will have up to one year to become certified by participating in and following the requirements of one or more of the approved binder groups.

A supplier may become certified through active participation in other binder certification/round robin groups that are approved by the NDR. The NDR may request from the supplier prior to approval, past or current round robin results, quality control testing, laboratory inspection reports, and/or technician training and proficiency testing reports.

#### **IV. Loss of Certification**

Certification will be withdrawn from a supplier for a minimum of 6 months when one or more of the following conditions exist.

1. Inability to consistently supply material meeting specifications as outlined herein.
2. Failure to maintain an acceptable quality control program.
3. The failure to meet one or more of the conditions of being a Certified Supplier as outlined above.

Notification of decertification of a supplier will be submitted in writing by the NDR. Material from a decertified source will not be accepted for use on NDR projects and the NDR districts will be notified of this action.

#### **V. Supplier Recertification**

If a supplier has lost certification and seeks to be recertified, the following steps are required.

1. Fulfill the requirements outlined above for gaining Certified Supplier status.
2. Submit documentation to the Flexible Pavement Engineer explaining why decertification occurred, and the actions that are going to be taken to correct the problems identified in writing by the NDR.

#### **VI. Binder Sampling and Testing:**

1. Lots: Each 3750 tons (3400 Mg) of HMA type produced, or portion thereof, will be a binder lot.
2. A binder lot will include only one PG Binder grade or a blend as allowed in paragraph VI.6.e.
3. A binder lot will only include one supplier of the PG Binder or a blend as allowed in paragraph VI.6.e.
4. Blending of different binder grades and binders from different suppliers will be allowed with restrictions as noted in paragraph VI.6.e. The Engineer must be notified of the intent to blend prior to actual blending.
5. All binders shall be sampled at the rate of at least one sample per lot.
  - a. The sample shall consist of two one-quart (liter) cans and shall be taken by the Contractor's Certified Sampling Technician, with assistance from or under supervision of NDR personnel. The sample shall be taken at the plant from the line between the storage tank and the 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. One can will be tested for specification compliance, and the other can portion will be saved for check tests and dispute resolution, if needed. The sampling process shall follow procedures of the NDR Materials Sampling Guide.

- b. Testing. When the tested PG Binder is in compliance, the binder lot will be accepted and both cans of the sample can be discarded. If the tested PG Binder does not comply, then the price of the PG Binder lot represented by the sample shall be adjusted according to Tables 2 and 3. Overall project average testing requirements and price adjustments will also apply, as stated in Table 4.
- c. In cases where the total HMA type is less than 3750 tons, only one PG Binder lot sample per grade per supplier is required. If the tested PG Binder does not comply, the price of the PG Binder lot shall be adjusted according to Tables 2 and 3.

## 6. Material Requirements

- a. Performance Graded Binder, as specified in the contract items, shall be in accordance with the PG+ specifications as noted, and AASHTO M320 with the exception of Direct Tension.
- b. Substitution of a PG Binder, which exceeds the upper and lower grade designations from the specified, requires advance notification to, and approval by, the Engineer. The substitution of the PG Binder shall also be identified in the sample identification submittals.
- c. Material Certification - A Material Certification shall be submitted prior to construction, stating the type of modifier being used, and the recommended mixing and compaction temperatures for the Hot Mix Asphalt. The Material Certification must state that acid has not been used. The Material Certification must also state that the material has not been air blown or oxidized.
- d. The Contractor shall receive from the supplier, instructions on the proper storage and handling of each grade and shipment of PG Binder.
- e. Blending of PG Binders at the hot mix plant site will be allowed only when transitioning to an asphalt mixture requiring a different grade of binder, and with the following restrictions:
  - (1) The resultant blend will meet PG+ (modified binders) and/or AASHTO M320 specifications when tested as  $\pm 3^{\circ}$  C of the specified PG Binder. The sample of the blended material 1) will be considered as a lot sample, 2) will be taken during initial production following the blending of the binders, and 3) shall have deductions applied as per Tables 2, 3, and 4 when not meeting specifications. On the blended sample's identification form will be a note explaining the blending conditions and a statement that the sample is a blend of materials. The next lot sample, following the sample representing the blend, will be tested as the specified binder grade for the asphalt mixture being produced and shall meet AASHTO M320 and PG+ (if modified) specifications.
  - (2) Modified Binders - Only blending of the same type of elastomer modifiers listed in VI.6.f.(1) will be allowed.

- f. When modified binders are specified, the following PG+ specifications (Table 1) and AASHTO M320 (with the exception of Direct Tension) will apply:
- (1) The Performance Graded Binder shall be a binder, which incorporates a blend of base asphalt and elastomer modifiers of styrene-butadiene (SB), styrene-butadiene-styrene (SBS) or styrene-butadiene-rubber (SBR). Acid shall not be used. Air blown and/or oxidized asphalt will not be allowed. The supplier must certify that the binder is not acid modified, and that acid was not used. The binder supplier must also certify that air blowing or oxidization has not been done/used to modify the binder or used to change the properties of the binder.
  - (2) The composite material shall be thoroughly blended at the asphalt refinery or terminal prior to being loaded into the transport vehicle. The polymer modified binder shall be heat and storage stable and shall not separate when handled and stored as per the supplier's storage and handling recommendations.
  - (3) The composite material shall be homogenous, and shall not demonstrate evidence of 1) localized gellation or over-crosslinking of polymers, 2) improper use of gelling modifiers used in addition to polymer modification, or 3) otherwise any other lumpy conglomerations.
  - (4) To insure the binder is of a modification system in which no acid is used, the Materials and Research Bituminous Laboratory will perform a random free-acid verification test. ARR-MAZ AD-here LOF65-00, amine anti strip will be added at the rate of 0.5% to sample(s) that have been heated to 300 degrees F or until viscous and stirred for a minimum of 5 minutes. The resultant blend will then be tested for PG grading and compared to PG grading prior to the blending. Binders tested for acid modification shall meet AASHTO M320 specifications, and shall not show a drop of  $G^*/\sin(\delta)$  of more than 25% when compared to the result(s) of the sample prior to the verification test. If the verification test reveals material that does not meet AASHTO M320 specifications, or shows a drop of  $G^*/\sin(\delta)$  greater than 25%, the material that is represented by the sample will be rejected. If a random sample demonstrates acid modification, additional samples will be tested.
  - (5) Supplier-submitted samples of binder proposed for use, can be tested for acid modification. Binders that demonstrate acid modification will not be accepted for use.
  - (6) Lot samples of the binder shall meet or exceed the PG+ specifications as listed, in addition to AASHTO M320 specifications. For PG+, Table 1 specification testing, material will be tested on original unaged binder for phase angle specification, and RTFO aged material for elastic recovery. Project lot samples can also be tested for acid modification as described in VI.6.f.(4).

- (7) When it is determined that material exceeds Table 1, Table 2 will apply. When it is determined that a single sample(s) does not meet AASHTO M320 specifications, Table 3 will apply.
- (8) All project samples will be tested for original binder dynamic shear rheometry compliance.
- (9) Modified binders with a temperature spread of 104 shall be exempt of the AASHTO M320 requirement for the test of Viscosity, AASHTO T316.
- (10) All specified binders with a temperature spread of 92 or greater, shall be modified with an elastomer modifier as specified in paragraph VI.6.f.(1).

**Table 1**  
**Additional Specifications for Modified Binders**

PG+ Specifications	Spec Base			Spec w/Tol. <sup>2</sup>		
	92	98	104	92	98	104
Temperature Spread <sup>1</sup>						
Elastic Recovery; AASHTO T301 tested at 77°F (RTFO Aged AASHTO T301)	Minimum 65%			Minimum 60%		
Phase Angle; degrees (Maximum) (Original Binder)	77.0	75.0	73.0	79.0	77.0	75.0

- <sup>1</sup> Temperature Spread is determined by subtracting the low temperature from the high temperature. Example (PG 64-28: 64 – (-28) = 92).
- <sup>2</sup> Tolerances were determined from CSBG round robin data and AASHTO or ASTM precision statements. Material exceeding these tolerances is subject to 75% pay or removal.

**Table 2**  
**PG + Single Sample Tolerance and Pay Factor Table**

	Pay Factor of 0.75 or Removal <sup>1</sup>		
Temperature Spread	92	98	104
Elastic Recovery Percentage (RTFO Aged AASHTO T301)	< 60%		
Phase Angle (degrees) (Original Binder)	> 79.0	> 77.0	>75.0

- <sup>1</sup> Price Reduction will be applied to contract unit price of asphalt binder. The Engineer will determine if the non-compliant material will be removed. Removal and replacement will be at no additional cost to the Department. If the non-compliant material is accepted, a price factor of 0.75 will be applied. The price factor will be applied to the contract unit price of asphalt binder.

**Table 3**  
**Single Sample Tolerance and Price Factor Table**

	Pay Factor of 0.75 or Removal <sup>1</sup>

<u>Tests on Original Binder</u> Dynamic Shear, $G^*/\text{Sin } \delta$ , kPa	< 0.93
<u>Tests on Rolling Thin Film Oven Residue</u> Dynamic Shear, $G^*/\text{Sin } \delta$ , kPa	< 1.98
<u>Tests on Pressure Aging Vessel Residue</u> Dynamic Shear, $G^*\text{Sin } \delta$ , kPa	> 5600
<u>Creep Stiffness</u> S, mPa	> 325
m-Value	< 0.285

<sup>1</sup> Price Reduction will be applied to contract unit price of asphalt binder. The Engineer will determine if the non-compliant material will be removed. Removal and replacement will be at no additional cost to the Department. If the non-compliant material is accepted, a price factor of 0.75 will be applied. The price factor will be applied to the contract unit price of asphalt binder.

**VII. Overall Project Average - Price Reduction Based on Complete M320 Testing**

1. Binders that demonstrate acid modification as per VI.6.f.(4) shall be rejected, and the test results will not be included in Overall Project Averages.
2. PG+, Table 1 specifications do not apply to Overall Project Averages.
3. Out of specification material will be determined by the specifications outlined in AASHTO M320, excluding Direct Tension.
4. The Nebraska Department of Roads, Materials and Research Bituminous Laboratory, will do complete specifications testing on at least one sample per HMA type from the project. The Department will randomly select one sample for complete specifications testing out of every five samples received. When any test result shows a sample not meeting specifications, the previous and following lot sample received will also be tested for complete specifications compliance. Adjacent lot sample testing will continue in this manner until tested samples meet all specifications, or there are no more lot samples to be tested.
5. Samples not selected for complete specifications testing are “control” samples. Control samples will be tested for original binder AASHTO M320 Dynamic Shear, as well as PG+ phase angle if modified. When a control sample falls out of AASHTO M320 Dynamic Shear and/or PG+ phase angle specification, it will then be tested for complete M320 and PG+ specifications compliance. And, as mentioned in VII.4, adjacent lot samples will be tested when any results do not meet specification. Adjacent lot testing will continue until tested samples meet all specifications, or there are no more lot samples to be tested. This additional complete testing for M320 and PG+ compliance is in addition to the minimum number of samples that will be tested for complete M320 and PG+ compliance.
6. At the completion of testing, all M320 test results will be averaged. The average will not include M320 results from any binder lots that have already been reduced in pay by Table 3. For averages that do not meet M320 specifications, the largest reduction shown in Table 4 will be applied to all the Performance Graded

Binder used on the project, with the exception of any binder lots that were already reduced in pay by Tables 2 and/or 3. In cases where there is only one PG Binder Grade lot sample left when determining the Overall Project Average tests results, then the Pay Factor for the PG Binder lot represented by that sample is determined by Table 4.

**Table 4**  
**Overall Project Average – Pay Factor Table**

	Range of Average	Pay Factor Applied
<u>Tests on Original Binder</u> Dynamic Shear, $G^*/\sin \delta$ , kPa Min. 1.00 kPa	< 1.00 – 0.98	0.98
	< 0.98 – 0.96	0.95
	< 0.96 – 0.94	0.92
	< 0.94	0.85
<u>Tests on Rolling Thin Film Oven Residue</u> Dynamic Shear, $G^*/\sin \delta$ , kPa Min. 2.20 kPa	< 2.20 – 2.156	0.98
	< 2.156 – 2.09	0.95
	< 2.09 – 2.024	0.92
	< 2.024	0.85
<u>Tests Pressure Aging Vessel Residue</u> Dynamic Shear, $G^*\sin \delta$ , kPa Max. 5000 kPa	>5000 – 5100	0.98
	>5100 – 5250	0.95
	>5250 – 5400	0.92
	>5400	0.85
m-Value Min. 0.300	< 0.300 – 0.298	0.98
	< 0.298 – 0.293	0.95
	< 0.293 – 0.290	0.92
	< 0.290	0.85
<u>Creep Stiffness</u> S, mPa Max. 300 mPa	>300 – 306	0.98
	>306 – 315	0.95
	>315 – 324	0.92
	>324	0.85

### VIII. Single Sample Reduction and Overall Project Average Reduction

A sample representing a lot, incurring pay reduction or removal by Table 2 and/or 3, will incur pay reduction or removal only for the material that the sample represents.

Only the largest overall project average reduction from Table 4 will apply when more than one test average falls out of AASHTO M320 specifications.

Pay Factors or removals, based on single sample test results, and pay factors based on overall project average test results, are separate from each other, and both will be applied.

### IX. Investigation of Verification Lot Samples That Do Not Meet Specifications

When the lot sample shows test results out of specification limits, the process of resolving the sample failure will include the following actions, as appropriate:

1. The Bituminous Lab may conduct retesting of the remaining portion of the sample as determined necessary to confirm or disaffirm the original test result(s).

2. The Bituminous Laboratory will notify the NDR project personnel, who will in turn notify the Contractor. All will arrange to investigate all aspects of the testing, loading, handling and delivery of the material in question. The Contractor and NDR project personnel shall report findings to the Bituminous Laboratory.
3. The Bituminous Laboratory will collect and compile all information provided.
4. The Bituminous Laboratory will issue the standard report of tests for all samples tested, to include any resulting pay factor deductions or removals. A copy of the report of tests will be distributed to the District and Construction Division. The District will then provide a copy to the Contractor. Supplier requests for a copy of this report will be directed to the Contractor.

#### **X. Dispute Resolution**

After testing and investigations have been completed on the sample, and there is still a dispute, the NDR will select an independent laboratory for referee testing to take place on the remainder of the sample, or any other representative samples obtained. The identity of the independent laboratory will not be revealed until the selected laboratory has completed the referee testing, and the NDR has submitted a final report of the results. If the independent lab's tests indicate failing results and pay deductions equal to or greater than the NDR's, the Contractor will reimburse the NDR for the cost of testing. If the independent lab's tests indicate that the material meets specification or is at a pay deduction less than the NDR's, the NDR will assume the cost of testing. When the independent lab's tests indicate a pay deduction, the lesser of the NDR's and the independent lab's deductions will be applied.

Only the Contractor can initiate dispute resolution, and request referee testing. The request must be made, in writing, to the NDR Construction Division within 60 days of awareness of sample results. For any period of time past 60 days, dispute resolution is forfeited.

#### **XI. Method of Measurement**

PG Binder shall be measured in accordance with Subsection 503.05 in the Standard Specifications.

#### **XII. Basis of Payment**

Subsection 503.06 in the Standard Specifications is amended to provide that PG Binder, accepted by the Engineer for use in asphaltic concrete, will be paid for at the contract unit price per ton (Megagram) for the item "Performance Graded Binder \_\_\_\_\_", less any deductions as prescribed in the tolerance and price reduction tables.