New Jersey Department of Transportation
1035 Parkway Avenue, PO Box 600, Trenton, New Jersey 08625-0600

Baseline Document Change Announcement

ANNOUNCEMENT: **BDC18S-03**

DATE: **April 26, 2018**

SUBJECT: **Pavements, Materials, Equipment and NJDOT Test Methods.**
- **Revision to Divisions 400, 420, Sections 902, 914, 1009 & NJDOT B-10 Test Methods, and addition of new Section 408, Subsection 902.12, 902.13 & NJDOT A-7 and B-13 Test Methods of the *2007 Standard Specifications for Road and Bridge Construction.***

Divisions 400, 420, Sections 902, 914, 1009 & NJDOT B-10 Test Method of the 2007 Standard Specifications for the Road and Bridge Construction have been revised as a clarification of the intent of the Specifications, which includes an adjustment in the production tolerance of all asphalt gradations. Also, a new Section 408 "Asphalt Rubber Gap Graded Courses" along with corresponding Subsection 901.12 have been added. An additional Subsection 901.13 for a new composition of Hot Mix Asphalt and NJDOT A-7 & B-13 Test Methods are added to the Standards. Section 902.01.02 "Cutback Asphalts" has been deleted due to the availability of more environmentally friendly options.

The changes to the Standard Input, SI2007 are attached.

Implementation Code R (ROUTINE)

Changes must be implemented in all applicable Department projects scheduled for Final Design Submission at least one month after the date of the BDC announcement. This will allow designers to make necessary plan, specifications, and estimate/proposal changes without requiring the need for an addenda or postponement of advertisement or receipt of bids.

Recommended By:

Paul F. Schneider
Director
Capital Program Support

Approved By:

Eli D. Lambert III, P.E.
Assistant Commissioner
Capital Program Management

Attachment: Division 400, 420, Sections 902, 914 1009 & NJDOT Test Method B-10, and addition of new Section 408, Subsections 902.12, 902.13 & NJDOT A-7 and B-13 Test Methods of the *2007 Standard Specifications for Road and Bridge Construction.*

PS: NJ: HP

DIVISION 400 – PAVEMENTS

SECTION 401 – HOT MIX ASPHALT (HMA) COURSES

401.02.01 Materials
THE FIRST PARAGRAPH IS CHANGED TO:

Provide materials as specified:

Tack Coat 64-22, PG 64-22 ..... 902.01.01
Prime Coat, Grade CSS-1 ..... 902.01.03
Tack Coat:
  Emulsified Asphalt, Grade RS-1, RS-1h, CRS-1, or CRS-1h 902.01.03
Polymer Modified Tack Coat:
  Polymer Modified Emulsified Asphalt 902.01.04
HMA 902.02
HMA HIGH RAP 902.13
Joint Sealer, Hot-Poured 914.02
Polymerized Joint Adhesive 914.03

401.02.02 Equipment
THE LAST PARAGRAPH IS CHANGED TO:

When an MTV is used, install a paver hopper with a minimum capacity of 14 tons in the hopper of the HMA paver.

401.03.02 Tack Coat and Prime Coat
THE ENTIRE TEXT IS CHANGED TO:

Clean the surface where the HMA is to be placed of foreign and loose material. Immediately before beginning paving operations, ensure that the surface is dry. Do not place tack coat or prime coat unless the weather restrictions, as specified in 401.03.03.B, are met.

Do not apply tack coat or prime coat to asphalt-stabilized drainage course.

For curbs, gutters, manholes, and other similar structures, do not apply tack coat or prime coat. Clean the exposed surfaces of these structures and apply a uniform coating of polymerized joint adhesive to contact surfaces before paving.

In areas inaccessible to distributor spray bars, use hand spraying equipment for tack and prime coat. Do not allow traffic on tack coated or prime coated surfaces. Treat surfaces as follows:

1. **Tack Coat.** Uniformly spray tack coat when placing HMA on paved surfaces. Apply tack coat only to areas to be paved in the same day. Apply tack coat as specified in Table 401.03.02-1:

Table 401.03.02-1 Tack Coat Application

Material	Spraying Temp, °F	Gallons per Square Yard	Season
Emulsified Asphalt:			
RS-1, RS-1h	125 to 185	0.05 to 0.15	All year
CRS-1, CRS-1h	125 to 185	0.05 to 0.15	All year

Correct uncoated or lightly coated areas. Blot areas showing an excess of tack coat with sand or other similar material. Remove blotting material before paving. Ensure that the material is not streaked or ribboned.

Before paving, allow tack coat to cure to a condition that is tacky to the touch.

2. **Tack Coat 64-22.** When precipitation has occurred within 24 hours before application, the RE will determine whether to allow the work to proceed, or to wait until the surface is completely dry. Only apply tack coat that can be paved over in the same day. Apply tack coat 64-22 at a rate of 0.06 to 0.14 gallons per square yard and at a spraying temperature of 325 °F. Adjust the spraying temperature and application rate to produce a uniform coating, with no excess material.

   Correct uncoated or lightly coated areas and remove excess tack coat from affected areas. Ensure that the material is not streaked or ribboned.

3. **Polymer Modified Tack Coat**. Apply polymer modified tack coat with an ultra-thin paver at a temperature of 140 to 185 °F. Continuously monitor rate of spray, ensuring a uniform application rate over entire width to be overlaid. Apply at the rate of 0.20 ± 0.05 gallons per square yard. Do not allow traffic, equipment, tools, or any other disturbance to the polymer modified tack coat before placing the ultra-thin friction course.

4. **Prime Coat.** Clean the surface of foreign and loose material where the HMA is to be placed. Immediately before beginning paving operations, ensure that the surface is dry. Do not place prime coat unless the weather restrictions, as specified in 401.03.03.B, are met.

   Do not apply prime coat to asphalt-stabilized drainage course.

   For curbs, gutters, manholes, and other similar structures, do not apply prime coat. Clean the exposed surfaces of these structures and apply a uniform coating of polymerized joint adhesive to contact surfaces before paving.

   In areas inaccessible to distributor spray bars, use hand spraying equipment for. Do not allow traffic on prime coated surfaces. Treat surfaces as follows:

   Apply prime coat of emulsified asphalt on unpaved surfaces as follows:

Table 401.03.02-2 Prime Coat Application

Material	Spraying Temp, °F	Gallons per Square Yard	Season
Emulsified Asphalt:			
CSS-1	70 to 140	0.1 to 0.50	All year

   Apply prime coat at least 12 hours before placement of the HMA and when the base courses are not saturated or frozen. Unless the prime coat is under asphalt-stabilized drainage course, the RE may waive the application of prime coat if more than 5 inches of HMA is placed on the unbound aggregate course before the roadway is opened to traffic. Take measures to prevent prime coat from entering into the drainage system or extending beyond the area to be paved.

401.03.03 HMA Courses

A. Paving Plan.

THE FOLLOWING IS ADDED AT THE END OF THE FIRST PARAGRAPH AS IT APPEARS IN THE SI:

16. Proposed location for test strip.

THE FOLLOWING PARAGRAPH IS ADDED:

When using HMA HIGH RAP submit for Department approval a plan of the location for the HMA HIGH RAP on the project.

C. Test Strip.

THE FOLLOWING IS ADDED AFTER THE FIRST SENTENCE OF THE FIRST PARAGRAPH AS IT APPEARS IN THE SI:

For HMA HIGH RAP, construct the test strip at least 14 days prior to production.

THE SECOND PARAGRAPH AS IT APPEARS IN THE SI IS CHANGED TO:

Upon completion of the test strip, the Contractor may continue paving except when paving HMA HIGH RAP. If the Contractor does not continue paving, the Department will accept the test strip as the first lot regardless of size.

E. Spreading and Grading.

THE FOLLOWING PARAGRAPH IS ADDED AFTER THE FIFTH PARAGRAPH AS IT APPEARS IN THE SI:

When paving HMA HIGH RAP record the laydown temperature (temperature immediately behind the paver) at least once per hour during paving. Submit the temperatures to the RE and the HMA Plant producing the HMA HIGH RAP.

401.04 MEASUREMENT AND PAYMENT

THE FOLLOWING ITEMS ARE ADDED:

Item	*Pay Unit*
HOT MIX ASPHALT ___ ___ ___ SURFACE COURSE HIGH RAP	TON
HOT MIX ASPHALT ___ ___ ___ INTERMEDIATE COURSE HIGH RAP	TON
HOT MIX ASPHALT ___ ___ ___ BASE COURSE HIGH RAP	TON

SECTION 403 – ULTRA-THIN FRICTION COURSE

403.02.01 Materials
THE ENTIRE TEXT IS CHANGED TO:

Provide materials as specified:

Polymer Modified Emulsified Asphalt, Grade CRS-1P 902.01.04
Ultra-Thin HMA 902.04

SECTION 406 – HIGH PERFORMANCE THIN OVERLAY (HPTO)

406.02.01 Materials
THE ENTIRE TEXT AS IT APPEARS IN THE SI IS CHANGED TO:

Provide materials as specified:

Tack Coat:
Emulsified Asphalt, Grade RS-1, RS-1h, CRS-1, CRS-1h, or CRS-1P 902.01.03
HPTO 902.08

SECTION 407 - BINDER RICH INTERMEDIATE COURSE

407.02.01 Materials
THE ENTIRE TEXT AS IT APPEARS IN THE SI IS CHANGED TO:

Provide materials as specified:

Tack Coat:
Emulsified Asphalt, Grade RS-1, RS-1h, CRS-1, or CRS-1h 902.01.03
Binder Rich Intermediate Course 902.11

Use an approved HMA surface course to fill core holes, maintaining the material hot enough to compact. The Contractor may use a commercial type of cold mixture as patching material for filling core holes if HMA surface course is not being produced when coring.

407.02.02 Equipment
THE LAST PARAGRAPH AS IT APPEARS IN THE SI IS CHANGED TO:

Install a paver hopper with a minimum capacity of 14 tons in the hopper of the HMA Paver.

THE FOLLOWING SECTION IS ADDED:

SECTION 408 – ASPHALT RUBBER GAP GRADED COURSES

408.01 DESCRIPTION

This Section describes the requirements for constructing Asphalt Rubber Gap Graded (ARGG) Surface Course and Asphalt Rubber Gap Graded Intermediate Course.

408.02 MATERIALS

408.02.01 Materials

Provide materials as specified:

Tack Coat:
Emulsified Asphalt, Grade RS-1, RS-1h, CRS-1, or CRS-1h 902.01.03
Asphalt Rubber Gap Graded Course 902.12
Polymerized Joint Adhesive 914.03

408.02.02 Equipment

Provide equipment as specified:

Materials Transfer Vehicle (MTV) 1003.01
HMA Paver 1003.03
HMA Compactor 1003.05
Bituminous Material Distributor 1003.07
HMA Plant 1009.01
HMA Trucks 1009.02
Asphalt-Rubber Binder Blending Equipment 1009.03

Provide a thin-lift nuclear density gauge according to ASTM D 2950.

Install a paver hopper with a minimum capacity of 14 tons in the HMA Paver.

408.03 CONSTRUCTION

408.03.01 ARGG COURSE

A. Paving Plan. At least 20 days before beginning placing the ARGG course, submit to the RE for approval a detailed plan of operation as specified in 401.03.03.A. Include in the paving plan a proposed location for the test strip.

B. Weather Limitations. If within the 12 hours before paving, the National Weather Service locally forecasts a 50 percent chance or greater of precipitation during the scheduled placement, postpone the placement of ARGG course. Do not place ARGG course if it is precipitating and do not allow trucks to leave the plant when precipitation is imminent. The Contractor may resume paving operations when the chance of precipitation is less than 50 percent and the surface is dry.

Do not pave if the surface temperature of the underlying pavement is below 50 °F.

C. Test Strip. Construct a test strip as specified in 401.03.03.C except for the allowance to continue paving. Submit test strip results to the RE. The RE will analyze the test strip results in conjunction with the ME's results from the HMA plant to approve the test strip. Do not proceed with production paving until receiving written permission from the RE.

D. Transportation and Delivery of ARGG Course. Transport and deliver ARGG course as specified in 401.03.03.D.

E. Spreading and Grading. Do not start paving until the RE has approved the underlying surface. Apply tack coat as specified in 401.03.02. Spread and grade ARGG course as specified in 401.03.03.E.

F. Compacting. Compact ARGG course as specified in 401.03.03.F, but use a minimum of three rollers and ensure fabric softener is added to the roller water to prevent material pick-up on the roller drum. One pint of fabric softener per fill-up of the roller water has been shown to be adequate in preventing material pick-up. Ensure that the compaction is completed before the mix cools down to 240°F. If vibratory compaction causes aggregate breakdown or forces liquid asphalt binder to the surface, operate rollers in static mode only.

G. Opening to Traffic. Remove loose material from the traveled way, shoulder, and auxiliary lanes before opening to traffic. Before opening ARGG course to traffic or construction equipment, ensure that the lime water has been applied, the surface is tack free and the surface temperature is less than 140 °F.

H. Air Void Requirements. Drill cores as specified in 401.03.05.

Mainline lots are defined as the area covered by a day's paving production of the same job mix formula for the traveled way and auxiliary lanes. The RE may combine daily production areas less than 1000 tons with previous or subsequent production areas. If a day's production is greater than 4000 tons, the RE may divide the area of HMA placed into 2 lots with approximately equal areas.

Ramp pavement lots are defined as approximately 10,000 square yards of pavement in ramps. The RE may combine ramps with less than the minimum area into a single lot. If 2 or more ramps are included in a single lot, the RE will require additional cores to ensure that at least 1 core is taken from each ramp.

Other pavement lots are defined as approximately 10,000 square yards of pavement in shoulders and other undefined areas. Inside shoulders less than 6 feet in width will not be included in other lots unless requested by the RE.

If areas of existing shoulders are found to be insufficient to support the proposed HMA pavement and the required compaction cannot be achieved, notify the RE immediately. The RE may either direct additional milling and paving to provide a suitable base to pave the proposed HMA, or waive coring and air void requirements in such shoulder areas.

The ME will calculate the percent defective (PD) as the percentage of the lot outside the acceptable range of 1 percent air voids to 7 percent air voids. The acceptable quality limit is 10 percent defective. For lots in which PD<10, the Department will award a positive pay adjustment. For lots in which PD>10, the Department will assess a negative pay adjustment.

The ME will determine air voids from 5 cores taken from each lot in random locations. The ME will determine air voids of cores from the values for the maximum specific gravity of the mix and the bulk specific gravity of the core. The ME will determine the maximum specific gravity of the mix according to NJDOT B-3 and AASHTO T 209, except that minimum sample size may be waived in order to use a 6-inch diameter core sample. The ME will determine the bulk specific gravity of the compacted mixture by testing each core according to AASHTO T166.

The ME will calculate pay adjustments based on the following:

1. **Sample Mean ($\overline{X}$) and Standard Deviation (S) of the N Test Results (X_1, X_2,..., X_N).**

$$\overline{X} = \frac{(X_1 + X_2 + \ldots + X_N)}{N}$$

$$S = \sqrt{\frac{(X_1 - \overline{X})^2 + (X_2 - \overline{X})^2 + \ldots + (X_N - \overline{X})^2}{N-1}}$$

2. **Quality Index (Q).**

$$Q_L = \frac{(\overline{X} - 1.0)}{S}$$

$$Q_U = \frac{(7.0 - \overline{X})}{S}$$

3. **Percent Defective (PD).** Using NJDOT ST for the appropriate sample size, the Department will determine PD_L and PD_U associated with Q_L and Q_U, respectively. $PD = PD_L + PD_U$

4. **Percent Pay Adjustment (PPA).** Calculate the PPA for traveled way and ramp lots as specified in Table 408.03.01-1.

Table 408.03.01-1 PPA for Mainline Lots and Ramp Lots

Quality	PPA

Surface	PD < 10	PPA = 4 − (0.4 PD)
	10 ≤ PD < 30	PPA = 1 − (0.1 PD)
	PD ≥ 30	PPA = 40 − (1.4 PD)
Intermediate and Base	PD < 30	PPA = 1 − (0.1 PD)
	PD ≥ 30	PPA = 40 − (1.4 PD)

Calculate the PPA for other pavement lots as specified in Table 408.03.01-2.

Table 408.03.01-2 PPA for Other Pavement Lots

	Quality	PPA
All Courses	PD < 50	PPA = 1 − (0.1 PD)
	PD ≥ 50	PPA = 92 − (1.92 PD)

5. **Outlier Detection.** If PD < 10, the ME will not screen for outliers. If PD ≥ 10, the ME will screen all acceptance cores for outliers using a statistically valid procedure. The following procedure applies only for a sample size of 5 or 10.

   1. The ME will arrange the core results in ascending order, in which X_1 represents the smallest value and X_N represents the largest value.
   2. If X_N is suspected of being an outlier, the ME will calculate:

$$R = \frac{X_N - X_{(N-1)}}{X_N - X_1}$$

   3. If X_1 is suspected of being an outlier, the ME will calculate:

$$R = \frac{X_2 - X_1}{X_N - X_1}$$

   4. For N = 5 if R > 0.642, the value is judged to be statistically significant and the core is excluded. For N = 10 if R > 0.412, the value is judged to be statistically significant and the core is excluded.

   If an outlier is detected for N=5, and no retest is warranted, the Contractor may replace that core by taking an additional core at the same offset and within 5 feet of the original station. If an outlier is detected and a retest is justified, take a replacement core for the outlier at the same time as the 5 additional retest cores are taken. If the outlier replacement core is not taken within 15 days, the ME will use the initial core results to determine PPA.

   If an outlier is detected for N = 10, the Contractor may replace that core by taking an additional core at the same offset and within 5 feet of the original station. If the outlier replacement core is not taken within 15 days, the ME will use the initial core results to determine PPA.

6. **Retest.** If the initial series of 5 cores produces a percent defective value of PD ≥ 30 for mainline or ramp lots, or PD ≥ 50 for other pavement lots, the Contractor may elect to take an additional set of 5 cores at random locations chosen by the ME. Notify the RE within 15 days of receipt of the initial core results to take the additional cores. If the RE is not notified within the 15 days, the ME will use the initial core results to determine the PPA. If the additional cores are taken, the ME will recalculate the PPA using the combined results from the 10 cores.

7. **Removal and Replacement.** If the final lot PD ≥75 (based on the combined set of 10 cores or 5 cores if the Contractor does not take additional cores), remove and replace the lot and all overlying work. The replacement work is subject to the same requirements as the initial work.

I. Thickness Requirements. When required for thickness determination, drill cores as specified in 401.03.05. The Department will evaluate thickness as specified in 401.03.03.I.

J. Ride Quality Requirements. The Department will evaluate the ARGG course as specified in 401.03.03.J.

408.04 MEASUREMENT AND PAYMENT

Item	*Pay Unit*
ASPHALT RUBBER GAP GRADED SURFACE COURSE	TON
ASPHALT RUBBER GAP GRADED INTERMEDIATE COURSE	TON

The Department will measure ASPHALT RUBBER GAP GRADED SURFACE COURSE and ASPHALT RUBBER GAP GRADED INTERMEDIATE COURSE by the ton as indicated on the certified weigh tickets, excluding unused material.

The Department will make payment for CORE SAMPLES, HOT MIX ASPHALT as specified in 401.04.

The Department will make payment for POLYMERIZED JOINT ADHESIVE as specified in 401.04.

The Department will make payment for TACK COAT as specified in 401.04.

DIVISION 420 – PAVEMENT PRESERVATION TREATMENTS

SECTION 421 – MICRO SURFACING AND SLURRY SEAL

421.02.01 Materials
THE ENTIRE TEXT AS IT APPEARS IN THE SI IS CHANGED TO:

Provide materials as specified:

Tack Coat:
Emulsified Asphalt, Grade RS-1, RS-1h, CRS-1, or CRS-1h 902.01.03
Micro Surfacing 902.09
Slurry Seal 902.10

SECTION 422 – FOG SEAL

422.02 MATERIALS

422.02.01 Materials
THE ENTIRE TEXT AS IT APPEARS IN THE SI IS CHANGED TO:

Provide materials as specified:

Fine Aggregate for Fog Seal 901.07.02

1 **Asphalt Emulsion.** For fog seal surface treatment, fog seal of centerline rumble strips and HMA longitudinal cold joint provide emulsified asphalt of grades RS-1 or RS-2 in accordance with AASHTO M 140; or provide cationic emulsified asphalt of grades CRS-1 or CRS-2 in accordance with AASHTO M 208; and ensure all emulsified asphalts are provided as specified in 902.01.03.

2 **Polymerized Maltene Emulsion.** As an alternative for asphalt emulsion specified above for fog seal strip of centerline rumble strips and HMA longitudinal cold joints, provide JOINTBOND® emulsion. JOINTBOND® is proprietary to Pavement Technology, Inc. of Westlake, OH, telephone number (800)333-6309. For new pavements, use JOINTBOND®. For pavements that are more than 12 months old, use JOINTBOND® PM.

All dilution must be done at the place of manufacture.

Other emulsified asphalt designed specifically for fog sealing may be used if approved by the Bureau of Materials. Determine the application rate by the amount of residual asphalt required as specified in 422.03.01.E.

DIVISION 900 – MATERIALS

SECTION 902 – ASPHALT

902.01 BITUMINOUS MATERIALS
THE ENTIRE TEXT IS CHANGED TO:

Use the following temperature-volume correction (TVC) factors to convert the volume of bituminous materials, measured at the temperature at the point of use, to the volume at 60 °F:

1. For PG Binder, use the following equation:

$$TVC = 1.0211326242 - 3.548988118 \times 10^{-4} [T (°F)] + 4.49881 \times 10^{-8} [T (°F)]^2$$

2. For emulsified asphalts, use Table 902.01-1.

Table 902.01-1 TVC Factors for Emulsified Asphalt Material (40 – 103 °F)

Temp (°F)	Factor	Temp (°F)	Factor	Temp (°F)	Factor	Temp (°F)	Factor
40	1.0050	56	1.0010	72	0.9970	88	0.9930
41	1.0048	57	1.0008	73	0.9968	89	0.9928
42	1.0045	58	1.0005	74	0.9965	90	0.9925
43	1.0043	59	1.0003	75	0.9953	91	0.9923
44	1.0040	60	1.0000	76	0.9960	92	0.9920
45	1.0038	61	0.9998	77	0.9958	93	0.9918
46	1.0035	62	0.9995	78	0.9955	94	0.9915
47	1.0033	63	0.9993	79	0.9953	95	0.9913
48	1.0030	64	0.9990	80	0.9950	96	0.9910
49	1.0028	65	0.9988	81	0.9948	97	0.9908
50	1.0025	66	0.9985	82	0.9945	98	0.9905
51	1.0023	67	0.9983	83	0.9943	99	0.9903
52	1.0020	68	0.9980	84	0.9940	100	0.9901
53	1.0018	69	0.9978	85	0.9938	101	0.9899
54	1.0015	70	0.9975	86	0.9935	102	0.9896
55	1.0013	71	0.9973	87	0.9933	103	0.9884
104	0.9891	123	0.9845	142	0.9799	161	0.9754
105	0.9889	124	0.9843	143	0.9797	162	0.9751
106	0.9886	125	0.9840	144	0.9794	163	0.9749
107	0.9884	126	0.9838	145	0.9792	164	0.9747
108	0.9881	127	0.9835	146	0.9790	165	0.9744
109	0.9879	128	0.9833	147	0.9787	166	0.9742
110	0.9876	129	0.9830	148	0.9785	167	0.9739
111	0.9874	130	0.9828	149	0.9782	168	0.9737
112	0.9872	131	0.9826	150	0.9780	169	0.9735
113	0.9869	132	0.9823	151	0.9778	170	0.9732
114	0.9867	133	0.9821	152	0.9775	171	0.9730
115	0.9864	134	0.9818	153	0.9773	172	0.9728
116	0.9862	135	0.9816	154	0.9770	173	0.9725
117	0.9860	136	0.9814	155	0.9768	174	0.9723
118	0.9857	137	0.9811	156	0.9766	175	0.9721
119	0.9855	138	0.9809	157	0.9763	176	0.9718
120	0.9852	139	0.9806	158	0.9761	177	0.9716
121	0.9850	140	0.9804	159	0.9758	178	0.9713
122	0.9847	141	0.9802	160	0.9756	179	0.9711

902.01.01 Asphalt Binder
THE SECOND PARAGRAPH AS IT APPEARS IN THE SI IS CHANGED TO:

When specified, use PG 64E-22 asphalt binder that is a storage-stable and conforms to AASHTO M 332 including compliance with the elastic response requirement in Appendix X1.1.

902.01.02 Cutback Asphalts
THE ENTIRE SUBPART IS DELETED.

902.01.03 Emulsified Asphalts
THE ENTIRE TEXT IS CHANGED TO:

Use undiluted anionic emulsified asphalts of the rapid-setting (RS) and medium-setting (MS) types conforming to AASHTO M 140. Use undiluted cationic emulsified asphalts of the rapid-setting (CRS), quick-setting (CQS), and medium-setting (CMS) types conforming to AASHTO M 208.

For prime coats, use an anionic emulsified asphalt of the slow-setting (SS) type conforming to AASHTO M140 or cationic emulsified asphalt of the slow-setting (CSS) type confirming to AASHTO M 208.

The emulsified asphalt producer shall provide the emulsified asphalt quality control plan annually to the ME for approval. Ensure that the quality control plan conforms to AASHTO R77.

Submit to the ME a certification of compliance, as specified in 106.07, for the emulsified asphalt. The ME will perform quality assurance sampling and testing of each emulsified asphalt lot as defined in the approved quality control plan.

902.01.04 Polymer Modified Tack Coat
THE TITLE AND ENTIRE TEXT IS CHANGED TO:

902.01.04 Polymer Modified Emulsified Asphalt

Use undiluted polymer modified emulsified asphalt of the rapid-setting (RS), cationic rapid-setting (CRS), medium-setting (MS), and cationic quick-setting (CQS) types conforming to AASHTO M 316. The polymer modified emulsified asphalt producer shall provide the polymer modified emulsified asphalt quality control plan annually to the ME for approval. Ensure that the quality control plan conforms to AASHTO R77.

Submit to the ME a certification of compliance, as specified in 106.07, for the polymer modified emulsified asphalt. The ME will perform quality assurance sampling and testing of each polymer modified emulsified asphalt lot as defined in the approved quality control plan.

902.02.04 Sampling and Testing

B. Sampling.
THE ENTIRE TEXT AS IT APPEARS IN THE SI IS CHANGED TO:

> The ME will take a random sample from each 700 tons of production for volumetric acceptance testing and to verify composition. The ME will perform sampling according to AASHTO T 168, NJDOT B-2, or ASTM D 3665. During production at the plant, a sample of asphalt binder will be taken once every 3500 tons or as directed by the ME.

902.03.03 Sampling and Testing
THE THIRD PARAGRAPH IS CHANGED TO:

If the composition testing results are outside of the production control tolerances specified in Table 902.03.03-2 for an acceptance sample, immediately run a quality control sample. If the quality control sample is also outside of the control tolerances in Table 902.03.03-2, determine if a plant adjustment is needed and take corrective action to bring the mix into compliance. Take additional quality control samples after the corrective action to ensure that the mix is within the production control tolerances. If 2 consecutive acceptance samples are outside the tolerances specified in Table 902.03.03-2, immediately stop production. Obtain ME approval of a plant correction plan before resuming production. Upon restarting production, do not transport mixture to the Project Limits before the results of a QC sample from the mixture indicate that the mixture meets JMF tolerances. The ME will reject mixture produced at initial restarting that does not meet tolerances.

THE FOURTH PARAGRAPH AS IT APPEARS IN THE SI IS CHANGED TO:

The ME will perform sampling according to NJDOT B-2 or ASTM D 3665, and will perform testing for composition according to AASHTO T 308 or NJDOT B-5. Perform testing for air voids according to AASHTO T 209 and either NJDOT B-6 or AASHTO T 331. Perform testing for draindown according to NJDOT B-7 or NJDOT B-8. During production at the plant, a sample of asphalt binder will be taken once every 3500 tons or as directed by the ME.

TABLE 902.03.03-2 IS CHANGED TO:

Table 902.03.03-2 Production Control Tolerances for OGFC and MOGFC Mixtures

Sieve Sizes	Production Control Tolerances from JMF[1]
1/2"	±3.0
3/8"	±4.0
No. 4	±3.0
No. 8	±1.0
No. 200	±1.0
Asphalt Binder Content, % (AASHTO T 308)[2]	±0.40
Asphalt Binder Content, % (NJDOT B-5)[2]	±0.15
Minimum % Air Voids	1.0% less than design requirement

1. Production tolerances may not fall outside of the wide band gradation limits in Table 902.03.03-1.
2. The asphalt binder content may not be lower than the minimum after the production tolerance is applied.

902.04 ULTRA-THIN HMA

THE ENTIRE SUBSECTION IS CHANGED TO:

902.04.01 Composition of Mixture

Mix ultra-thin HMA in a plant listed on the QPL conforming to the requirements for HMA plants specified in 1009.01.

Use ultra-thin HMA that consists of coarse aggregate, fine aggregate, and polymer modified asphalt binder and that may contain mineral filler or a WMA additive. Do not add RAP, CRCG, GBSM, or RPCSA. Combine the material in such proportions that the total aggregate and asphalt binder conform to the composition percentages specified in Table 902.04.02-1.

To produce the ultra-thin HMA, use aggregates and asphalt binder that conforms to the following:

1. For asphalt binder, use PG 64E-22 conforming to the requirements of 902.01.01.
2. If used, ensure that WMA additives or processes conform to 902.01.05. If a WMA additive is pre-blended in the asphalt binder, ensure that the asphalt binder meets the requirements of the specified grade after the addition of the WMA additive. If a WMA additive is added at the HMA plant, ensure that the addition of the additive will not negatively impact the grade of asphalt binder. Follow the manufacturer's recommendations for percentage of WMA additive needed. For controlled asphalt foaming system WMA, the Department may require an anti-stripping additive.
3. For fine aggregate, use 100 percent stone sand conforming to 901.05.02. Ensure that the gradation conforms to Table 902.04.01-1 and that the sand equivalent is more than 45 percent when tested according to AASHTO T 176.

Table 902.04.01-1 Fine Aggregate Gradation

Sieve Size	Total % Passing By Mass
3/8″	100
No. 4	95-100
No. 8	70-90
No. 16	50-70
No. 30	45-55
No. 50	25-40

No. 100	15-28
No. 200	10.0-17.0

4. Use coarse aggregate that conforms to 901.05.01 and Table 902.04.01-2. Permissible geologic classifications for coarse aggregate are, gneiss, granite, quartzite, or trap rock. Ensure that the gradation conforms to Table 902.04.01-3.

Table 902.04.01-2 Coarse Aggregate Properties

Tests	Test Method	Minimum Percent	Maximum Percent
Percentage of wear, Los Angeles Abrasion Test	AASHTO T 96		25
Flakiness Index	NJDOT A-8		20
Clay Lumps and Friable Particles	ASTM C 142		2
Asphalt Affinity[1]	ASTM D 3625	95	

1. Anti-stripping agents may be required to provide resistance to stripping.

Table 902.04.01-3 Coarse Aggregate Gradation

Sieve Size	Total % Passing By Mass
1/2″	100
3/8″	85-100
1/4″	0-15
No. 4	0-5
No. 200	0.0-3.0

5. Use mineral filler, if necessary, that conforms to 901.05.03.

902.04.02 Mix Design

Design the ultra-thin HMA as specified in NJDOT Test Method B-13 and ensure the JMF meets the requirements in Table 902.04.02-1.

Size, uniformly grade, and combine aggregate fractions in proportions so that the grading of total aggregate and asphalt binder in the JMF conform to the composition by mass percentages specified in Table 902.04.02-1.

Table 902.04.02-1 JMF Requirements for Ultra-Thin Friction Course

Sieve Size	Percent Passing[1]	Production Control Tolerances[2]
1/2″	100	0.0
3/8″	85-100	±3.0
1/4″	30-50	±4.0
No. 4	24-40	±3.0
No. 8	21-32	±3.0
No. 16	16-26	±3.0
No. 30	12-20	±2.0
No. 50	8-16	±2.0
No. 100	5-10	±1.0
No. 200	4.0-7.0	±1.0
Asphalt Binder Content (Ignition Oven)[3]	4.9 - 6.0	±0.30

1. Aggregate percent passing to be determined based on dry aggregate weight.
2. Production tolerances are for the approved JMF and may not fall outside of the wide band gradation limits.
3. The asphalt binder content may not be lower than the minimum after the production tolerance is applied.

Design the ultra-thin HMA to meet the requirements in Table 902.04.02-2.

Table 902.04.02-2 UTFC Mix Properties			
Tests	**Test Method**	**Minimum**	**Maximum**
Draindown	AASHTO T 305		0.3 %
Film Thickness	NJDOT B-13	10 micron	
Cantabro Loss	NJDOT B-8		30 %
Air Voids (@ 75 gyrations)	NJDOT B-13		8.0 %

When tested for moisture sensitivity according to AASHTO T 283, ensure that the ultra-thin HMA has a tensile strength ratio of at least 80 percent. Prepare specimens according to AASHTO T 312, and test according to AASHTO T 283 except for the following:

1. Before compaction, condition the mixture for 2 hours according to AASHTO R 30, Section 7.1.
2. Compact specimens with 75 gyrations.
3. Extrude specimens as soon as possible without damaging.
4. Use NJDOT Test Method B-13 to determine void content.
5. Record the void content of the specimens.
6. If less than 55 percent saturation is achieved, repeat the procedure, unless the difference in tensile strength between duplicate specimens is greater than 25 pounds per square inch.
7. If visual stripping is detected, modify or readjust the mix.

At least 30 days before the initial production date, submit the mix design to the ME for approval on forms supplied by the Department, including JMF for the ultra-thin HMA. Include a statement naming the source of each component and a report with the results for the criteria specified in Tables 902.04.01-1, 902.04.01-2 and 902.04.02-1.

If the source of any component material changes, submit a new JMF and obtain ME approval before using the new material. When unsatisfactory results or other conditions make it necessary, the ME may require a new JMF.

During the construction of the test strip, take samples to confirm that the plant mixed material meets the requirements of the mix design. The ME will not grant final approval of the mix design until a successful verification of the plant produced mix and construction test strip.

902.04.03 Sampling and Testing

Ensure that the mix meets the requirements as specified in 902.02.04.A, otherwise the RE or ME will reject the material. Maintain the temperature of the mix between 300 °F and 330 °F. Perform and meet requirements for quality control testing as specified in 902.02.04.C.

Ensure that a technical representative from the lab which designed the mix is present during the first night of production to make adjustments as needed for mix compliance. During production, the ME will take one random acceptance sample from each 700 tons of production to verify composition. Conduct draindown tests as directed by the ME.

If the composition testing results are outside of the production control tolerances specified in Table 902.04.02-1 for an acceptance sample, immediately run a quality control sample. If the quality control sample is also outside of the control tolerances in Table 902.04.02-1, determine if a plant adjustment is needed and take corrective action to bring the mix into compliance. Take additional quality control samples after the corrective action to ensure that the mix is within the production control tolerances. If 2 consecutive acceptance samples are outside the tolerances specified in Table 902.04.02-1, immediately stop production. Obtain ME approval of a plant correction plan before resuming production. Upon restarting production, do not transport mixture to the Project Limits before the results of a QC sample from the mixture indicate that the mixture meets JMF tolerances. The ME will reject mixture produced at initial restarting that does not meet tolerances.

The ME will perform sampling according to NJDOT B-2 or ASTM D 3665, and will perform testing for composition according to AASHTO T 308. Perform testing for draindown according to AASHTO T 305 for every 3500 tons or as directed by the RE. The ME may require testing and calculations of film thickness according to NJDOT B-13. The ME may require adjustment or re-design of the UTFC for failure of draindown or film thickness based on the requirements in Table 902.04.02-2. During production at the plant, the ME will take a sample of the asphalt binder once every 3500 tons or as directed by the ME.

902.05.02 Mix Design

THE ENTIRE TEXT AS IT APPEARS IN THE SI IS CHANGED TO:

Design the SMA to meet the requirements in Table 902.05.02-1 and Table 902.05.02-2. Prepare the JMF according to AASHTO R 46. Determine the JMF at 4 percent air voids and 75 gyrations of the Superpave gyratory compactor.

Table 902.05.02-1 SMA Specification Band (% passing) nominal-maximum aggregate size

Production Control Tolerances from JMF[1]	Sieve Size	19 mm % Passing	12.5 mm % Passing	9.5 mm % Passing
0%	1"	100	100	100
±2%	3/4"	90-100	100	100
±5%	1/2"	50-88	90-100	100
±5%	3/8"	25-60	50-80	70-95
±3%	No. 4	20-28	20-35	30-50
±2%	No. 8	16-24	16-24	20-30
±4%	No. 16	–	–	0-21
±3%	No. 30	–	–	0-18
±3%	No. 50	–	–	0-15
±2%	No. 200	8.0-11.0	8.0-11.0	8.0-12.0
	Coarse Aggregate Fraction	Portion Retained on No. 4 Sieve	Portion retained on No. 4 Sieve	Portion retained on No. 8 Sieve
	Minimum Lift Thickness	2 inches	1 1/2 inch	1 inch

1. Production tolerances may fall outside of the wide band gradation limits.

Table 902.05.02-2 SMA Mixtures Volumetrics For Design and Plant Production

Property	Production Control Tolerances	Requirement
Air Voids	±1%	3.5%
Voids in Mineral Aggregate (VMA)	–	17.0% minimum
VCA_{mix}	–	Less than VCA_{dry}
Draindown @ production temperature	–	0.30% maximum
Asphalt Binder Content (AASHTO T 308)[1]	±0.40%	6% minimum
Tensile Strength Ratio (AASHTO T 283)	–	80% minimum

1. Asphalt binder content may not be lower than the minimum after the production tolerance is applied.

902.05.03 Sampling and Testing

THE ENTIRE TEXT AS IT APPEARS IN THE SI IS CHANGED TO:

Perform quality control testing as specified in 902.02.04.C. Ensure that the mix meets the requirements as specified in 902.02.04.A, otherwise the RE or ME will reject the material.

During production at the plant, the ME will take a sample from each 700 tons of production to verify composition and air voids. Conduct draindown, VCAmix, VCAdry, and VMA testing as directed by the ME. Perform tests according to AASHTO R 46.

If the testing results are outside of the production control tolerances specified in Table 902.05.02-1 and Table 902.05.02-2 for an acceptance sample, immediately run a quality control sample. If the quality control sample is also outside of the control tolerances in Table 902.05.02-1, determine if a plant adjustment is needed and take corrective action to bring the mix into compliance. Take additional quality control samples after completing the corrective action to ensure that the mix is within tolerances. If 2 consecutive acceptance samples are outside the tolerances specified in Table 902.05.02-1 and Table 902.05.02-2, immediately stop production. Obtain ME approval of a plant correction plan before resuming production. Upon restarting production, do not transport mixture to the Project Limits before the results of a QC sample

from the mixture indicate that the mixture meets JMF tolerances. The ME will reject mixture produced at initial restarting that does not meet tolerances.

The ME will perform sampling according to NJDOT B-2 or ASTM D 3665, and will perform testing for composition according to AASHTO T 308. The ME will determine bulk specific gravity of the compacted sample according to AASHTO T 166 or AASHTO T 331. The ME will use the most current QC maximum specific gravity test result, obtained according to AASHTO T 209, in calculating the volumetric properties of the SMA. Perform testing for draindown according to AASHTO T 305. During production at the plant, a sample of asphalt binder will be taken once every 3500 tons or as directed by the ME.

902.06.01 Composition
THE ENTIRE TEXT AS IT APPEARS IN THE SI IS CHANGED TO:

Mix ASDC in a plant that is listed on the QPL and conforms to the requirements specified in 1009.01.

The mixture shall consist of asphalt binder and aggregate and may contain a WMA additive. Use asphalt binder that is PG 64-22 as specified in 902.01.01. Use aggregate that conforms to 901.05.01 or 901.05.02 and the gradation requirements specified in Table 902.06.01-1.

If used, ensure that WMA additives or processes conform to 902.01.05. If a WMA additive is pre-blended in the asphalt binder, ensure that the asphalt binder meets the requirements of the specified grade after the addition of the WMA additive. If a WMA additive is added at the HMA plant, ensure that the addition of the additive will not negatively impact the grade of asphalt binder. Follow the manufacturer's recommendations for percentage of WMA additive needed. For controlled asphalt foaming system WMA, the Department may require an anti-stripping additive.

Table 902.06.01-1 Gradation Requirements and Tolerances for ASDC

Production Tolerance (Variation From JMF)	Sieve Size	JMF (Percent Passing)
	1"	100
±1.0	3/4"	95 - 100
±3.0	1/2"	85 - 100
±6.0	3/8"	60 - 90
±2.0	No. 4	15 - 25
±2.0	No. 8	2 - 10
±1.0	No. 200	2 - 5

Design the mixture to have an asphalt binder content of 3 ± 1/2 percent by weight of dry aggregate.

902.06.03 Sampling and Testing
THE THIRD AND FOURTH PARAGRAPH AS IT APPEARS IN THE SI IS CHANGED TO:

If the composition testing results are outside of the production control tolerances specified in Table 902.06.01-1 for an acceptance sample, immediately run a quality control sample. If the quality control sample is also outside of the control tolerances specified in Table 902.06.01-1, determine if a plant adjustment is needed and take corrective action to bring the mix into compliance. Take additional quality control samples after the corrective action to ensure that the mix is within tolerances. If 2 consecutive acceptance samples are outside the tolerances specified in Table 902.06.01-1, immediately stop production. Obtain ME approval of a plant correction plan before resuming production. Upon restarting production, do not transport mixture to the Project before the results of a QC sample from the mixture indicate that the mixture meets JMF tolerances. The ME will reject mixture produced at initial restarting that does not meet tolerances.

The ME will perform sampling according to NJDOT B-2 or ASTM D-3665 and will perform testing for composition according to AASHTO T 308. If directed by the ME, perform testing for draindown according to AASHTO T 305. During production at the plant, a sample of asphalt binder will be taken once every 3500 tons or as directed by the ME.

902.07.04 Sampling and Testing

C. Acceptance Testing.
THE ENTIRE TEXT AS IT APPEARS IN THE SI IS CHANGED TO:

During production, the ME will take one random acceptance sample from each 700 tons of production to verify composition. The ME will perform sampling according to NJDOT B-2 or ASTM D 3665, and will perform testing for composition according to AASHTO T 308. Perform testing for air voids according to T 209 and either B-6 or T 331. Perform testing for draindown according to NJDOT B-8. During production at the plant, a sample of asphalt binder will be taken once every 3500 tons or as directed by the ME.

Conduct air voids and draindown tests as directed by the ME.

If the composition testing results are outside of the production control tolerances specified in Table 902.07.04-1 for an acceptance sample, immediately run a quality control sample. If the quality control sample is also outside of the control tolerances in Table 902.07.04-1, determine if a plant adjustment is needed and take corrective action to bring the mix into compliance. Take additional quality control samples after the corrective action to ensure that the mix is within the production control tolerances. If two consecutive acceptance samples are outside the tolerances specified in Table 902.07.04-1, immediately stop production. Obtain ME approval of a plant correction plan before resuming production. Upon restarting production, do not transport mixture to the Project Limits before the results of a QC sample from the mixture indicate that the mixture meets JMF tolerances. The ME will reject mixture produced at initial restarting that does not meet tolerances.

Table 902.07.04-1 Production Control Tolerances for AR-OGFC Mixtures

Sieve Sizes	Production Control Tolerances from JMF[1]
1/2"	±6.0
3/8"	±2.0
No. 4	±4.0
No. 8	±1.0
No. 200	±1.0
Asphalt-rubber binder, % (AASHTO T 308)[2]	±0.40
Minimum % Air Voids	1.0% less than design requirement

1. Production tolerances may fall outside of the wide band gradation limits in Table 902.07.03-1.
2. Asphalt-rubber binder content may not be lower than the minimum in Table 902.07.03-1 after the production tolerance is applied.

902.08.03 Sampling and Testing

B. Sampling.

THE ENTIRE TEXT AS IT APPEARS IN THE SI IS CHANGED TO:

The ME will take a sample of HPTO for volumetric acceptance testing from each 700 tons of a mix. The ME will perform sampling according to AASHTO T 168, NJDOT B-2, or ASTM D 3665. During production at the plant, a sample of asphalt binder will be taken once every 3500 tons or as directed by the ME.

902.09.03 Sampling and Testing

TABLE 902.09.03-1 AS IT APPEARS IN THE SI IS CHANGED TO:

Table 902.09.03-1 Gradation Requirements for Aggregate and Mineral Filler

Sieve Size	Type II Percent Passing	Type III Percent Passing	Stockpile Tolerances from JMF
3/8″	100	100	-
No. 4	90-100	70-90	±4%
No. 8	65-90	45-70	±5%
No. 16	45-70	28-50	±4%
No. 30	30-50	19-34	±3%
No. 50	18-30	12-25	±3%
No. 100	10-21	7-18	±2%
No. 200	5-15	5-15	±2%

902.10.03 Sampling and Testing

TABLE 902.10.03-1 AS IT APPEARS IN THE SI IS CHANGED TO:

Table 902.10.03-1 Gradation Requirements for Aggregate and Mineral Filler				
Sieve Size	**Type I Percent Passing**	**Type II Percent Passing**	**Type III Percent Passing**	**Stockpile Tolerances from JMF**
3/8″	100	100	100	-
No. 4	100	90-100	70-90	±5%
No. 8	90-100	65-90	45-70	±5%
No. 16	65-90	45-70	28-50	±5%
No. 30	40-65	30-50	19-34	±5%
No. 50	25-42	18-30	12-25	±3%
No. 100	15-30	10-21	7-18	±3%
No. 200	10-20	5-15	5-15	±2%

902.11.03 Sampling and Testing

B. Sampling.

THE ENTIRE TEXT AS IT APPEARS IN THE SI IS CHANGED TO:

> The ME will take a sample of BRIC for volumetric acceptance testing from each 700 tons. The ME will perform sampling according to AASHTO T 168, NJDOT B-2, or ASTM D 3665. During production at the plant, a sample of asphalt binder will be taken once every 3500 tons or as directed by the ME.

THE FOLLOWING SUBSECTIONS ARE ADDED:

902.12 ASPHALT RUBBER GAP GRADED COURSE

902.12.01 Composition of Mixture

Mix ARGG course in a plant listed on the QPL and conforming to the requirements for HMA plants specified in 1009.01. Ensure the HMA plant is equipped with asphalt-rubber binder blending equipment as specified in 1009.03.

Composition of mixture for ARGG surface course is coarse aggregate, fine aggregate and asphalt-rubber binder. Do not use RAP, CRCG, GBSM, or RPCSA in ARGG surface course.

Composition of mixture for ARGG intermediate course is coarse aggregate, fine aggregate and asphalt-rubber binder. ARGG intermediate course may contain up to 10 percent RAP.

Use aggregates that conform to 901.05. Use coarse aggregate that is crushed stone conforming to 901.05.01 and Table 902.12.01-1.

Table 902.12.01-1 Coarse Aggregate Properties for ARGG		
Tests	**Test Method**	**Maximum Percent**
Percentage of wear, Los Angeles Abrasion Test	AASHTO T 96	30
Flat and Elongated, 5 to 1 (Material Retained on the No. 4 Sieve)	ASTM D 4791	5
Flat and Elongated, 3 to 1 (Material Retained on the No. 4 Sieve)	ASTM D 4791	20

Use fine aggregate that is manufactured stone sand and conforms to Table 902.02.02-2.

Use asphalt-rubber binder that conforms to 902.07.02.

902.12.02 Mix Design

At least 45 days before initial production, submit job mix formula(s) for each ARGG mixture performed by an AASHTO accredited lab with at least five successfully completed ARGG course projects greater than 5,000 tons each. Include a statement naming the source of each component and a report with the results for the criteria specified in Table 902.12.02-1 and 902.12.02-2. Include a report detailing the rotational viscosity of the asphalt-rubber binder at 60, 90, 135, 240, and 1440 minutes. Submit lab qualifications and references to the ME for approval prior to beginning work.

Design the mix to meet the criteria in Table 902.12.02-1 and Table 902.12.02-2. Prepare the JMF according to AASHTO R 46. Determine the JMF at 4 percent air voids and 75 gyrations of the Superpave gyratory compactor.

Table 902.12.02-1 JMF Master Ranges and Mixture Requirements ARGG Course		
Mixture Designations (% Passing[1])		
Sieve Sizes	**ARGG Course**	**Production Control Tolerances[2]**
3/4"	100	±0%
1/2"	90-100	±2%
3/8"	83-87	±1%
No. 4	28-42	±3%
No. 8	14-22	±2%
No. 200	0-6	±2%
Coarse Aggregate Fraction	Portion retained on No. 4 Sieve	
Minimum Lift Thickness	1.5 inch	

1. Aggregate percent passing to be determined based on dry aggregate weight.
2. Production tolerances are for the approved JMF and may fall outside of the wide band gradation limits.

Table 902.12.02-2 ARGG Course Mixtures Volumetrics For Design and Plant Production		
Property	**Production Control Tolerances**	**Design Requirement**
Air Voids	±1%	4%
Voids in Mineral Aggregate (VMA)	–	18.0% minimum
Voids in Coarse Aggregate of Mix(VCA_{mix})	–	Less than VCA_{dry}
Draindown @ production temperature	–	0.30% maximum
Asphalt Binder Content (Ignition Oven)[1, 2]	±0.40%	7.6% minimum
Tensile Strength Ratio	–	80% minimum

1. Asphalt-rubber binder content to be determined based on total weight of mix.
2. The asphalt binder content may not be lower than the minimum after the production tolerance is applied.

902.12.03 Sampling and Testing

Perform quality control testing as specified in 902.02.04.C. Ensure that the mix meets the requirements as specified in 902.02.04.A, otherwise the RE or ME will reject the material. Ensure that the temperature of the mixture at discharge from the plant or surge and storage bins meets the WMA additive manufacturer's recommendations. Do not allow the mixture temperature to exceed 300 °F at discharge from the plant.

During production at the plant, the ME will take a sample from each 700 tons of production to verify composition and air voids. Conduct draindown, VCA_{mix}, VCA_{dry}, and VMA testing every 3500 Tons or as directed by the ME. Perform tests according to AASHTO R 46.

If the testing results are outside of the production control tolerances specified in Table 902.12.02-1 and Table 902.12.02-2 for an acceptance sample, immediately run a quality control sample. If the quality control sample is also outside of the control tolerances in Table 902.12.02-1, determine if a plant adjustment is needed and take corrective action to bring the mix into compliance. Take additional quality control samples after completing the corrective action to ensure that the mix is within tolerances. If 2 consecutive acceptance samples are outside the tolerances specified in Table 902.12.02-1 and Table 902.12.02-2, immediately stop production. Obtain ME approval of a plant correction plan before resuming production. Upon restarting production, do not transport mixture to the Project Limits before the results of a QC sample from the mixture indicate that the mixture meets JMF tolerances. The ME will reject mixture produced at initial restarting that does not meet tolerances.

The ME will perform sampling according to NJDOT B-2 or ASTM D 3665, and will perform testing for composition according to AASHTO T 308, or NJDOT B-5. The ME will determine bulk specific gravity of the compacted sample according to AASHTO T 166. The ME will use the most current QC maximum specific gravity test result, obtained according to AASHTO T 209, in calculating the volumetric properties of the ARGG. Perform testing for draindown according to AASHTO T 305. During production at the plant, the ME will take a sample of the asphalt binder once every 3500 tons or as directed by the ME.

902.13 HOT MIX ASPHALT HIGH RAP

902.13.01 Mix Designations

The requirements for specific HMA mixtures with required minimum amounts of RAP are identified by the abbreviated fields in the Item description as defined as follows:

HOT MIX ASPHALT 12.5ME SURFACE COURSE HIGH RAP

1. **"HOT MIX ASPHALT"** "Hot Mix Asphalt" is located in the first field in the Item description for the purpose of identifying the mixture requirements.
2. **"12.5"** The second field in the Item description designates the nominal maximum size aggregate (in millimeters) for the job mix formula (sizes are 4.75, 9.5, 12.5, 19, 25, and 37.5 mm).
3. **"M"** The third field in the Item description designates the design compaction level for the job mix formula based on traffic forecasts as listed in Table 902.02.03-2 (levels are L=low and M=medium).
4. **"E"** The fourth field in the Item description designates the high temperature designation of the performance-graded binder. Options are "64" for PG 64-22 and "E" for PG 64E-22.
5. **"SURFACE COURSE"** The last field in the Item description designates the intended use and location within the pavement structure (options are surface, intermediate, or base course).
6. **"HIGH RAP"** This additional field designates that there will be a minimum percentage of RAP required for the mixture in 902.13.02.

902.13.02 Composition of Mixture

Provide materials as specified:

Aggregates for Hot Mix Asphalt 901.05

Use a virgin asphalt binder that will result in a mix that meets the performance requirements specified in Table 902.13.03-2. Ensure that the virgin asphalt binder meets the requirements of 902.01.01 except the performance grade. Use a performance grade of asphalt binder as determined by the mix design and mix performance testing. Submit a certificate of analysis (COA) showing the PG continuous grading (AASHTO R 29) for the asphalt binder used in the mix design.

For quality assurance testing of the asphalt binder, the ME may sample the asphalt binder during production of the mix and compare the results with the COA submitted during test strip approval. To analyze the binder the ME will test the binder at the nearest standard PG temperature then compare the results with the COA. If the high ($G^*/\sin\delta$) and low (stiffness and m value) temperature passing test results are within 5 percent of the results from the passing temperature on the COA, then the ME will consider the asphalt binder comparable to the binder used during the test strip.

Mix HMA HIGH RAP in a plant that is listed on the QPL for HMA Plants and conforms to the requirements for HMA Plants as specified in 1009.01.

Composition of the mixture for HMA HIGH RAP surface course is coarse aggregate, fine aggregate, asphalt binder, and a minimum of 20 percent Reclaimed Asphalt Pavement (RAP), and may also include mineral filler, asphalt rejuvenator and Warm Mix Asphalt (WMA) additives or processes as specified in 902.01.05. When WMA is used it must meet the requirements as specified in 902.10. Ensure that the finished mix does not contain more than a total of 1 percent by weight contamination from Crushed Recycled Container Glass (CRCG).

The composition of the mixture for HMA HIGH RAP base or intermediate course is coarse aggregate, fine aggregate, asphalt binder, and a minimum of 30 percent Reclaimed Asphalt Pavement (RAP), and may also include mineral filler, up to 10 percent of additional recycled materials, asphalt rejuvenator, and Warm Mix Asphalt (WMA) additives or processes as specified in 902.01.05. When WMA is used it must meet the requirements as specified in 902.10. The recycled materials may consist of a combination of RAP, CRCG, Ground Bituminous Shingle Material (GBSM), and RPCSA, with the following individual limits:

Table 902.13.02-1 Use of Recycled Materials in Base or Intermediate Course

Recycled Material	Minimum Percentage	Maximum Percentage
RAP	30	

CRCG	10
GBSM	5
RPCSA	20

Combine the aggregates to ensure that the resulting mixture meets the grading requirements specified in Table 902.02.03-1. In determining the percentage of aggregates of the various sizes necessary to meet gradation requirements, exclude the asphalt binder.

Ensure that the combined coarse aggregate, when tested according to ASTM D 4791, has less than 10 percent flat and elongated pieces retained on the No. 4 sieve and larger. Measure aggregate using the ratio of 5:1, comparing the length (longest dimension) to the thickness (smallest dimension) of the aggregate particles.

Ensure that the combined fine aggregate in the mixture conforms to the requirements specified in Table 902.02.02-2. Ensure that the material passing the No. 40 sieve is non-plastic when tested according to AASHTO T 90.

902.13.03 Mix Design

At least 45 days before initial production, submit a job mix formula for the HMA HIGH RAP on forms supplied by the Department, to include a statement naming the source of each component and a report showing that the results meet the criteria specified in Tables 902.02.03-1 and 902.13.03-1.

Include in the mix design the following based on the weight of the total mixture:

1. Percentage of RAP or GBSM.
2. Percentage of asphalt binder in the RAP or GBSM.
3. Percentage of new asphalt binder.
4. Total percentage of asphalt binder.
5. Percentage of each type of virgin aggregate.

Table 902.13.03-1 HMA HIGH RAP Requirements for Design

Compaction Levels	Required Density (% of Theoretical Max. Specific Gravity)		Voids in Mineral Aggregate (VMA)[2], % (minimum)					Voids Filled With Asphalt (VFA) %	Dust-to-Binder Ratio
			Nominal Max. Aggregate Size, mm						
	@N_{des}[1]	@N_{max}	25.0	19.0	12.5	9.5	4.75		
L	96.0	≤ 98.0	13.0	14.0	15.0	16.0	17.0	70 - 85	0.6 - 1.2
M	96.0	≤ 98.0	13.0	14.0	15.0	16.0	17.0	65 - 85	0.6 - 1.2

1. As determined from the values for the maximum specific gravity of the mix and the bulk specific gravity of the compacted mixture. Maximum specific gravity of the mix is determined according to AASHTO T 209. Bulk specific gravity of the compacted mixture is determined according to AASHTO T 166. For verification, specimens must be between 95.0 and 97.0 percent of maximum specific gravity at N_{des}.
2. For calculation of VMA, use bulk specific gravity of the combined aggregate include aggregate extracted from the RAP.

The job mix formula for the HMA HIGH RAP mixture establishes the percentage of dry weight of aggregate, including the aggregate from the RAP, passing each required sieve size and an optimum percentage of asphalt binder based upon the weight of the total mix. Determine the optimum percentage of asphalt binder according to AASHTO R 35 and M 323 with an N_{des} as required in Table 902.02.03-2. Before maximum specific gravity testing or compaction of specimens, condition the mix for 2 hours according to the requirements for conditioning for volumetric mix design in AASHTO R 30, Section 7.1. If the absorption of the combined aggregate is more than 1.5 percent according to AASHTO T 84 and T 85, ensure that the mix is short term conditioned for 4 hours according to AASHTO R 30, Section 7.2 prior to compaction of specimens (AASHTO T 312) and determination of maximum specific gravity (AASHTO T 209). Ensure that the job mix formula is within the master range specified in Table 902.02.03-1.

Ensure that the job mix formula provides a mixture that meets a minimum tensile strength ratio (TSR) of 80 percent when prepared according to AASHTO T 312 and tested according to AASHTO T 283. Submit the TSR results with the mix design.

Determine the correction factor of the mix including the RAP by using extracted aggregate from the RAP in the proposed proportions when testing is done to determine the correction factor as specified in AASHTO T 308. Use extracted aggregate from the RAP in determining the bulk specific gravity of the aggregate blend for the mix design.

For each mix design, submit with the mix design forms 3 gyratory specimens and 1 loose sample corresponding to the composition of the JMF. Ensure that the samples include the percentage of RAP that is being proposed for the mix. The ME will use these to verify the properties of the JMF. Compact the specimens to the design number of gyrations (N_{des}). For the mix design to be acceptable, all gyratory specimens must comply with the requirements specified in Tables 902.02.03-1 and 902.13.03-1. The ME reserves the right to be present at the time the gyratory specimens are molded.

In addition, submit 11 gyratory specimens and two 5 gallon buckets of loose mix to the ME. The ME will use these additional gyratory samples for performance testing of the HMA HIGH RAP mix. The ME reserves the right to be present at the time of molding the gyratory specimens. Ensure that the additional gyratory specimens are compacted according to AASHTO T 312. Compact 6 of the specimens to 77 millimeter height, and have an air void content of 6.5 ± 0.5 percent. The ME will test 6 specimens using an Asphalt Pavement Analyzer (APA) according to AASHTO T 340 at 64 ºC, 100 pound per square inch hose pressure, and 100 pound wheel load. Compact the other 5 specimens to 115 mm height. These 5 specimens will be cut, from the middle of each 115 millimeter height specimen, to 38 millimeter height test specimens. The air void content of the 5 cut specimen will be determined to ensure compliance with the target air void content of 6.5 ± 0.5 percent. The ME will use the five 38 millimeter height specimens to test using an Overlay Tester (NJDOT B-10) at 25 °C and a joint opening of 0.025 inch. The ME will eliminate the high and low Overlay test results then average and report the middle 3 test results. The ME will ensure that all submitted specimens are within the target air void content as tested at the Material's Central Lab.

The ME will approve the JMF if the results meet the criteria in Table 902.13.03-2.

Table 902.13.03-2 Performance Testing Requirements for HMA HIGH RAP Design

Test	Requirement			
	Surface Course		Intermediate and Base Course	
	PG 64-22	PG 64E-22	PG 64-22	PG 64E-22
APA @ 8,000 loading cycles (AASHTO T 340)	≤ 7 mm	≤ 4 mm	≤ 7 mm	≤ 4 mm
Overlay Tester (NJDOT B-10)	≥ 200 cycles	≥ 275 cycles	≥ 100 cycles	≥ 150 cycles

If the JMF does not meet the APA and Overlay Tester criteria, redesign the HMA HIGH RAP mix and submit for retesting. The JMF for the HMA HIGH RAP mixture is in effect until modification is approved by the ME.

When unsatisfactory results for any specified characteristic of the work make it necessary, the Contractor may establish a new JMF for approval. In such instances, if corrective action is not taken, the ME may require an appropriate adjustment to the JMF.

Should a change in sources be made or any changes in the properties of materials occur, the ME will require that a new JMF be established and approved before production can continue.

902.13.04 Sampling and Testing

A. General Acceptance Requirements. The RE or ME may reject and require disposal of any batch or shipment that is rendered unfit for its intended use due to contamination, segregation, improper temperature, lumps of cold material, or incomplete coating of the aggregate. For other than improper temperature, visual inspection of the material by the RE or ME is considered sufficient grounds for such rejection.

Ensure that the temperature of the mix at discharge from the plant or storage silo meets the recommendation of the supplier of the asphalt binder, supplier of the asphalt modifier and WMA manufacturer. For HMA, do not allow the mixture temperature to exceed 330 °F at discharge from the plant. For WMA, do not allow the mixture temperature to exceed 300 °F at discharge from the plant.

Combine and mix the aggregates and asphalt binder to ensure that at least 95 percent of the coarse aggregate particles are entirely coated with asphalt binder as determined according to AASHTO T 195. If the ME determines that there is an on-going problem with coating, the ME may obtain random samples from 5 trucks and will determine the adequacy of the mixing on the average of particle counts made on these 5 test portions. If the requirement for 95 percent coating is not met on each sample, modify plant operations, as necessary, to obtain the required degree of coating.

B. Sampling. The ME will take 5 stratified random samples of HMA HIGH RAP for volumetric acceptance testing from each lot of approximately 3500 tons of a mix. When a lot of HMA HIGH RAP is less than 3500 tons, the ME will take samples at random for each mix at the rate of one sample for each 700 tons. The ME will perform sampling according to AASHTO T 168, NJDOT B-2, or ASTM D 3665. During production at the plant, a sample of asphalt binder will be taken once every 3500 tons or as directed by the ME.

Use a portion of the samples taken for volumetric acceptance testing for composition testing.

C. Quality Control Testing. The HMA HIGH RAP producer shall provide a quality control (QC) technician who is certified by the Society of Asphalt Technologists of New Jersey as an Asphalt Technologist, Level 2. The QC technician may substitute equivalent technician certification by the Mid-Atlantic Region Technician Certification Program (MARTCP). Ensure that the QC technician is present during periods of mix production for the sole purpose of quality control testing and to assist the ME. The ME will not perform the quality control testing or other routine test functions in the absence of, or instead of, the QC technician.

The QC technician shall perform sampling and testing according to the approved quality control plan, to keep the mix within the limits specified for the mix being produced. The QC technician may use acceptance test results or perform additional testing as necessary to control the mix.

To determine the composition, perform ignition oven testing according to AASHTO T 308.

For each acceptance test, perform maximum specific gravity testing according to AASHTO T 209 on a test portion of the sample taken by the ME. Sample and test coarse aggregate, fine aggregate, mineral filler, and RAP according to the approved quality control plan for the plant.

Ensure that the supplier has in operation an ongoing daily quality control program to evaluate the RAP. As a minimum, this program shall consist of the following:

1. An evaluation performed to ensure that the material conforms to 901.05.04 and compares favorably with the design submittal.
2. An evaluation of the RAP material performed using a solvent or an ignition oven to qualitatively evaluate the aggregate components to determine conformance to 901.05.
3. Quality control reports as directed by the ME.

D. Acceptance Testing and Requirements. The ME will determine volumetric properties at N_{des} for acceptance from samples taken, compacted, and tested at the HMA plant. The ME will compact HMA HIGH RAP to the number of design gyrations (N_{des}) specified in Table 902.02.03-2, using equipment according to AASHTO T 312. The ME will determine bulk specific gravity of the compacted sample according to AASHTO T 166. The ME will use the most current QC maximum specific gravity test result in calculating the volumetric properties of the HMA HIGH RAP.

The ME will determine the dust-to-binder ratio from the composition results as tested by the QC technician.

Ensure that the HMA HIGH RAP mixture conforms to the requirements specified in Table 902.13.04-1, and to the gradation requirements in Table 902.02.03-1. If 2 samples in a lot fail to conform to the gradation or volumetric requirements, immediately initiate corrective action.

The ME will test a minimum of 1 sample per lot for moisture, basing moisture determinations on the weight loss of an approximately 1600 gram sample of mixture heated for 1 hour in an oven at 280 ± 5 °F. Ensure that the moisture content of the mixture at discharge from the plant does not exceed 1.0 percent.

Table 902.13.04-1 HMA HIGH RAP Requirements for Control

Compaction Levels	Required Density (% of Theoretical Max. Specific Gravity)	Voids in Mineral Aggregate (VMA), % (minimum)					Dust-to-Binder Ratio
		Nominal Max. Aggregate Size, mm					
	@Ndes[1]	25.0	19.0	12.5	9.5	4.75	
L, M	95.0 – 98.5	13.0	14.0	15.0	16.0	17.0	0.6 - 1.3

1. As determined from the values for the maximum specific gravity of the mix and the bulk specific gravity of the compacted mixture. Maximum specific gravity of the mix is determined according to AASHTO T 209. Bulk specific gravity of the compacted mixture is determined according to AASHTO T 166.

E. Performance Testing for HMA HIGH RAP. Provide 11 gyratory specimens that are compacted according to AASHTO T 312 and 2 boxes of loose mix. Compact 6 of the specimens to 77 millimeter height and an air void

content of 6.5 ± 0.5 percent. Compact the other 5 specimens to 115 millimeter height. These 5 specimens will be cut, from the middle of each 115 millimeter height specimen, to 38 millimeter height test specimens. The air void content of the 5 cut test specimens will be determined to ensure compliance with the target air void content of 6.5 ± 0.5 percent.

The ME will use the boxes of loose mix to determine the maximum specific gravity of the mix according to AASHTO T 209. The ME will use the gyratory samples for performance testing of the HMA HIGH RAP mix. The ME will test six 77 millimeter height specimens using an Asphalt Pavement Analyzer (APA) according to AASHTO T 340 at 64 °C, 100 pound per square inch hose pressure, and 100 pound wheel load. The ME will use the five 38 millimeter height specimens to test using an Overlay Tester (NJDOT B-10) at 25 °C and a joint opening of 0.025 inch. The ME will eliminate the high and low Overlay test result then average and report the middle 3 test results. The ME will ensure that all submitted specimens are within the target air void content as tested at the Material's Central Lab.

Ensure that the first sample is taken during the construction of the test strip as specified in 406.03.01.C. Thereafter, sample every lot or as directed by the ME. If the test strip is done within the project limits and the performance testing results are acceptable to the ME, the results will be included into the first lot. A lot is defined as material placed on the traveled way within the project limits.

If a sample does not meet the criteria for performance testing as specified in Table 902.13.03-2, the Department will assess a pay adjustment as specified in Table 902.13.04-2 and 902.13.04-3. If a lot fails to meet requirements for both APA and Overlay Tester, the Department will assess pay adjustments for both parameters or may require removal and replacement of the lot. The Department will calculate the pay adjustment by multiplying the percent pay adjustment (PPA) by the quantity in the lot and the bid price for the HMA HIGH RAP item. If samples received are not within the target air void range, 6.5 ± 0.5 percent, the Department will consider the samples un-testable and asses a PPA of -100 percent for APA specimens and/or Overlay specimens or may require removal and replacement of the lot. PPA for both APA and Overlay are cumulative and may not exceed -100 percent in total. If the Department requires removal and replacement, then the replacement work is subject to the same requirements as the initial work.

Table 902.13.04-2 Surface Course Performance Testing Pay Adjustments for HMA HIGH RAP

	Surface Course		PPA
	PG 64-22	PG 64E-22	
APA @ 8,000 loading cycles, mm (AASHTO T 340)	t ≤ 7	t ≤ 4	0
	7 < t ≤ 10	4 < t ≤ 7	PG 64-22: -50(t-7)/3 PG 64E-22: -50(t-4)/3
	t > 10	t > 7	-100 or Remove & Replace
Overlay Tester, cycles (NJDOT B-10)	t ≥ 200	t ≥ 275	0
	200 > t ≥ 150	275 > t ≥ 200	Surface PG 64-22: -(200-t) Surface PG 64E-22: -(275-t)/1.5
	t ≤ 150	t ≤ 200	-100 or Remove & Replace

Table 902.13.04-3 Intermediate and Base Course Performance Testing Pay Adjustments for HMA HIGH RAP

	Intermediate and Base Course		PPA
	PG 64-22	PG 64E-22	
APA @ 8,000 loading cycles, mm (AASHTO T 340)	t ≤ 7	t ≤ 4	0
	7 < t ≤ 10	4 < t ≤ 7	PG 64-22: -50(t-7)/3 PG 64E-22: -50(t-4)/3
	t > 10	t > 7	-100 or Remove & Replace
Overlay Tester, cycles (NJDOT B-10)	t ≥ 100	t ≥ 150	0
	100 > t ≥ 75	150 > t ≥ 110	Intermediate PG 64-22: -(2t-200) Intermediate PG 64E-22: -1.25(150-t)
	t ≤ 75	t ≤ 110	-100 or Remove & Replace

SECTION 914 – JOINT MATERIALS

914.03 POLYMERIZED JOINT ADHESIVE

TABLE 914.03-1 IS CHANGED TO:

Table 914.03-1 Requirements for Polymerized Joint Adhesive

Property	Test Method	Requirement
Cone Penetration, 25 °C	ASTM D 5329	60-100
Flow, 60 °C	ASTM D 5329	5 mm maximum
Resilience, 25 °C	ASTM D 5329	30% minimum
Ductility, 4 °C	ASTM D 113	30 cm minimum
Tensile Adhesion, 25 °C[1]	ASTM D 5329	500% minimum
Softening Point	ASTM D 36	77 °C minimum
Asphalt Compatibility	ASTM D 5329	Pass

1. A precision estimate for this standard has not been developed, so it should not be used for acceptance or rejection of a material during product approval.

DIVISION 1000 – EQUIPMENT

SECTION 1009 – HMA PLANT EQUIPMENT

1009.01 HMA PLANT

A. Requirements for HMA Mixing Plants

1. Plant Laboratory.

a. General Equipment.

THE PART NUMBER 1 IS CHANGED TO:

1. An office for the exclusive use of the ME with a floor area of at least 100 square feet, excluding the plant lab area.

NJDOT TEST METHODS

THE FOLLOWING TEST METHOD IS ADDED:

NJDOT A-7 – DETERMINING FLAKINESS INDEX

A. Scope. Use this test method to determine the percentage of particles in a coarse aggregate material that have a thickness (smallest dimension) of less than approximately one-half of the nominal size.

Note: For purposes of test method, only NJDOT specified #8 or approximately equivalent NJDOT *8 for use in UTFCand Chip Seal are to be considered for this test method.

B. Apparatus

1. Standard U.S. sieves meeting the requirements of AASHTO M 92, in the following sizes:
   a. 1/2 in. (12.6 mm)
   b. 3/8 in. (9.5 mm)
   c. 1/4 in. (6.3 mm)
2. Metal thickness gauge, made of 12 gauge carbon steel sheet.
3. Scoop, brass wire brush, bristle brush, and other miscellaneous laboratory equipment.
4. Sample splitter, quartering machine, quartering cloth, or shovel and a smooth surface.
5. Forced draft oven, capable of maintaining the temperatures specified in the test procedure.

C. Procedure

1. Obtain a representative sample of processed aggregates in accordance with AASHTO T 248.
2. Place aggregate sample in an oven and dry between 100 – 300 °F (38 – 150 °C) until sufficiently dry for testing.
3. Quarter the aggregate sample of approximately 1,000 grams passing the 1/2 in. (12.6 mm) sieve and retained on the 1/4 in. (6.3 mm) sieve.
4. Sieve the quartered sample through the 1/2 in. (12.6 mm), 3/8 in. (9.5 mm) and 1/4 in. (6.3 mm) sieves. Discard the material retained on the 1/2 in. (12.6 mm) sieve and passing the 1/4 in. (6.3 mm) sieve.
5. Count the aggregate particles obtained in Step 4. The total sample count must be a minimum of 200 particles with at least 100 particles from the portion passing the 1/2 in. (12.6 mm) and retained on the 3/8 in. (9.5 mm) and at least 100 particles from the portion passing the 3/8 in. (9.5 mm) and retained on the 1/4 in. (6.3 mm) sieve.
6. Try to pass each of the particles of the sample through the 1/4 in. (6.3 mm) slot of the thickness gauge. Separate the particles passing through the gauge from those retained on the gauge.
7. Combine all particles retained on the gauge and count. The total is Retained Sample.
8. Combine all particles passing through the slot and count. The total is the Passing Sample.

D. Calculations. Use the following calculations to determine Flakiness Index:

$$\text{Flakiness Index} = \frac{Passing\ Sample\ Particle\ Count}{Retained\ Sample\ Particle\ Count + Passing\ Sample\ Particle\ Count}\ x\ 100$$

Report the Flakiness Index to the nearest whole number.

NJDOT B-10 – OVERLAY TEST FOR DETERMINING CRACK RESISTANCE OF HMA

B. Apparatus.

THE PART 1 AND PART 2 AS IT APPEARS IN THE SI ARE CHANGED TO:

1. Overlay Tester. An electro-hydraulic or electro-pneumatic system that applies repeated direct tension loads to specimens. The machine features two blocks, one is fixed and the other slides horizontally. The device automatically measures and records a time history of load versus displacement every 0.1 sec at a selected test temperature.

   The sliding block applies tension in a cyclic triangular waveform to a constant maximum displacement of 0.06 cm (0.025 in.). This sliding block reaches the maximum displacement and then returns to its initial position in 10 sec. (one cycle).

2. Temperature Control System. The temperature chamber must be capable of controlling the test temperature with a range of 50 to 95 ºF (10 to 35 ºC).

THE FOLLOWING TEST METHOD IS ADDED:

NJDOT B-13 – DESIGN OF ULTRA-THIN FRICTION COURSE (UTFC)

A. Scope. This test method determines the proper proportions by weight of approved aggregates and asphalt, which, when combined, will produce a UTFC mixture that will satisfy the specification requirements.

B. Apparatus. Use the following apparatus:

1. Equipment as needed for Superpave mix design as specified in AASHTO T 312
2. Equipment as needed for AASHTO T 209
3. Ovens capable of maintaining temperatures as specified in this method.
4. L.A. Abrasion Machine conforming to AASHTO T 96.
5. Equipment as needed for AASHTO T 84 and T 85.
6. Equipment as needed for AASHTO T 331.

C. Procedure. Perform the following steps:

1. Selecting Materials:

   a. Select the necessary type and source for each aggregate. Obtain representative samples consisting of a minimum of 23 kg (50 lb.) of each aggregate. Sample the aggregates in accordance with AASHTO T 2.
   b. Obtain an adequate quantity of the asphalt binder and additives (if necessary).
   c. Dry the aggregate to constant weight at a minimum temperature of 38 °C (100 °F)
   d. If the stockpile gradation is unknown, obtain the average washed gradation of each proposed aggregate stockpile in accordance with AASHTO T 11 and T 27. Enter the stockpile gradations on the 'Combined Gradation' worksheet.
   e Check the aggregate gradations for compliance with the applicable specifications. Check the individual aggregate stockpiles for compliance with applicable specifications.
   f. Check asphalt and additives for compliance with the applicable specifications.
   g. If the specific gravity values for aggregate sources are unknown, determine the 24 hr. water absorption, the bulk specific gravity, and the apparent specific gravity of the individual sizes of each aggregate in accordance with AASHTO T 84 and T 85. Enter the results or the known values from previous history on the 'Bulk Gravity' worksheet.
   h. Calculate the bin percentages with the proposed aggregate so that the blended combination will fall within the specified gradation ranges for the specified mixture type.
   Note 1- Consider material availability, mixture strength, handling, compaction, pavement texture, and durability as the primary factors of the combination to be tested.
   i. Determine the sand equivalent value of the combined virgin aggregates in accordance with AASHTO T 176.
   j. Plot the combined gradation and specification limits using the 'Power 45 Curve'. Confirm that the blend meets the specification requirements.

2. Preparing laboratory Mixed Samples:

   a. Separate the materials larger than the # 8 (2.36 mm) sieve into individual sizes for each stockpile for preparation of laboratory mixtures. Separate the material passing the # 8 (2.36 mm) sieve into individual sizes if it is prone to segregation.
   b Select two asphalt contents around the anticipated Optimum Asphalt Content (OAC). Select the asphalt contents within the allowed tolerances in accordance with specifications.
   Note 2- Select the asphalt contents to determine the OAC depending on experience and knowledge of materials used.
   c. Calculate individual aggregates and asphalts weights to produce two laboratory-molded samples and one Gmm sample for each asphalt content selected.

d. Prepare the asphalt mixtures in accordance with AASHTO T 312. Determine the mixing and compaction temperatures in accordance with manufacturer's recommendations. Oven-cure the mixture for Gmm for 2 hr. at the selected compaction temperature.
e. Determine the Gmm of the two mixtures in accordance with AASHTO T 209.
f. Mold two specimens at each asphalt content selected in accordance with AASHTO T 312. Mold specimens to 75 gyrations.
g. Determine the Gmb of the specimens using the Corelok device in accordance with AASHTO T 331.
h. Calculate the air voids and VMA of the molded samples.

3. Determining the OAC:

a. Calculate the surface area (SA) and film thickness (FT) of the mixtures.
b. The mixture at the OAC must meet the air voids and film thickness requirements, while staying within the limits for asphalt content as outlined in the specification. If it is not possible according to the predicted estimates, redesign by assuming another combination of aggregates or by obtaining different materials.
c. Calculate individual aggregate and asphalt weights to produce two laboratory-molded samples and one Gmm sample at the OAC.
d. Prepare the asphalt mixture in accordance with AASHTO T 312. Oven-cure the mixture for Gmm for 2 hr. at the selected compaction temperature.
e. Determine the Gmm at the OAC in accordance with AASHTO T 209.
f. Mold two specimens at the OAC in accordance with AASHTO T 312. Mold specimens to 50 gyrations or as shown in the plans
g. Determine the Gmb of the specimens in accordance with AASHTO T 331.
h. Calculate the G_{me}. Calculate the air voids of the molded samples and the FT for the combined aggregate at the OAC. The calculated air voids and FT must meet the specifications.
i. If the air voids or the FT does not meet the specifications, modify the OAC and repeat procedure.

4. Evaluating the Mixture at the OAC:

a. Evaluate the draindown of the mixture in accordance with the AASHTO T 305. Use 300± 5°F (149 ± 3°C) for testing temperature.
b. Evaluate the moisture resistance of the mixture in accordance with AASHTO T 283.
c. Evaluate the abrasion and impact resistance of the mixture in accordance with NJDOT B-8 Cantabro Test. Mold two specimens at the OAC to 75 gyrations. The air voids of the specimens must meet the specifications.
d. If any of the test results do not meet specifications, redesign by using another combination of aggregates, by obtaining different materials, or by a different OAC.

D. Calculations

1. Calculate G_{me}:

$$G_{me}=\frac{(100-P_b)}{\left[\left(\frac{100}{G_{mm}}\right)-\left(\frac{P_b}{G_b}\right)\right]}$$

Where:
Gme = effective specific gravity of mix
Pb = asphalt content, %
Gmm = theoretical maximum specific gravity
Gb = specific gravity of the asphalt binder

2. Calculate SA:

$$SA=\frac{0.41+(\%P\#4)0.41+(\%P\#8)0.82+(\%P\#16)1.64+(\%P\#30)2.87+(\%P\#50)6.14+(\%P\#100)12.29+(\%P\#200)32.77}{100}$$

Where:
SA = surface area, m2/kg
% Pi = Aggregate passing sieve # i, %.

3. Calculate FT:

$$P_{ba} = 100 * G_b \left(\frac{G_{me} - G_{sb}}{G_{sb} * G_{me}}\right)$$

$$P_{be} = P_b - P_{ba} \left(\frac{100 - P_b}{100}\right)$$

$$FT = \frac{\left(\frac{P_{be}/100}{1 - P_{be}/100}\right)}{SA * G_b * 1000} * 10^6$$

Where:
Pba = absorbed asphalt in mixture, %
Gsb = bulk specific gravity of combined aggregates
Pbe = effective asphalt in mixture, %
FT = film thickness of asphalt binder in mixture, microns