n-30-1-87728- SUPERSEDED BY EB 99-066 EFFECTIVE 11/4/99		*New York State Department of Transportation* ENGINEERING INSTRUCTION	EI 98-002

Title: **Changing from Asphalt Cement (AC) Viscosity Graded Specifications to SUPERPAVE Performance Graded Binder (PGB) Specifications**

Distribution:

- ☐ Manufacturers (18)
- ☒ Main Office (30)
- ☒ Local Govt. (31)
- ☒ Regions/Agencies (32)
- ☐ Surveyors (33)
- ☒ Consultants (34)
- ☒ Contractors/AGC (39)
- ☐ _____( )

Approved:

Paul J. Mack
Deputy Chief Engineer, Technical Services

2/2/98
Date

EFFECTIVE DATE: This Engineering Instruction affects all Department contracts that include hot mix asphalt (HMA) Items let on or after 05/21/98.

PURPOSE: The Purpose of this Engineering Instruction is to change the Asphalt Cement (AC) Viscosity Graded (or Penetration Graded) Specifications to SUPERPAVE Performance Graded Binder (PGB) Specifications and change the computation of Asphalt Price Adjustment by amending §401, §698, and §702 of the Standard Specification books of January 2, 1990 and January 2, 1995.

BACKGROUND: The Department is converting from Asphalt Cement (AC) viscosity graded specifications to SUPERPAVE Performance Graded Binder (PGB) specifications. SUPERPAVE includes a Performance Graded Binder specification and mix design system developed by the national Strategic Highway Research Program (SHRP). SUPERPAVE represents an entirely new approach to designing HMA mixes and specifying SUPERPAVE binders that addresses rutting, fatigue cracking, and low temperature cracking.

The existing viscosity graded specifications are empirically based, having only an indirect relationship to pavement performance. The SUPERPAVE PGB system is, however, a performance based system that addresses specific climate and traffic conditions that the pavement will be subjected to at the project site.

COST IMPACTS: The change to the PGB Specification for conventional mixes will be cost neutral since the majority of the viscosity or penetration graded asphalt currently supplied will meet the PG 64 -22 requirement.

ACTIONS BY THE MAIN OFFICE DESIGN QUALITY ASSURANCE BUREAU: Shelf Notes shall be inserted into proposals by the Design Quality Assurance Bureau starting with the 05/21/98 letting for all contracts as follows:

When Item XX403.YYZZ, 403.XX, 403.XXYY, 405.0101, 407.0101, 410.04, 410.05, or 410.07 is specified insert Shelf Notes 401, 698, and 702 for amendment to the January 2, 1990 Standard Specification book.

When Item XX403.YYZZ M, 403.XX M, 405.01 M, 407.01 M, 410.04 M, 410.05 M, or 410.07 M is specified insert Shelf Notes 401, 698, and 702 for amendment to the January 2, 1995 Standard Specification book.

The revisions to the Standard Specification book dated January 2, 1995 will be incorporated into the next addenda to that document.

CONTACT PERSON: Direct any questions regarding this Engineering Instruction to Kurt Matias of the Materials Bureau, Field Engineering II Section at (518) 457-4582.

BITUMINOUS PAVEMENTS

Make the following changes to the Standard Specifications of January 2, 1990, Section 401 - Plant Mix Pavements - General:

Page 4-1.
Under §401-2.02 Composition of Mixtures, Marshall Requirements, ***delete*** the current table and replace it with the following:

MARSHALL MIX PROPERTY CRITERIA

	Mix Criteria	
Mix Property	Type 6F and 6 FX	Type 7F and 7FX
Air Voids, %	3.0 - 5.0	3.0 - 5.0
Voids in Mineral Agg. (VMA), %, min.	14.0	16.0
Voids Filled with Binder (VFB), %	65 - 78	65 - 78

Page 4-3.
Under §401-2.02, Composition of Mixtures, Composition of Bituminous Plant Mixtures, ***delete*** the current table and replace it with the following:

Table 401-1, Composition of Hot Mix Asphalt Mixtures (see the following page).

TABLE 401-1
COMPOSITION OF HOT MIX ASPHALT MIXTURES

Mixture	Base				Binder		Shim		Top[2]			
Require-ments[1]	Type 1		Type 2		Type 3		Type 5		Type 6, 6F, 6FX		Type 7, 7F, 7FX	
Screen Sizes	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %
2 in.	100	-	100	-	-	-	-	-	-	-	-	-
1 ½ in.	90 -100	-	75 - 100	± 7	100	-	-	-	-	-	-	-
1 in.	78 - 95	± 5	55 - 80	± 8	95 - 100	-	-	-	100	-	-	-
½ in.	57 - 84	± 6	23 - 42	± 7	70 - 90	± 6	-	-	95 - 100	-	100	-
¼ in.	40 - 72	± 7	5 - 20	± 6	48 - 74	± 7	100	-	65 - 85	± 7	90 - 100	—
⅛ in.	26 - 57	± 7	2 - 15	± 4	32 - 62	± 7	80 - 100	± 6	36 - 65	± 7	45 - 70	± 6
No. 20	12 - 36	± 7	-	-	15 - 39	± 7	32 - 72	± 7	15 - 39	± 7	15 - 40	± 7
No. 40	8 - 25	± 7	-	-	8 - 27	± 7	18 - 52	± 7	8 - 27	± 7	8 - 27	± 7
No. 80	4 -16	± 4	-	-	4 - 16	± 4	7- 26	± 4	4 - 16	± 4	4 - 16	± 4
No. 200	2 - 8	± 2	-	-	2 - 8	± 2	2- 12	± 2	2- 6	± 2	2 - 6	± 2
PGB Content, %[3,4]	4.0 - 6.0	±0.4	2.5 - 4.5	±0.4	4.5 - 6.5	±0.4	7.0-9.5	±0.4	5.4 - 7.0	±0.4	5.7 - 8.0	±0.4
PGB Grade & No.	PG 64 -22		PG 64 -22		PG 64 -22		PG 64 -22		PG 64 -22		PG 64 -22	
Mixing and[5] Placing Temp. Range, °F	250-325		225-300		250-325		250-325		250-325		250-325	

NOTES:

1. All aggregate percentages are based on the total weight of the aggregate. The PGB content is based on the total weight of the mix.

2. The "F" designation in the mix type indicates friction coarse aggregates are required and the "X" designation in the mix type indicates that the more stringent friction aggregate requirements exist.

3. When slag aggregates are used in the mix, the PGB content shall be increased accordingly, minimum 25 percent for an all slag mix.

4. The PGB content job mix tolerance of ±0.4% shall not apply to Marshall Design mixtures.

5. The PGB shall be introduced into the pugmill at a temperature compatible with that of the aggregate as determined by th Regional Director or the authorized representative, between the limits of 225 °F and 325 °F.

ASPHALT PRICE ADJUSTMENT

Make the following changes to the Standard Specifications of January 2, 1990, Section 698 - Price Adjustments.

Page 6-134.
Under §698-1.03 Method of Computation, A. Asphalt Price Adjustment, ***revise*** the current subsection to read as follows:

"**Average Posted Price.** The average FOB terminal price for neat PG 64 -22 performance graded binder, without anti-stripping agent, will be determined for each Bituminous Material Primary Source on the Materials Bureau Approved List of Materials and Equipment For Use On New York State Department of Transportation Projects, by the Department on a regular basis.

The asphalt price adjustment will be based solely on the price changes for asphalt as determined by the above formulas. No consideration will be given to the situation where an individual supplier's price exceeds the Average Posted Price, nor shall any adjustment be made unless the Average Posted Price is either $10.00 greater than or less than the Index Price."

Page 6-135.
Under §698-5 Basis of Payment, ***revise*** the current subsection to read as follows:

"The adjustment will be based on the quantity of eligible work placed and the Average Posted Price in effect at the time of placement. For the purpose of calculating fuel price adjustments, the Average Posted Price will be updated on the twentieth of each month and will apply to eligible work performed on and after the first of the following month. For the purpose of calculating asphalt price adjustment, the Average Posted Price will be updated on the twentieth of each month and will apply to eligible work performed on and after the first of the following month."

BITUMINOUS MATERIALS

Make the following changes to the Standard Specifications of January 2, 1990, Section 702 - Bituminous Materials.

Page 7-5.
Under §702, Materials Requirements, 1. Asphalt Cements, ***delete*** the current subsection and replace it with the following:

"***1A. Performance Graded Binders For Paving.*** A Performance Graded Binder (PGB), designated PG XX-YY, is defined as the range of pavement temperatures expressed in degrees Celsius, maximum to minimum, over which the PGB can be expected to provide acceptable performance. PGBs shall meet the requirements of AASHTO Designation MP1 - Standard Specification For Performance Graded Asphalt Binder and Table 702-1, PERFORMANCE GRADED BINDERS FOR PAVING. The PGB shall be prepared from refining crude petroleum by suitable methods with the addition of a modifier, if necessary, to meet the required Performance Grade. The PGB Supplier shall certify that the PGB meets NYSDOT quality requirements for a Primary Source appearing on the Department's Approved List of Performance Graded Binders for Paving.

The PGB Supplier shall provide the design mixing and compaction temperatures on a NYSDOT BR-X6M. Also, provide MP1 test data and all necessary shipping documents in accordance with Department written instructions.

Silicone additives will be permitted in paving binders. Silicone may be introduced into the PGB in accordance with the manufacture's recommendations either at the refinery, terminal or at a mixing plant storage tank. PGB treated with silicone shall conform to the specifications for untreated PGB.

Any previously approved PGB that has been stored in the mixing plant tank over the winter shall be resampled and accepted by the Department before it is used.

1B. Miscellaneous Asphalt Cements. Asphalt cements shall meet the requirements of Table 702-2, MISCELLANEOUS ASPHALT CEMENTS. The asphalt shall be prepared by refining crude petroleum using suitable methods. The asphalt cement shall be homogenous, free from water and shall not foam when heated to 347 °F. The supplier shall maintain the identity of the asphalts in accordance with the Department's written instructions from the point of refining to the point where the asphalt is incorporated into the work. Test data and shipping documents shall be provided by the supplier in accordance with the Department's written instructions."

Page 7-6.
Under §702, Table 702-1, Asphalt Cements for Paving, ***delete*** the current table and replace it with the following:

Table 702-1 - Performance Graded Binders for Paving (see the following page).

Page 7-7.
Under §702, Table 702-2, Miscellaneous Asphalt Cements, ***delete*** the current table and replace it with the following:

Table 702-2 - Miscellaneous Asphalt Cements (see page 3).

TABLE 702-1
PERFORMANCE GRADED BINDERS FOR PAVING

MATERIAL DESIGNATION	702-5828	702-5834	702-6422	702-6428	702-7022	702-7622
PERFORMANCE GRADE	PG 58		PG 64		PG 70	PG 76
	-28	-34	-22	-28	-22	-22
Original Binder						
Flash Point Temp, T48: Min °C	230					
Viscosity, ASTM D 4402:[1] Maximum, 3 Pa•s (3000 cP) Test Temp, °C	135					
Dynamic Shear, TP5:[2] G*/sinδ, Minimum, 1.00 kPa Test Temp @ 10 rad/s, °C	58		64		70	76
Rolling Thin Film Oven (T240) or Thin Film Oven (T179) Residue						
Mass Loss, Maximum, %	1.00					
Dynamic Shear, TP5: G*/sinδ, Minimum, 2.20 kPa Test Temp @ 10 rad/s, °C	58		64		70	76
Pressure Aging Vessel Residue (PP1)						
PAV Aging Temp, °C	100		100		100	100
Dynamic Shear, TP5: G*/sinδ, Minimum, 5000 kPa Test Temp @ 10 rad/s, °C	19	16	25	22	28	31
Physical Hardening[3]	Report					
Creep Stiffness, TP1:[4] S, Maximum, 300 Mpa m-value, Minimum, 0.300 Test Temp, @ 60 sec, °C	-18	-24	-12	-18	-12	-12
Direct Tension, TP3:[4] Failure Strain, Min, 1.0% Test Temp @ 1.0 mm/min, °C	-18	-24	-12	-18	-12	-12

NOTES:

1. This requirement may be waived by the Director, Materials Bureau if the supplier warrants that the PGB can be adequately pumped and mixed at temperatures that meet all applicable safety standards.

2. For quality control of unmodified PGB production, measurement of the viscosity of the original PGB may be substituted for dynamic shear measurements of G*/Sin δ at test temperatures where the PGB is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary or rational viscometry (AASHTO T 201 or T 202).

3. Physical Hardening - TP 1 is performed on a set of PGB beams according to Section 13.1, except the conditioning time is extended to 24 hours ± 10 minutes at 10 °C above the minimum performance temperature. The 24-hour stiffness and m-value are reported for information purposes.

4. If the creep stiffness is below 300 MPa, the direct tension test is not required. If the creep stiffness 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 mu: be satisfied in both cases.

TABLE 702-2
MISCELLANEOUS ASPHALT CEMENTS

MATERIAL DESIGNATION	702-0700	
GRADE	18-60	
Test Requirements	Min.	Max.
Penetration, 77°F, 100g, 5s (AASHTO T49)	18	60
Flash Point, COC, °F (AASHTO T48)	393	-
Solubility in Trichlorethylene, % (AASHTO T44)	99.5	-
Softening Point, °F (AASHTO T53)	130	167
Loss on Heating, 325°F, 5h, % (AASHTO T47)	-	1.0
Penetration of Residue, % of Original	60	-
Ductility, 77°F, 5 cm/min, cm (AASHTO T51)	5	-
Typical Uses	Joint and Crack Filler	

BITUMINOUS PAVEMENTS

Make the following changes to the Standard Specifications of January 2, 1995, Section 401 - Plant Mix Pavements - General:

Page 4-1.
Under §401-2.02 Composition of Mixtures, Marshall Mix Property Criteria, ***delete*** the current table and replace it with the following:

MARSHALL MIX PROPERTY CRITERIA

	Mix Criteria	
Mix Property	Type 6F and 6 FX	Type 7F and 7FX
Air Voids, %	3.0 - 5.0	3.0 - 5.0
Voids in Mineral Agg. (VMA), %, min.	14.0	16.0
Voids Filled with Binder (VFB), %	65 - 78	65 - 78

Page 4-3.
Under §401-2.02, Composition of Mixtures, Composition of Bituminous Plant Mixtures, ***delete*** the current table and replace it with the following:

Table 401-1, Composition of Hot Mix Asphalt Mixtures (see the following page).

TABLE 401-1
COMPOSITION OF HOT MIX ASPHALT MIXTURES

Mixture	Base				Binder		Shim		Top[2]			
Require-ments[1]	Type 1		Type 2		Type 3		Type 5		Type 6, 6F, 6FX		Type 7, 7F, 7FX	
Screen Sizes	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %
50.0 mm	100	-	100	-	-	-	-	-	-	-	-	-
37.5 mm	90 -100	-	75 - 100	± 7	100	-	-	-	-	-	-	-
25.0 mm	78 - 95	± 5	55 - 80	± 8	95 - 100	-	-	-	100	-	-	-
12.5 mm	57 - 84	± 6	23 - 42	± 7	70 - 90	± 6	-	-	95 - 100	-	100	-
6.3 mm	40 - 72	± 7	5 - 20	± 6	48 - 74	± 7	100	-	65 - 85	± 7	90 - 100	--
3.2 mm	26 - 57	± 7	2 - 15	± 4	32 - 62	± 7	80 - 100	± 6	36 - 65	± 7	45 - 70	± 6
850 μm	12 - 36	± 7	-	-	15 - 39	± 7	32 - 72	± 7	15 - 39	± 7	15 - 40	± 7
425 μm	8 - 25	± 7	-	-	8 - 27	± 7	18 - 52	± 7	8 - 27	± 7	8 - 27	± 7
180 μm	4 -16	± 4	-	-	4 - 16	± 4	7- 26	± 4	4 - 16	± 4	4 - 16	± 4
75 μm	2 - 8	± 2	-	-	2 - 8	± 2	2- 12	± 2	2- 6	± 2	2 - 6	± 2
PGB Content, %[3,4]	4.0 - 6.0	±0.4	2.5 - 4.5	±0.4	4.5 - 6.5	±0.4	7.0-9.5	±0.4	5.4 - 7.0	±0.4	5.7 - 8.0	±0.4
PGB Grade & No.	PG 64 -22		PG 64 -22		PG 64 -22		PG 64 -22		PG 64 -22		PG 64 -22	
Mixing and[5] Placing Temp. Range, °C	120-165		110-150		120-165		120-165		120-165		120-165	

NOTES:

1. All aggregate percentages are based on the total weight of the aggregate. The PGB content is based on the total weight of the mix.

2. The "F" designation in the mix type indicates friction coarse aggregates are required and the "X" designation in the mix type indicates that the more stringent friction aggregate requirements exist.

3. When slag aggregates are used in the mix, the PGB content shall be increased accordingly, minimum 25 percent for an all slag mix.

4. The PGB content job mix tolerance of ±0.4% shall not apply to Marshall Design mixtures.

5. The PGB shall be introduced into the pugmill at a temperature compatible with that of the aggregate as determined by the Regional Director or the authorized representative, between the limits of 110 °C and 175 °C.

ASPHALT PRICE ADJUSTMENT

Make the following changes to the Standard Specifications of January 2, 1995, Section 698 - Price Adjustments.

Page 6-207, line 32.
Under §698-1.03 Method of Computation, A. Asphalt Price Adjustment, ***revise*** the current subsection to read as follows:

"**Average Posted Price.** The average FOB terminal price for neat PG 64 -22 performance graded binder, without anti-stripping agent, will be determined for each Bituminous Material Primary Source on the Materials Bureau Approved List of Materials and Equipment For Use On New York State Department of Transportation Projects, by the Department on a regular basis.

The fuel adjustment will be based solely on the price changes for fuel as determined by the above formulae. No consideration will be given to the situation where an individual supplier's price exceeds the Average Posted Price, nor shall any adjustment be made unless the Average Posted Price is either $0.03 greater than or less than the Index Price."

Page 6-208, line 38.
Under §698-5 Basis of Payment, ***revise*** the current subsection to read as follows:

"The adjustment will be based on the quantity of eligible work placed and the Average Posted Price in effect at the time of placement. For the purpose of calculating fuel price adjustments, the Average Posted Price will be updated on the twentieth of each month and will apply to eligible work performed on and after the first of the following month. For the purpose of calculating asphalt price adjustment, the Average Posted Price will be updated on the twentieth of each month and will apply to eligible work performed on and after the first of the following month."

BITUMINOUS MATERIALS

Make the following changes to the Standard Specifications of January 2, 1995, Section 702 - Bituminous Materials.

Page 7-7.
Under §702, Table 702-1, Asphalt Cements for Paving, ***delete*** the current table and replace it with the following:

Table 702-1 - Performance Graded Binders for Paving (see the following page).

Page 7-8.
Under §702, Materials Requirements, 1. Asphalt Cements, ***delete*** the current subsection and replace it with the following:

"***1A. Performance Graded Binders For Paving.*** A Performance Graded Binder (PGB), designated PG XX-YY, is defined as the range of pavement temperatures expressed in degrees Celsius, maximum to minimum, over which the PGB can be expected to provide acceptable performance. PGBs shall meet the requirements of AASHTO Designation MP1 - Standard Specification For Performance Graded Asphalt Binder and Table 702-1, PERFORMANCE GRADED BINDERS FOR PAVING. The PGB shall be prepared from refining crude petroleum by suitable methods with the addition of a modifier, if necessary, to meet the required Performance Grade. The PGB Supplier shall certify that the PGB meets NYSDOT quality requirements for a Primary Source appearing on the Department's Approved List of Performance Graded Binders for Paving.

The PGB Supplier shall provide the design mixing and compaction temperatures on a NYSDOT BR-X6M. Also, provide MP1 test data and all necessary shipping documents in accordance with Department written instructions.

Silicone additives will be permitted in paving binders. Silicone may be introduced into the PGB in accordance with the manufacture's recommendations either at the refinery, terminal or at a mixing plant storage tank. PGB treated with silicone shall conform to the specifications for untreated PGB.

Any previously approved PGB that has been stored in the mixing plant tank over the winter shall be resampled and accepted by the Department before it is used.

1B. Miscellaneous Asphalt Cements. Asphalt cements shall meet the requirements of Table 702-2, MISCELLANEOUS ASPHALT CEMENTS. The asphalt shall be prepared by refining crude petroleum using suitable methods. The asphalt cement shall be homogenous, free from water and shall not foam when heated to 175°C. The supplier shall maintain the identity of the asphalts in accordance with the Department's written instructions from the point of refining to the point where the asphalt is incorporated into the work. Test data and shipping documents shall be provided by the supplier in accordance with the Department's written instructions."

Page 7-8.
Under §702, Table 702-2, Miscellaneous Asphalt Cements, ***delete*** the current table and replace it with the following:

Table 702-2 - Miscellaneous Asphalt Cements (see page 3).

TABLE 702-1
PERFORMANCE GRADED BINDERS FOR PAVING

MATERIAL DESIGNATION	702-5828	702-5834	702-6422	702-6428	702-7022	702-7622
PERFORMANCE GRADE	PG 58		PG 64		PG 70	PG 76
	-28	-34	-22	-28	-22	-22
Original Binder						
Flash Point Temp, T48: Min °C	230					
Viscosity, ASTM D 4402: [1] Maximum, 3 Pa•s (3000 cP) Test Temp, °C	135					
Dynamic Shear, TP5: [2] G*/sinδ, Minimum, 1.00 kPa Test Temp @ 10 rad/s, °C	58		64		70	76
Rolling Thin Film Oven (T240) or Thin Film Oven (T179) Residue						
Mass Loss, Maximum, %	1.00					
Dynamic Shear, TP5: G*/sinδ, Minimum, 2.20 kPa Test Temp @ 10 rad/s, °C	58		64		70	76
Pressure Aging Vessel Residue (PP1)						
PAV Aging Temp, °C	100		100		100	100
Dynamic Shear, TP5: G*/sinδ, Minimum, 5000 kPa Test Temp @ 10 rad/s, °C	19	16	25	22	28	31
Physical Hardening [3]	Report					
Creep Stiffness, TP1: [4] S, Maximum, 300 Mpa m-value, Minimum, 0.300 Test Temp, @ 60 sec, °C	-18	-24	-12	-18	-12	-12
Direct Tension, TP3: [4] Failure Strain, Min, 1.0% Test Temp @ 1.0 mm/min, °C	-18	-24	-12	-18	-12	-12

NOTES:

1. This requirement may be waived by the Director, Materials Bureau if the supplier warrants that the PGB can be adequately pumped and mixed at temperatures that meet all applicable safety standards.

2. For quality control of unmodified PGB production, measurement of the viscosity of the original PGB may be substituted for dynamic shear measurements of G*/Sin δ at test temperatures where the PGB is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary or rational viscometry (AASHTO T 201 or T 202).

3. Physical Hardening - TP 1 is performed on a set of PGB beams according to Section 13.1, except the conditioning time is extended to 24 hours ± 10 minutes at 10 °C above the minimum performance temperature. The 24-hour stiffness and m-value are reported for information purposes.

4. If the creep stiffness is below 300 MPa, the direct tension test is not required. If the creep stiffness 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.

TABLE 702-2
MISCELLANEOUS ASPHALT CEMENTS

MATERIAL DESIGNATION	702-0700	
GRADE	18-60	
Test Requirements	Min.	Max.
Penetration, 25°C, 100g, 5s (AASHTO T49)	18	60
Flash Point, COC, °C (AASHTO T48)	200	-
Solubility in Trichlorethylene, % (AASHTO T44)	99.5	-
Softening Point, °C (AASHTO T53)	55	75
Loss on Heating, 163°C, 5h, % (AASHTO T47)	-	1.0
Penetration of Residue, % of Original (AASHTO T49)	60	-
Ductility, 25°C, 5 cm/min, cm (AASHTO T51)	5	-
Typical Uses	Joint and Crack Filler	