SPECIAL SPECIFICATION

3165

Crack Attenuating Mixture

1. Description. Construct a crack attenuating mixture (CAM), a pavement layer composed of a compacted mixture of aggregate and asphalt binder mixed hot in a mixing plant.

2. Materials. Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications.

Notify the Engineer of all material sources. Notify the Engineer before changing any material source or formulation. When the Contractor makes a source or formulation change, the Engineer will verify that the specification requirements are met and may require a new laboratory mixture design, trial batch, or both. The Engineer may sample and test project materials at any time during the project to verify specification compliance.

A. Aggregate. Furnish aggregates from sources that conform to the requirements shown in Table 1, and as specified in this Section, unless otherwise shown on the plans. Provide aggregate stockpiles that meet the definition in this Section for either a coarse aggregate or fine aggregate. Do not use reclaimed asphalt pavement (RAP) in the CAM mixture. Supply mechanically crushed gravel or stone aggregates that meet the definitions in Tex-100-E. The Engineer will designate the plant or the quarry as the sampling location. Samples must be from materials produced for the project. The Engineer will establish the surface aggregate classification (SAC) and perform Los Angeles abrasion, magnesium sulfate soundness, and Micro-Deval tests. Perform all other aggregate quality tests listed in Table 1. Document all test results on the mixture design report. The Engineer may perform tests on independent or split samples to verify Contractor test results. Stockpile aggregates for each source and type separately. Determine aggregate gradations for mixture design in accordance with Tex-200-F, Part II. Do not add material to an approved stockpile from sources that do not meet the aggregate quality requirements of the Department's *Bituminous Rated Source Quality Catalog* (BRSQC) unless otherwise approved.

1. Coarse Aggregate. Coarse aggregate stockpiles must have no more than 20% material passing the No. 8 sieve. Provide aggregates from sources listed in the BRSQC. Provide aggregate from non-listed sources only when the Engineer tests and approves before use. Allow 30 calendar days for the Engineer to sample, test, and report results for non-listed sources.

Provide coarse aggregate with at least the minimum SAC as shown on the plans. SAC requirements apply only to aggregates used on the surface of travel lanes. When shown on the plans, SAC requirements apply to aggregates used on surfaces other than travel lanes. The SAC for sources on the Department's Aggregate Quality Monitoring Program (AQMP) is listed in the BRSQC.

Class B aggregate meeting all other requirements in Table 1 may be blended with a Class A aggregate in order to meet requirements for Class A materials. When blending Class A and B aggregates to meet a Class A requirement, ensure that at least 50% by weight of material retained on the No. 8 sieve comes from the Class A aggregate source. Blend by volume if the bulk specific gravities of the Class A and B aggregates differ by more than 0.300. When blending, do not use Class C or D aggregates.

2. Fine Aggregate. Fine aggregates consist of manufactured sands and screenings. Natural sands are not allowed. Fine aggregate stockpiles must meet the gradation requirements in Table 2. Supply fine aggregates that are free from organic impurities. The Engineer may test the fine aggregate in accordance with Tex-408-A to verify that the material is free from organic impurities. Use fine aggregate from coarse aggregate sources that meet the requirements in Table 1, unless otherwise approved.

If 10% or more of the stockpile is retained on the No. 4 sieve, test the stockpile and verify that it meets the requirements in Table 1 for coarse aggregate angularity (Tex-460-A) and flat and elongated particles (Tex-280-F).

Table 1
Aggregate Quality Requirements

Property	Test Method	Requirement
Coarse Aggregate		
SAC	AQMP	As shown on plans
Deleterious material, %, max	Tex-217-F, Part I	1.0
Decantation, %, max	Tex-217-F, Part II	1.5
Micro-Deval abrasion, %, max	Tex-461-A	Note 1
Los Angeles abrasion, %, max	Tex-410-A	30
Magnesium sulfate soundness, 5 cycles, %, max	Tex-411-A	20
Coarse aggregate angularity, 2 crushed faces, %, min	Tex 460-A, Part I	95[2]
Flat and elongated particles @ 5:1, %, max	Tex-280-F	10
Fine Aggregate		
Linear shrinkage, %, max	Tex-107-E	3
Combined Aggregate[3]		
Sand equivalent, %, min	Tex-203-F	45

1. Not used for acceptance purposes. Used by the Engineer as an indicator of the need for further investigation.
2. Only applies to crushed gravel.
3. Aggregates, without mineral filler, or additives, combined as used in the job-mix formula (JMF).

Table 2
Gradation Requirements for Fine Aggregate

Sieve Size	% Passing by Weight or Volume
3/8"	100
#8	70–100
#200	0–30

B. Lime Mineral Filler. Add lime as a mineral filler at a rate of 1% by weight of the total dry aggregate in accordance with Item 301, "Asphalt Antistripping Agents." Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream, unless the plant has a baghouse or dust collection system that reintroduces the lime back into the drum.

Table 3
Gradation Requirements for Mineral Filler

Sieve Size	% Passing by Weight or Volume
#8	100
#200	55–100

C. Baghouse Fines. Fines collected by the baghouse or other dust-collecting equipment may be reintroduced into the mixing drum.

D. Asphalt Binder. Furnish the type and grade of performance-graded (PG) asphalt binder specified on the plans, in accordance with Section 300.2.J, "Performance-Graded Binders."

E. Tack Coat. Unless otherwise shown on the plans or approved, furnish CSS-1H, SS-1H, or a PG binder with a minimum high-temperature grade of PG 58 for tack coat binder, in accordance with Item 300, "Asphalts, Oils, and Emulsions." Do not dilute emulsion asphalts at the terminal, in the field, or at any other location before use.

The Engineer will obtain at least one sample of the tack coat binder per project and test it to verify compliance with Item 300. The Engineer will obtain the sample from the asphalt distributor immediately before use.

F. Additives. When shown on the plans, use the type and rate of additive specified. Other additives that facilitate mixing or improve the quality of the mixture may be allowed, when approved.

Warm Mix Asphalt (WMA) is defined as additives or processes that allow a reduction in the temperature at which asphalt mixtures are produced and placed. WMA is allowed for use at the Contractor's option, unless otherwise shown on the plans. The use of WMA is required when shown on plans. Unless otherwise directed, use only WMA additives or processes listed on the Department's Material Producer List maintained by the Construction Division (http://www.dot.state.tx.us/business/producer_list.htm).

If lime or liquid antistripping agent is used, add in accordance with Item 301, "Asphalt Antistripping Agents." When the plans require lime to be added as an antistripping agent, lime added as mineral filler will count towards the total quantity of lime specified.

3. Equipment. Provide required or necessary equipment in accordance with Item 320, "Equipment for Hot-Mix Asphalt Materials."

4. Construction. Produce, haul, place, and compact the specified paving mixture. Schedule and participate in a prepaving meeting with the Engineer as required in the Quality Control Plan (QCP).

A. Certification. Personnel certified by the Department-approved hot-mix asphalt certification program must conduct all mixture designs, sampling, and testing in accordance with Table 4. In addition to meeting the certification requirements in Table 4, all Level II certified specialists must successfully complete an approved Superpave training course. Supply the Engineer with a list of certified personnel and copies of their current certificates before beginning production and when personnel changes are made. Provide a mixture design developed and signed by a Level II certified specialist. Provide a Level IA certified specialist at the plant during production operations. Provide a Level IB certified specialist to conduct placement tests.

Table 4
Test Methods, Test Responsibility, and Minimum Certification Levels

1. Aggregate Testing	**Test Method**	**Contractor**	**Engineer**	**Level**
Sampling	Tex-400-A	✓	✓	IA
Dry sieve	Tex-200-F, Part I	✓	✓	IA
Washed sieve	Tex-200-F, Part II	✓	✓	IA
Deleterious material	Tex-217-F, Part I	✓	✓	II
Decantation	Tex-217-F, Part II	✓	✓	II
Los Angeles abrasion	Tex-410-A		✓	
Magnesium sulfate soundness	Tex-411-A		✓	
Micro-Deval abrasion	Tex-461-A		✓	
Coarse aggregate angularity	Tex-460-A	✓	✓	II
Flat and elongated particles	Tex-280-F	✓	✓	II
Linear shrinkage	Tex-107-E	✓	✓	II
Sand equivalent	Tex-203-F	✓	✓	II
Organic impurities	Tex-408-A	✓	✓	II
2. Mix Design & Verification	**Test Method**	**Contractor**	**Engineer**	**Level**
Design and JMF changes	Tex-204-F	✓	✓	II
Mixing	Tex-205-F	✓	✓	II
Molding (SGC)	Tex-241-F	✓	✓	IA
Laboratory-molded density	Tex-207-F	✓	✓	IA
VMA	Tex-207-F	✓	✓	II
Rice gravity	Tex-227-F	✓	✓	IA
Ignition oven calibration[1]	Tex-236-F	✓	✓	II
Indirect tensile strength	Tex-226-F	✓	✓	II
Overlay Test	Tex-248-F		✓	
Hamburg Wheel test	Tex-242-F	✓	✓	II
Boil test	Tex-530-C	✓	✓	IA
3. Production Testing	**Test Method**	**Contractor**	**Engineer**	**Level**
Random sampling	Tex-225-F		✓	IA
Mixture sampling	Tex-222-F	✓	✓	IA
Molding (SGC)	Tex-241-F	✓	✓	IA
Laboratory-molded density	Tex-207-F	✓	✓	IA
VMA (calculation only)	Tex-207-F	✓	✓	IA
Rice gravity	Tex-227-F	✓	✓	IA
Gradation & asphalt content[1]	Tex-236-F	✓	✓	IA

Control charts	Tex-233-F	✓	✓	IA
Moisture content	Tex-212-F	✓	✓	IA
Overlay Test	Tex-248-F		✓	
Hamburg Wheel Test	Tex-242-F	✓	✓	II
Overlay Test	Tex-248-F		✓	
Micro-Deval abrasion	Tex-461-A		✓	
Boil Test	Tex-530-C	✓	✓	IA
Aging Ratio	Tex-211-F		✓	
4. Placement Testing	**Test Method**	**Contractor**	**Engineer**	**Level**
Random sampling	Tex-225-F		✓	IA
Establish rolling pattern	Tex-207-F	✓		IB
In-Place air voids	Tex-207-F	✓	✓	IA
Control charts	Tex-233-F	✓	✓	IA
Ride quality measurement	Tex-1001-S	✓	✓	IB
Segregation (density profile)	Tex-207-F, Part V	✓	✓	IB
Longitudinal Joint Density	Tex-207-F, Part VII	✓	✓	IB
Thermal profile	Tex-244-F	✓	✓	IB
Tack coat adhesion	Tex-243-F		✓	IB

1. Refer to Section 4.I.2.c for exceptions to using an ignition oven.

B. Reporting. Use Department-provided software to record and calculate all test data. The Engineer and the Contractor must provide any available test results to the other party when requested. The Engineer and the Contractor must immediately report to the other party any test result that requires production to be suspended or fails to meet the specification requirements. Use the approved communication method (e.g., email, diskette, hard copy) to submit test results to the Engineer.

Use the procedures described in Tex-233-F to plot the results of all quality control (QC) and quality assurance (QA) testing. Update the control charts as soon as test results for each sublot become available. Make the control charts readily accessible at the field laboratory. The Engineer may suspend production for failure to update control charts.

C. QCP. Develop and follow the QCP in detail. Obtain approval from the Engineer for changes to the QCP made during the project. The Engineer may suspend operations if the Contractor fails to comply with the QCP.

Submit a written QCP to the Engineer before the mandatory prepaving meeting. Receive the Engineer's approval of the QCP before beginning production. Include the following items in the QCP:

1. Project Personnel. For project personnel, include:

- a list of individuals responsible for QC with authority to take corrective action; and
- contact information for each individual listed.

2. Material Delivery and Storage. For material delivery and storage, include:

- the sequence of material processing, delivery, and minimum quantities to assure continuous plant operations;
- aggregate stockpiling procedures to avoid contamination and segregation;

- frequency, type, and timing of aggregate stockpile testing to assure conformance of material requirements before mixture production; and
- procedure for monitoring the quality and variability of asphalt binder.

3. **Production.** For production, include:
   - loader operation procedures to avoid contamination in cold bins;
   - procedures for calibrating and controlling cold feeds;
   - procedures to eliminate debris or oversized material;
   - procedures for adding and verifying rates of each applicable mixture component (e.g., aggregate, asphalt binder, lime, liquid antistrip);
   - procedures for reporting job control test results; and
   - procedures to avoid segregation and drain-down in the silo.

4. **Loading and Transporting.** For loading and transporting, include:
   - type and application method for release agents; and
   - truck loading procedures to avoid segregation.

5. **Placement and Compaction.** For placement and compaction, include:
   - proposed agenda for mandatory prepaving meeting, including date and location;
   - type and application method for release agents in the paver and on rollers, shovels, lutes, and other utensils;
   - procedures for the transfer of mixture into the paver, while avoiding segregation and preventing material spillage;
   - process to balance production, delivery, paving, and compaction to achieve continuous placement operations;
   - paver operations (e.g., operation of wings, height of mixture in auger chamber) to avoid physical and thermal segregation and other surface irregularities; and
   - procedures to construct quality longitudinal and transverse joints.

D. Mixture Design.

1. **Design Requirements.** Unless otherwise shown on the plans, use the mixture design procedure given in Tex-204-F, Part IV, to design a mixture meeting the requirements listed in Tables 1, 2, 3, 5, and 6. Design for a target laboratory-molded density of 98.0% at Ndes = 50 as the design number of gyrations.

   Use an approved laboratory to perform the Hamburg Wheel test and provide results with the mixture design, or provide the laboratory mixture and request that the Department perform the Hamburg Wheel test. The Construction Division maintains a list of approved laboratories. Provide the laboratory mixture and request that the Department perform the Overlay test. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test and Overlay test results on the laboratory mixture design.

The Contractor may submit a new mixture design at any time during the project. The Engineer will approve all mixture designs before the Contractor can begin production. When shown on the plans, the Engineer will provide the mixture design.

Provide the Engineer with a mixture design report using Department-provided software. Include the following items in the report:

- the combined aggregate gradation, source, specific gravity, and percent of each material used;
- results of all applicable tests;
- the mixing and molding temperatures;
- the signature of the Level II person or persons that performed the design;
- the date the mixture design was performed; and
- a unique identification number for the mixture design.

Table 5
Master Gradation Bands (% Passing by Weight or Volume) and Volumetric Properties

Sieve Size	**Fine Mixture (% Passing by Weight or Volume)**
2"	–
1-1/2"	–
1"	–
3/4"	–
1/2"	–
3/8"	98.0–100.0
#4	70.0-90.0
#8	40.0–65.0
#16	20.0-45.0
#30	10.0–30.0
#50	10.0–20.0
#200	2.0–10.0
Property	**Requirement**
Binder Content	7.0% minimum
Design VMA[1], % Minimum	17.0
Plant-Produced VMA, % Minimum	16.5

1. Voids in mineral aggregates.

Table 6
Laboratory Mixture Design Properties

Mixture Property		Test Method	Requirement
Design Gyrations (Ndesign)[1]		Tex-241-F	50
Target Laboratory-Molded Density, %		Tex-207-F	98.0
Tensile Strength (dry), psi		Tex-226-F	85–200[2]
Dust/Asphalt Ratio[3]			1.4 max
Boil Test[4]		Tex-530-C	–
Hamburg Wheel Test Requirements			
High-Temperature Binder Grade	**Test Method**		**Minimum # of Passes[5] @ 0.5" Rut Depth, Tested @122°F**
PG 64 or lower	Tex-242-F		10,000
PG 70			15,000
PG 76 or higher			20,000
Overlay Tester Requirements			
Test Method	**Minimum # of Cycles[5]**		
Tex-248-F	750		

1. May be adjusted within a range of 50-100 gyrations when shown on the plans or allowed by the Engineer.
2. May exceed 200 psi, when approved, and may be waived, when approved.
3. Defined as % passing #200 sieve divided by asphalt content.
4. Used to establish baseline for comparison to production results. May be waived, when approved.
5. May be decreased, when shown on the plans or when directed.

2. Job-Mix Formula Approval. The job-mix formula (JMF) is the combined aggregate gradation and target asphalt percentage used to establish target values for hot mix production. JMF1 is the original laboratory mixture design used to produce the trial batch. The Engineer and the Contractor will verify JMF1 based on a plant-produced mixture from the trial batch, unless otherwise approved. The Engineer may accept an existing mixture design previously used on a Department project and may waive the trial batch to verify JMF1.

a. Contractor's Responsibilities.

(1) Providing Superpave Gyratory Compactor. Furnish a Superpave gyratory compactor (SGC), calibrated in accordance with Tex-241-F, for molding production samples. Locate the SGC at the Engineer's field laboratory and make the SGC available to the Engineer for use in molding production samples.

(2) Gyratory Compactor Correlation Factors. Use Tex-206-F, Part II, to perform a gyratory compactor correlation when the Engineer uses a different SGC. Apply the correlation factor to all subsequent production test results.

(3) Submitting JMF1. Furnish the Engineer a mix design report (JMF1), and request approval to produce the trial batch. If opting to have the Department perform the Hamburg Wheel test on the laboratory mixture, provide the Engineer with approximately 10,000 g of the design mixture and request that the Department perform the Hamburg Wheel test. Provide the Engineer with approximately 25,000 g of the design mixture and request that the Department perform the Overlay test.

(4) Supplying Aggregate. Provide the Engineer with approximately 40 lb. of each aggregate stockpile, unless otherwise directed.

(5) Supplying Asphalt. Provide the Engineer at least 1 gal. of the asphalt material and sufficient quantities of any additives proposed for use.

(6) Ignition Oven Correction Factors. Determine the aggregate and asphalt correction factors from the ignition oven in accordance with Tex-236-F. Provide the Engineer with split samples of the mixtures, including all additives (except water), and blank samples used to determine the correction factors. Correction factors established from a previously approved mixture design may be used for the current mixture design, if the mixture design and ignition oven are the same as previously used, unless otherwise directed.

(7) Boil Test. Perform the test and retain the tested sample from Tex-530-C. Use this sample for comparison purposes during production. The Engineer may waive the requirement for the boil test.

(8) Trial Batch Approval. Upon receiving conditional approval of JMF1 from the Engineer, provide a plant-produced trial batch, including the WMA additive or process, if applicable, for verification testing of JMF1 and development of JMF2.

(9) Trial Batch Production Equipment. To produce the trial batch, use only equipment and materials proposed for use on the project.

(10) Trial Batch Quantity. Produce enough quantity of the trial batch to ensure that the mixture is representative of JMF1.

(11) Number of Trial Batches. Produce trial batches as necessary to obtain a mixture that meets the requirements in Table 7.

(12) Trial Batch Sampling. Obtain a representative sample of the trial batch and split it into three equal portions, in accordance with Tex-222-F. Label these portions as “Contractor,” “Engineer,” and “Referee.” Deliver samples to the appropriate laboratory as directed.

(13) Trial Batch Testing. Test the trial batch to ensure that the mixture produced using the proposed JMF1 meets the verification testing requirements for gradation, asphalt content, laboratory-molded density, and VMA listed in Table 7 and is in compliance with the Hamburg Wheel and Overlay test requirements in Table 6. Use an approved laboratory to perform the Hamburg Wheel test on the trial batch mixture or request that the Department perform the Hamburg Wheel test. The Department will perform the Overlay test. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel and Overlay test results on the trial batch. Provide the Engineer with a copy of the trial batch test results.

(14) Development of JMF2. After the Engineer grants full approval of JMF1 based on results from the trial batch, evaluate the trial batch test results, determine the optimum mixture proportions, and submit as JMF2.

(15) Mixture Production. After receiving approval for JMF2 and receiving a passing result from the Department's or a Department-approved laboratory's Hamburg Wheel test and the Department's Overlay test on the trial batch, use JMF2 to produce Lot 1. As an option, once JMF2 is approved, proceed to Lot 1 production at the Contractor's risk without receiving the results from either the Department's Hamburg Wheel test or Overlay test on the trial batch. If electing to proceed without either the Hamburg Wheel test or Overlay test results from the trial batch, notify the Engineer. Note that the Engineer may require that up to the entire sublot of any mixture failing either the Hamburg Wheel test or Overlay test be removed and replaced at the Contractor's expense.

(16) Development of JMF3. Evaluate the test results from Lot 1, determine the optimum mixture proportions, and submit as JMF3 for use in Lot 2.

(17) JMF Adjustments. If necessary, adjust the JMF before beginning a new lot. The adjusted JMF must:

- be provided to the Engineer in writing before the start on a new lot;
- be numbered in sequence to the previous JMF;
- meet the master gradation limits shown in Table 5; and
- be within the operational tolerances of JMF2 listed in Table 7.

(18) Requesting Referee Testing. If needed, use referee testing in accordance with Section 4.I.1, "Referee Testing," to resolve testing differences with the Engineer.

Table 7
Operational Tolerances

Description	Test Method	Allowable Difference from Current JMF Target	Allowable Difference between Contractor and Engineer[1]
Individual % retained for #8 sieve and larger	Tex-200-F or Tex-236-F	±3.0[2]	±3.0
Individual % retained for sieves smaller than #8 and larger than #200		±3.0[2]	±3.0
% passing the #200 sieve		±2.0[2]	±1.6
Asphalt content, %	Tex-236-F	±0.3[3]	±0.3
Laboratory-molded density, %	Tex-207-F	±1.0	±0.5
In-Place air voids, %		N/A	±1.0
Laboratory-molded bulk specific gravity		N/A	±0.020
VMA, % min		Note 4	N/A
Theoretical maximum specific (Rice) gravity	Tex-227-F	N/A	± 0.020

1. Contractor may request referee testing only when values exceed these tolerances.
2. When within these tolerances, mixture production gradations may fall outside the master grading limits; however, the % passing the #200 sieve will be considered out of tolerance when outside the master grading limits.
3. Tolerance between trial batch test results and JMF1 (lab produced mix) is not allowed to exceed 0.5%, unless otherwise directed. Tolerance between JMF1 (lab produced mix) and JMF2 is allowed to exceed ±0.3%.
4. Test and verify that Table 5 requirements are met.

b. Engineer's Responsibilities.

(1) Gyratory Compactor. The Engineer will use a Department SGC, calibrated in accordance with Tex-241-F, to mold samples for laboratory mixture design verification. For molding trial batch and production specimens, the Engineer will use the Contractor-provided SGC at the field laboratory or will provide and use a Department SGC at an alternate location. The Engineer will make the Contractor-provided SGC in the Department field laboratory available to the Contractor for molding verification samples.

(2) Conditional Approval of JMF1. Within 10 working days of receiving the mixture design report (JMF1) and all required materials and Contractor-provided Hamburg Wheel test results, the Engineer will review the Contractor's mix design report and verify conformance with all aggregates, asphalt, additives, and mixture specifications. The Engineer may perform tests to verify that the aggregates meet the requirements listed in Table 1. The Engineer will grant the Contractor conditional approval of JMF1, if the information provided on the paper copy of JMF1 indicates that the Contractor's mixture design meets the specifications. When the Contractor does not provide Hamburg Wheel test results with laboratory mixture design, allow the Engineer 10 working days for conditional approval of JMF 1. The Engineer will base full approval of JMF1 on test results on mixture from the trial batch.

(3) Hamburg Wheel and Overlay Testing of JMF1. If the Contractor requests the option to have the Department perform the Hamburg Wheel test on the laboratory mixture, the Engineer will mold samples in accordance with Tex-242-F to verify compliance with the Hamburg Wheel test requirement in Table 6. The Engineer will perform the Overlay test. The Engineer will mold samples in accordance with Tex-248-F to verify compliance with the Overlay test requirements in Table 6.

(4) Authorizing Trial Batch. After conditionally approving JMF1, including either Contractor- or Department-supplied Hamburg Wheel test results, the Engineer will authorize the Contractor to produce a trial batch.

(5) Ignition Oven Correction Factors. The Engineer will use the split samples provided by the Contractor to determine the aggregate and asphalt correction factors for the ignition oven in accordance with Tex-236-F.

(6) Testing the Trial Batch. Within 1 full working day, the Engineer will sample and test the trial batch to ensure that the gradation, asphalt content, laboratory-molded density, and VMA meet the requirements listed in Table 7. If the Contractor requests the option to have the Department perform the Hamburg Wheel test on the trial batch mixture, the Engineer will mold samples in accordance with Tex-242-F to verify compliance with the Hamburg Wheel test requirement in Table 6. The Engineer will perform the Overlay test and mold specimens in accordance with Tex-248-F to verify compliance with the Overlay test requirements in Table 6.

The Engineer will have the option to perform the following tests on the trial batch:

- Tex-226-F, to verify that the indirect tensile strength meets the requirement shown in Table 6;
- Tex-461-A, to determine the need for additional magnesium sulfate soundness testing; and
- Tex-530-C, to retain and use for comparison purposes during production.

(7) Full Approval of JMF1. The Engineer will grant full approval of JMF1 and authorize the Contractor to proceed with developing JMF2 if the Engineer's results for gradation, asphalt content, laboratory-molded density, and VMA confirm that the trial batch meets the requirements in Table 7.

The Engineer will notify the Contractor that an additional trial batch is required if the trial batch does not meet the requirements in Table 5.

(8) Approval of JMF2. The Engineer will approve JMF2 within 1 working day if it meets the master grading limits shown in Table 5 and is within the operational tolerances of JMF1 listed in Table 7.

(9) Approval of Lot 1 Production. The Engineer will authorize the Contractor to proceed with Lot 1 production as soon as a passing result is achieved from the Department's or an approved laboratory's Hamburg Wheel test and from the Department's Overlay test. As an option, the Contractor may, at their own risk, proceed with Lot 1 production without results from the Hamburg Wheel test and Overlay test on the trial batch.

If the Department's or approved laboratory's sample from the trial batch fails the Hamburg Wheel or Overlay test, the Engineer will suspend production until further Hamburg Wheel or Overlay tests meet the specified values. The Engineer may require up to the entire sublot of any mixture failing the Hamburg Wheel or Overlay test to be removed and replaced at the Contractor's expense.

(10) Approval of JMF3. The Engineer will approve JMF3 within 1 working day if it meets the master grading limits shown in Table 5 and is within the operational tolerances of JMF2 listed in Table 7.

E. Production Operations. Perform a new trial batch when the plant or plant location is changed. Take corrective action and receive approval to proceed after any production suspension for noncompliance to the specification.

1. Storage and Heating of Materials. Do not heat the asphalt binder above the temperatures specified in Item 300, "Asphalts, Oils, and Emulsions," or outside the manufacturer's recommended values. On a daily basis, provide the Engineer with the records of asphalt binder and hot-mix asphalt discharge temperatures in accordance with Item 320, "Equipment for Hot-Mix Asphalt Materials." Unless otherwise approved, do not store mixture for a period long enough to affect the quality of the mixture, nor in any case longer than 12 hr.

2. Mixing and Discharge of Materials. When WMA is specified on the plans, produce the mixture and monitor the temperature of the material in the truck before shipping to ensure that it does not exceed 275ºF or is less than 215ºF. When WMA is not specified but used at the Contractor's discretion, the Department will not pay for or allow placement of any WMA produced at more than 350ºF or less than 215ºF, unless otherwise directed. When WMA is not required as shown on plans and is not used by the Contractor, produce an asphalt mixture within the temperature range of 275°F and 350°F.

Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant. If requested, determine the moisture content by oven drying in accordance with Tex-212-F, Part II, and verify that the mixture contains no more than 0.2% of moisture by weight. Obtain the sample immediately after discharging the mixture into the truck, and perform the test promptly.

F. Hauling Operations. Before use, clean all truck beds to ensure that mixture is not contaminated. When a release agent is necessary, use a release agent on the approved list maintained by the Construction Division to coat the inside bed of the truck.

G. Placement Operations. Collect haul tickets from each load of mixture delivered to the project and provide the Department's copy to the Engineer approximately every hour, or as directed by the Engineer. Measure and record the temperature of the mixture as discharged from the truck or material transfer device prior to entering the paver and an approximate station number on each ticket. Unless otherwise directed, calculate and report the yield and cumulative yield following the production of every 250 tons or following every 2 hours of production, whichever occurs first for the specified lift and provide to the Engineer. The Engineer may suspend production if the Contractor fails to produce and provide haul tickets and yield calculations.

Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Remove vegetation from pavement edges. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. Offset longitudinal joints of successive courses of hot mix by at least 6 in. Place mixture so that longitudinal joints on the surface course coincide with lane lines, or as directed. Ensure that all finished surfaces will drain properly. Place mixture within the compacted lift thickness shown in Table 8, unless otherwise shown on the plans or allowed.

Table 8
Compacted Lift Thickness and Required Core Height

Mixture Type	Compacted Lift Thickness		Minimum Untrimmed Core Height (in.) Eligible for Testing
	Minimum (in.)	Maximum (in.)	
Crack Attenuating Mixture (CAM)	1.00	2.00	0.75

1. Weather Conditions. Place mixture when the roadway surface temperature is equal to or higher than the temperatures listed in Table 9, unless otherwise approved or shown on the plans. Measure the roadway surface temperature with a handheld infrared thermometer. The Engineer may allow mixture placement to begin prior to the roadway surface reaching the required temperature requirements, if conditions are such that the roadway surface will reach the required temperature within 2 hrs. of beginning placement operations. Unless otherwise shown on the plans, place mixture only when weather conditions and moisture conditions of the roadway surface are suitable in the opinion of the Engineer.

Table 9
Minimum Pavement Surface Temperatures

	Minimum Pavement Surface Temperatures in Degrees Fahrenheit	
High Temperature Binder Grade	Subsurface Layers or Night Paving Operations	Surface Layers Placed in Daylight Operations
PG 64	45	50
PG 70	55[1]	60[1]
PG 76	60[1]	60[1]

1. Contractors may pave at temperatures 10°F lower than the values shown in Table 9 when utilizing a paving process or equipment that eliminates thermal segregation. In such cases, the contractor must use either an infrared bar attached to the paver, a hand held thermal camera, or a hand held infrared thermometer operated in accordance with Tex-244-F to demonstrate to the satisfaction of the Engineer that the uncompacted mat has no more than 10°F of thermal segregation.

2. Tack Coat. Clean the surface before placing the tack coat. Unless otherwise approved, apply tack coat uniformly at the rate directed by the Engineer. The Engineer will set the rate between 0.04 and 0.10 gal. of residual asphalt per square yard of surface area. Apply a thin, uniform tack coat to all contact surfaces of curbs, structures, and all joints. Allow adequate time for emulsion to break completely prior to placing any material. Prevent splattering of tack coat when placed adjacent to curb, gutter, and structures. Roll the tack coat with a pneumatic-tire roller when directed. The Engineer may use Tex-243-F to verify that the tack coat has adequate adhesive properties. The Engineer may suspend paving operations until there is adequate adhesion.

3. Lay-Down Operations.

a. Thermal Profile. For each sublot, obtain a thermal profile in accordance with Tex-244-F. The Engineer may reduce the testing frequency based on a satisfactory test history. The Engineer may also obtain as many thermal profiles as deemed necessary. If the temperature differential is greater than 25°F, the area will be deemed as having thermal segregation. Evaluate areas with thermal segregation by performing a density profile in accordance with section, 4.I.3.c.(2), “Segregation (Density Profile).” Take corrective action to eliminate areas that have thermal segregation. Unless otherwise directed, suspend operations if the maximum temperature differential exceeds 50°F. Resume operations when the Engineer determines that subsequent production will meet the specifications.

b. Windrow Operations. When hot mix is placed in windrows, operate windrow pickup equipment so that substantially all the mixture deposited on the roadbed is picked up and loaded into the paver.

H. Compaction. Uniformly compact the pavement to the density requirements of the specification. Use the control strip method given in Tex-207-F, Part IV, to establish the rolling pattern. Do not use pneumatic-tire rollers if excessive pickup of fines by roller tires occurs. Unless otherwise directed, use only water or an approved release agent on rollers, tamps, and other compaction equipment.

Compact mixture to achieve 2.0% to 6.0% in-place air voids as tested by the Engineer. Investigate in-place air void deficiencies and take corrective actions during production and placement to achieve the required in-place air voids. Suspend production if two consecutive sublots fail to meet the air void requirement, unless otherwise approved. Resume production after the Engineer approves changes to production or placement methods.

Referee testing is required for any sublot with in-place air voids less than 2.0% or greater than 6.0%. If after referee testing, the in-place air voids are not within the range of 2.0% to 6.0%, the Engineer will choose the location of two cores to be taken within 3 ft. of the original failing core location. The Contractor will obtain the cores in the presence of the Engineer. The Engineer will take immediate possession of the untrimmed cores and submit the untrimmed cores to the Construction Division, where they will be trimmed and tested for bulk specific gravity within 10 working days of receipt. The average bulk specific gravity of the cores will be divided by the Engineer's maximum theoretical specific gravity for that lot to determine the new in-place air voids of the sublot in question. If the new in-place air voids are within the range of 2.0% to 6.0%, the material will receive full payment in accordance with Sections 5.A and 5.B, provided that the material also meets the laboratory-molded density requirements. If the new in-place air voids are not within the range of 2.0% to 6.0%, the Engineer may require removal and replacement or may allow the sublot to be left in place without payment or at a reduced payment as determined by the Engineer. Replacement material meeting the requirements of this Item will be paid for in accordance with this Article.

Where specific air void requirements are waived, furnish and operate compaction equipment as approved. Use tamps to thoroughly compact the edges of the pavement along curbs, headers, and similar structures and in locations that will not allow thorough compaction with rollers. The Engineer may require rolling with a trench roller on widened areas, in trenches, and in other limited areas.

Allow the compacted pavement to cool to 160°F or lower before opening to traffic, unless otherwise directed. When directed, sprinkle the finished mat with water or limewater to expedite opening the roadway to traffic.

I. Acceptance Plan. Sample and test the hot mix on a lot and sublot basis at the frequency shown in Table 10. A production lot consists of four equal sublots. Lot 1 will be 1,000 tons. The Engineer will select subsequent lot sizes based on the anticipated daily production. The lot size will be between 1,000 tons and 4,000 tons. The Engineer may change the lot size before the Contractor begins any lot. If production or placement test results are not within the acceptable tolerances listed in Table 7, suspend production until test results or other information indicate to the satisfaction of the Engineer that the next material produced or placed will meet the specified values.

Table 10
Production and Placement Testing Frequency

Description	Test Method	Minimum Contractor Testing Frequency	Minimum Engineer Testing Frequency
Individual % retained for #8 sieve and larger	Tex-200-F or Tex-236-F	1 per sublot	1 per 12 sublots
Individual % retained for sieves smaller than #8 and larger than #200			
% passing the #200 sieve			
Laboratory-molded density	Tex-207-F	N/A	1 per sublot
VMA			
Laboratory-molded bulk specific gravity			
In-Place air voids			
Segregation (density profile)	Tex-207-F, Part V	1 per sublot	1 per project
Longitudinal joint density	Tex-207-F, Part VII		
Moisture content	Tex-212-F, Part II	When directed	
Theoretical maximum specific (Rice) gravity	Tex-227-F	N/A	1 per sublot
Asphalt content	Tex-236-F	1 per sublot	1 per lot
Hamburg Wheel test	Tex-242-F	N/A	1 per project
Thermal profile	Tex-244-F	1 per sublot	
Asphalt binder sampling and testing[1]	Tex-500-C	1 per sublot (sample only)	
Boil test[1]	Tex-530-C	1 per lot	

1. The Engineer may reduce or waive the sampling and testing requirements based on a satisfactory test history.

1. **Referee Testing.** The Construction Division is the referee laboratory. The Contractor may request referee testing if the differences between Contractor and Engineer test results exceed the operational tolerance shown in Table 7 and the differences cannot be resolved. Make the request within 5 working days after receiving test results and cores from the Engineer. Referee tests will be performed only on the sublot in question and only for the particular test in question. Allow 10 working days from the time the referee laboratory receives the samples for reporting of test results. The Department may require the Contractor to reimburse the Department for referee tests, if more than three referee tests per project are required, and the Engineer's test results are closer than the Contractor's test results to the referee test results.

   The Construction Division will determine the laboratory-molded density based on the molded specific gravity and the maximum theoretical specific gravity of the referee sample. The in-place air voids will be determined based on the bulk specific gravity of the cores, as determined by the referee laboratory, and the Engineer's average maximum theoretical specific gravity for the lot.

2. **Production Acceptance.**

   a. **Production Lot.** A production lot consists of four equal sublots. Lot 1 will be 1,000 tons. The Engineer will select subsequent lot sizes based on the anticipated daily production. The lot size will be between 1,000 tons and 4,000 tons. The Engineer may change the lot size before the Contractor begins any lot.

(1) Small-Quantity Production. When the anticipated daily production is less than 500 tons, the Engineer may waive all production and placement testing; however, the Engineer will retain the right to perform random acceptance tests for production and placement and may reject objectionable materials and workmanship.

When the Engineer waives all production and placement sampling and testing requirements:

- produce, haul, place, and compact the mixture as directed by the Engineer;
- control mixture production to yield a laboratory-molded density of 98.0% ± 1.0% as tested by the Engineer; and
- compact the mixture to achieve 2.0% to 6.0% in-place air voids as tested by the Engineer.

(2) Incomplete Production Lots. If a lot is begun but cannot be completed, such as on the last day of production or in other circumstances deemed appropriate, the Engineer may close the lot.

b. Production Sampling.

(1) Mixture Sampling. At the beginning of the project, the Engineer will select random numbers for all production sublots. Determine sample locations in accordance with Tex-225-F.

Obtain hot mix samples from trucks at the plant in accordance with Tex-222-F. For each sublot, take one sample at the location randomly selected. For each lot, the Engineer will randomly select and test a "blind" sample from at least one sublot. The location of the Engineer's "blind" sample will not be disclosed to the Contractor. The Engineer will use the Contractor's split sample for sublots not sampled by the Engineer.

The sampler will split each sample into three equal portions in accordance with Tex-200-F and label these portions as "Contractor," "Engineer," and "Referee." Deliver the samples to the appropriate party's laboratory. Deliver referee samples to the Engineer. Discard unused samples after the Engineer has accepted the material for payment.

(2) Asphalt Binder Sampling. Obtain a 1-qt. sample of the asphalt binder for each sublot of mixture produced. Obtain the sample at approximately the same time the mixture random is obtained. Sample from a port located immediately upstream from the mixing drum or pug mill. Take the sample in accordance with Tex-500-C, Part II. Label the can with the corresponding lot and sublot numbers, and deliver the sample to the Engineer.

The Engineer may also obtain independent samples. If the Engineer chooses to obtain an independent asphalt binder sample, the Engineer will split a sample of the asphalt binder with the Contractor. The Engineer will test at least one asphalt binder sample per project to verify compliance with Item 300, "Asphalts, Oils, and Emulsions."

c. Production Testing. The Contractor and Engineer must perform production tests in accordance with Table 10. The Contractor has the option to verify the Engineer's test results on split samples provided by the Engineer. Determine compliance with operational tolerances listed in Table 7 for all sublots.

Control mixture production to yield a laboratory-molded density of 98.0% ± 1.0% as tested by the Engineer. Suspend production if two consecutive sublots fail to meet this requirement, unless otherwise approved. Resume production after the Engineer approves changes to production methods.

Referee testing is required for any sublot with a laboratory-molded density greater than 99.0% or less than 96.5%. If the new laboratory-molded density is within the range of 96.5% to 99.0%, the material will receive full payment in accordance with Sections 5.A and 5.B provided that the material also meets the in-place air void requirements. If the new laboratory-molded density is not within the range of 96.5% to 99.0%, the Engineer may require removal and replacement or may allow the sublot to be left in place without payment or at a reduced payment. Replacement material meeting the requirements of this Item will be paid for in accordance with this Article.

If the aggregate mineralogy is such that Tex-236-F does not yield reliable results, the Engineer may allow alternate methods for determining the asphalt content and aggregate gradation. Unless otherwise allowed, the Engineer will require the Contractor to provide evidence that results from Tex-236-F are not reliable before permitting an alternate method. If an alternate test method is allowed, use the applicable test procedure as directed.

d. Operational Tolerances. Control the production process within the operational tolerances listed in Table 7. When production is suspended, the Engineer will allow production to resume when test results or other information indicates that the next mixture produced will be within the operational tolerances.

(1) Gradation. Unless otherwise directed, suspend production when either the Contractor's or the Engineer's test results for gradation exceed the operational tolerances for three consecutive sublots on the same sieve or four consecutive sublots on any sieve. The consecutive sublots may be from more than one lot.

(2) Asphalt Content. Unless otherwise directed, suspend production when two or more sublots within a lot are out of operational tolerance for asphalt content based on either the Contractor's or the Engineer's test results. Suspend production and shipment of mixture if the asphalt content deviates from the current JMF by more than 0.5% for any sublot.

(3) Hamburg Wheel Test. The Engineer may perform a Hamburg Wheel test at any time during production, including when the boil test indicates a change in quality from the materials submitted for JMF1. In addition to testing production samples, the Engineer may obtain cores and perform the Hamburg Wheel test on any area of the roadway where rutting is observed. When the production or core samples fail the Hamburg Wheel test criteria in Table 6, suspend production until further tests meet the specified values. Core samples, if taken, will be obtained from the center of the finished mat or other areas excluding the vehicle wheel path. The Engineer may require up to the entire sublot of any mixture failing the test to be removed and replaced at the Contractor's expense.

If the Department's or Department-approved laboratory's Hamburg Wheel test results do not meet the minimum number of passes specified in Table 6, the Contractor may request that the Department confirm the results by retesting the failing material. The Construction Division will perform the Hamburg Wheel tests and determine the final disposition of the material in question based on the Department's test results.

e. Individual Loads of Hot Mix. The Engineer can reject individual truckloads of hot mix. When a load of hot mix is rejected for reasons other than temperature, the Contractor may request that the rejected load be tested. Make this request within 4 hr. of rejection. The Engineer will sample and test the mixture. If test results are within the operational tolerances shown in Table 7, payment will be made for the load. If test results are not within operational tolerances, no payment will be made for the load, and the Engineer may require removal.

3. Placement Acceptance.

a. Placement Lot. A placement lot consists of four placement sublots. A placement sublot consists of the area placed during a production sublot.

(1) Incomplete Placement Lots. An incomplete placement lot consists of the area placed as described in Section 4.I.2.a.(2), "Incomplete Production Lots," excluding miscellaneous areas as defined in Section 4.I.3.a(3), "Miscellaneous Areas." Placement sampling is required if the random sample plan for production resulted in a sample being obtained from an incomplete production sublot.

(2) Shoulders and Ramps. Shoulders and ramps are subject to in-place air void determination, unless otherwise shown on the plans.

(3) Miscellaneous Areas. Miscellaneous areas include areas that are not generally subject to primary traffic, such as driveways, mailbox turnouts, crossovers, gores, spot level-up areas, and other similar areas. Miscellaneous areas also include level-ups and thin overlays, if the layer thickness designated on the plans is less than the compacted lift thickness shown in Table 8. Miscellaneous areas are not eligible for random placement sampling locations. Compact areas that are not subject to in-place air void determination in accordance with Section 4.H, "Compaction."

b. Placement Sampling. At the beginning of the project, the Engineer will select random numbers for all placement sublots. The Engineer will provide the Contractor with the placement random numbers immediately after the sublot is completed. Mark the roadway location at the completion of each sublot and record the station number. Determine one random sample location for each placement sublot in accordance with Tex-225-F. If the randomly generated sample location is within 2 ft. of a joint or pavement edge, adjust the location by no more than necessary to achieve a 2-ft. clearance.

Shoulders and ramps are always eligible for selection as a random sample location; however, if a random sample location falls on a shoulder or ramp designated on the plans as not subject to in-place air void testing, cores will not be taken for the sublot.

Unless otherwise determined, the Engineer will witness the coring operation and measurement of the core thickness. Unless otherwise approved, obtain the cores within 1 working day of the time the placement sublot is completed. Obtain two 6-in. diameter cores side-by-side from within 1 ft. of the random location provided for the placement sublot. Mark the cores for identification. Visually inspect each core and verify that the current paving layer is bonded to the underlying layer. If an adequate bond does not exist between the current and underlying layer, take corrective action to ensure that an adequate bond will be achieved during subsequent placement operations.

Immediately after obtaining the cores, dry the core holes and tack the sides and bottom. Fill the hole with the same type of mixture and properly compact the mixture. Repair core holes with other methods when approved.

If the core heights exceed the minimum untrimmed values listed in Table 8, trim the bottom or top of the core only when necessary to provide a flat and suitable surface for testing. Remove no more than 1/2 in. from the bottom of the core to remove any material from an underlying layer or surface treatment. Remove no more than 1/2 in. from the top of the core only when hot mix asphalt or a surface treatment has been placed on top of the material subject to testing. Deliver the cores to the Engineer within 1 working day following placement operations, unless otherwise approved.

If the core height before trimming is less than the minimum untrimmed value shown in Table 8, decide whether to include the pair of cores in the air void determination for that sublot. If the cores are to be included in air void determination, trim the bottom or top of the core only when necessary to remove any foreign matter and to provide a level and smooth surface for testing. Foreign matter is another paving layer, such as hot mix, surface treatment, subgrade, or base material. Trim the minimum amount necessary with a limit of 1/2 in. Do not trim the core if the surface is level and there is not foreign matter bonded to the surface of the core. Trim the cores as noted above before delivering to the Engineer. If the cores will not be included in air void determination, deliver untrimmed cores to the Engineer.

c. Placement Testing. Perform placement tests in accordance with Table 10. After the Engineer returns the cores, the Contractor has the option to test the cores to verify the Engineer's test results for in-place air voids. The allowable differences between the Contractor's and Engineer's test results are listed in Table 7.

(1) In-Place Air Voids. The Engineer will measure in-place air voids in accordance with Tex-207-F and Tex-227-F. Before drying to a constant weight, cores may be pre-dried using a Corelok or similar vacuum device to remove excess moisture. The Engineer will average the values obtained for all sublots in the production lot to determine the theoretical maximum specific gravity. The Engineer will use the average air void content for in-place air voids.

The Engineer will use paraffin coating or vacuum methods to seal the core, if required by Tex-207-F. The Engineer will use the test results from the unsealed core to determine in-place air voids if the sealed core yields a higher specific gravity than the unsealed core. After determining the in-place air void content, the Engineer will return the cores and provide test results to the Contractor.

(2) Segregation (Density Profile). Test for segregation using density profiles in accordance with Tex-207-F, Part V. Provide the Engineer with the results of the density profiles as they are completed. Areas defined in Section 4.IH.3.a.(3), "Miscellaneous Areas," are not subject to density profile testing.

Unless otherwise approved, perform a density profile every time the screed stops, on areas identified by either the Contractor or the Engineer as having thermal segregation, and on any visibly segregated areas. If the screed does not stop, and there are no visibly segregated areas or areas identified as having thermal segregation, perform a minimum of one profile per sublot. Reduce the test frequency to a minimum of one profile per lot if four consecutive profiles are within established tolerances. Continue testing at a minimum frequency of one per lot unless a profile fails, at which point resume testing at a minimum frequency of one per sublot. The Engineer may further reduce the testing frequency based on a consistent pattern of satisfactory results.

The density profile is considered failing if it exceeds the tolerances in Table 11. The Engineer may make as many independent density profile verifications as deemed necessary. The Engineer's density profile results will be used when available.

Investigate density profile failures and take corrective actions during production and placement to eliminate the segregation. Suspend production if two consecutive density profiles fail, unless otherwise approved. Resume production after the Engineer approves changes to production or placement methods.

Table 11
Segregation (Density Profile) Acceptance Criteria

Maximum Allowable Density Range (Highest to Lowest)	Maximum Allowable Density Range (Average to Lowest)
6.0 pcf	3.0 pcf

(3) Longitudinal Joint Density.

(a) Informational Tests. While establishing the rolling pattern, perform joint density evaluations, and verify that the joint density is no more than 3.0 pcf below the density taken at or near the center of the mat. Adjust the rolling pattern, if needed, to achieve the desired joint density. Perform additional joint density evaluations at least once per sublot, unless otherwise directed

(b) Record Tests. For each sublot, perform a joint density evaluation at each pavement edge that is or will become a longitudinal joint. Determine the joint density in accordance with Tex-207-F, Part VII. Record the joint density information and submit results on Department forms to the Engineer. The evaluation is considered failing if the joint density is more than 3.0 pcf below the density taken at the core random sample location, and the correlated joint density is less than 94.0%. The Engineer may make independent joint density verifications at the random sample locations. The Engineer's joint density test results will be used when available.

Investigate joint density failures and take corrective actions during production and placement to improve the joint density. Suspend production if two consecutive evaluations fail, unless otherwise approved. Resume production after the Engineer approves changes to production or placement methods.

(4) Recovered Asphalt Dynamic Shear Rheometer (DSR). The Engineer may take production samples or cores from suspect areas of the project to determine recovered asphalt properties. Asphalt binders with an aging ratio greater than 3.5 do not meet the requirements for recovered asphalt properties and may be deemed defective when tested and evaluated by the Construction Division. The aging ratio is the dynamic shear rheometer (DSR) value of the extracted binder divided by the DSR value of the original unaged binder. DSR values are obtained according to AASHTO T 315 at the specified high temperature performance grade of the asphalt. The Engineer may require removal and replacement of the defective material at the Contractor's expense. The asphalt binder will be recovered for testing from production samples or cores in accordance with Tex-211-F.

4. Irregularities. Immediately take corrective action if surface irregularities, including but not limited to segregation, rutting, raveling, flushing, fat spots, mat slippage, color, texture, roller marks, tears, gouges, streaks, or uncoated aggregate particles, are detected.

The Engineer may allow placement to continue for at most 1 day of production, while taking appropriate action. If the problem still exists after that day, suspend paving until the problem is corrected to the satisfaction of the Engineer.

At the expense of the Contractor and to the satisfaction of the Engineer, remove and replace any mixture that does not bond to the existing pavement or that has other surface irregularities identified above.

5. Ride Quality. Unless otherwise shown on the plans, measure ride quality in accordance with Item 585, "Ride Quality for Pavement Surfaces."

5. Measurement. CAM will be measured by the ton of composite CAM. The composite CAM is defined as the asphalt, aggregate, and additives. The weight of asphalt and aggregate will be calculated based on the measured weight of CAM and the target percentage of asphalt and aggregate. Measure the weight on scales in accordance with Item 520, "Weighing and Measuring Equipment."

A. Asphalt. The asphalt weight in tons will be determined from the total weight of CAM. Measured asphalt percentage will be obtained using Tex-236-F or asphalt flow meter readings, as determined by the Engineer,

1. Target Percentage. The JMF target asphalt percentage will be used to calculate the weight of asphalt binder for the lot, unless the measured asphalt percentage for any sublot is more than 0.3 percentage points below the JMF target asphalt. Volumetric meter readings will be adjusted to 140°F and converted to weight.

2. **Measured Percentage.** The averaged measured asphalt percentage from each sublot will be used for payment for that lot's production when the measured percentage for any sublot is more than 0.3 percentage points below the JMF target asphalt percentage.

B. Aggregate. The aggregate weight in tons will be determined from the total weight of CAM, less the weight of the asphalt.

6. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under Section 5, "Measurement," will be paid for at the unit price bid for "CAM (Asphalt)" of the binder specified and for "CAM (Aggregate)". These prices are full compensation for surface preparation; materials, including tack coat; placement; equipment, labor; tools; and incidentals.

Trial batches will not be paid for unless they are included in pavement work approved by the Department.

Pay adjustment for ride quality will be determined in accordance with Item 585, "Ride Quality for Pavement Surfaces."