

ITEM 342

PERMEABLE FRICTION COURSE (PFC)

342.1. Description. Construct a surface course composed of a compacted permeable mixture of aggregate, asphalt binder, and additives mixed hot in a mixing plant.

342.2. Materials. Furnish uncontaminated materials of uniform quality throughout 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 coarse aggregate. Do not use fine aggregate or reclaimed asphalt pavement (RAP) in PFC mixtures. 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 and production testing based on the washed sieve analysis given in 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 nonlisted sources only when tested by the Engineer and approved before use. Allow 30 calendar days for the Engineer to sample, test, and report results for nonlisted sources.

Provide coarse aggregate with at least the minimum SAC as shown on the plans. SAC requirements only apply to aggregates used on the surface of travel lanes, unless otherwise shown on the plans. 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 the material retained on the No. 4 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.

**Table 1
Coarse Aggregate Quality Requirements**

Property	Test Method	Requirement
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

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.

2. **RAP.** Do not use RAP in PFC mixtures.
- B. Baghouse Fines.** Fines collected by the baghouse or other dust collecting equipment may be reintroduced into the mixing drum.
- C. Asphalt Binder.** Furnish performance-graded (PG) asphalt binder and fibers unless the plans specify asphalt-rubber (A-R) binder. Provide asphalt binder that meets requirements of Item 300, “Asphalts, Oils, and Emulsions.”
1. **PG Binder.** When PG binder is specified, provide an asphalt binder with a high-temperature grade of PG 76 and low-temperature grade as shown on the plans in accordance with Section 300.2.J, “Performance-Graded Binders.”
 2. **A-R Binder** When A-R binder is specified, provide A-R binder that meets the Type I or Type II requirements of Section 300.2.I, “Asphalt-Rubber Binders,” unless otherwise shown on the plans. Use at least 15.0% by weight of Crumb Rubber Modifier (CRM) that meets the Grade B or Grade C requirements of Section 300.2.G, “Crumb Rubber Modifier,” unless otherwise shown on the plans.
 3. **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 in accordance with Item 300, “Asphalts, Oils, and Emulsions.” Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

The Engineer will obtain at least 1 sample of the tack coat binder per project and test to verify compliance with Item 300. The Engineer will obtain the sample from the asphalt distributor immediately before use.
- D. 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.
1. **Fibers.** When PG binder is specified, provide cellulose or mineral fibers. Do not use fibers when A-R binder is specified. Submit written certification to the Engineer that the fibers proposed for use meet the requirements of DMS-9204, “Fiber Additives for Bituminous Mixtures.”
 2. **Lime Mineral Filler.** When PG binder is specified, add lime as mineral filler at a rate of 1.0% by weight of the total dry aggregate. 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.
 3. **Antistripping Agents.** If lime or a 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.

342.3. Equipment. Provide required or necessary equipment in accordance with Item 320, “Equipment for Hot-Mix Asphalt Materials.” When A-R binder is specified, equip the hot-mix plant with an in-line viscosity measuring device located between the blending unit and the mixing drum.

342.4. Construction. Produce, haul, place, and compact the specified paving mixture. When shown on the plans, 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 2. In addition to meeting the certification requirements in Table 2, 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 that is 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 2
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
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
Rice gravity	Tex-227-F	✓	✓	IA
Ignition oven calibration ¹	Tex-236-F	✓	✓	II
Drain-down	Tex-235-F	✓	✓	IA
Boil test	Tex-530-C	✓	✓	IA
Cantabro loss	Tex-245-F	✓	✓	II

**Table 2 (continued)
Test Methods, Test Responsibility, and Minimum Certification Levels**

3. Production Testing	Test Method	Contractor	Engineer	Level
Control charts	Tex-233-F	✓	✓	IA
Mixture sampling	Tex-222-F	✓	✓	IA
Gradation & asphalt content ¹	Tex-236-F	✓	✓	IA
Moisture content	Tex-212-F	✓	✓	IA
Micro-Deval abrasion	Tex-461-A		✓	
Drain-down	Tex-235-F	✓	✓	IA
Boil test	Tex-530-C	✓	✓	IA
Aging ratio	Tex-211-F		✓	
4. Placement Testing	Test Method	Contractor	Engineer	Level
Control charts	Tex-233-F	✓	✓	IA
Ride quality measurement	Tex-1001-S	✓	✓	IB
Thermal profile	Tex-244-F	✓	✓	IB
Tack coat adhesion	Tex-243-F		✓	
Permeability	Tex-246-F	✓	✓	IB

1. Refer to Section 342.4.E for exceptions to using ignition oven.

B. Reporting. Use Department-provided software to record and calculate all test data. The Engineer and the Contractor shall provide any available test results to the other party when requested. The Engineer and the Contractor shall 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.

When directed, use the procedures described in Tex-233-F to plot the results of all productions and placement testing. Update the control charts as soon as test results for each subplot 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.

When directed, submit a written QCP to the Engineer before the mandatory preparing 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 quality control (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, RAP, lime, liquid antistriper),
 - 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 preparing 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.** Unless otherwise shown on the plans, use the PFC design procedure given in Tex-204-F, Part V, to design a mixture meeting the requirements listed in Tables 1, 3 and 4. Use $N_{des} = 50$ as the design number of gyrations.

The Contractor may submit a new mixture design at anytime 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 3
Master Gradation Band (% Passing by Weight or Volume)
and Binder Content**

Sieve Size	PG 76 Mixtures	A-R Mixtures
3/4"	100.0	100.0
1/2"	80.0–100.0	95.0–100.0
3/8"	35.0–60.0	50.0–80.0
#4	1.0–20.0	0.0–8.0
#8	1.0–10.0	0.0–4.0
#200	1.0–4.0	0.0–4.0
Binder Content, %		
	5.5–7.0	8.0–10.0

**Table 4
Laboratory Mixture Design Properties**

Mixture Property	Test Method	Minimum	Maximum
Drain-down, %	Tex-235-F	–	0.20
Laboratory-molded density, %	Tex-207-F, Part VI	78.0 ¹	82.0
Fiber content ² , %	Calculated	0.20	0.50
Lime content ² , %	Calculated	1.0	2.0
CRM content ³ , %	Calculated	15.0	
Boil test	Tex-530-C	–	None
Cantabro loss, %	Tex-245-F	–	20.0 ¹

1. Suggested limit. Test and report for informational purposes only.

2. By weight of total mixture. Not required when using A-R.

3. By weight of asphalt. Not required when using PG 76 and fibers.

1. 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 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 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.
- (4) Supplying Aggregates.** 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 using Tex-236-F. Provide the Engineer with split samples of the mixtures and blank samples used to determine the correction factors.
- (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. If signs of stripping exist, add lime or liquid antistripping agent as directed.
- (8) **Trial Batch Approval.** Upon receiving conditional approval of JMF1 from the Engineer, provide a plant-produced trial batch 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 operational tolerances in Table 5.
- (12) **Trial Batch Sampling.** Obtain a representative sample of the trial batch and split it into 3 equal portions in accordance with Tex-222-F. Label these portions as “Contractor,” “Engineer,” and “Referee.” Deliver samples to the appropriate laboratory.
- (13) **Trial Batch Testing.** Test the trial batch to ensure the mixture produced using the proposed JMF1 meets the verification testing requirements for gradation, binder content, laboratory-molded density, and drain-down listed in Table 5. 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, use JMF2 to produce Lot 1.
- (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 of a new lot,
 - be numbered in sequence to the previous JMF,
 - meet the master gradation limits shown in Table 3, and
 - be within the operational tolerances of JMF2 listed in Table 5.
- (18) **Requesting Referee Testing.** If needed, use the referee testing in accordance with Section 342.4.I.1, “Referee Testing,” to resolve testing differences with the Engineer.

b. Engineer’s Responsibilities.

- (1) **Gyratory Compactor.** For molding trial batch and production samples, the Engineer will use the Contractor-provided SGC at the Contractor’s field laboratory or provide and use a Department SGC, calibrated according to Tex-241-F, at an alternate location.
- (2) **Conditional Approval of JMF1.** Within 2 working days of receiving the mixture design report (JMF1) and all required materials, the Engineer will review the Contractor’s mixture design report and verify conformance with all aggregates, asphalt, additives, and mixture specifications. The Engineer may perform tests to verify 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 the Contractor’s mixture design meets the specifications. Full approval of JMF1 will be based on the Engineer’s test results on mixture from the trial batch.

Table 5
Testing Frequency and Mixture Production Tolerances

Test Description	Test Method	Minimum Contractor Testing Frequency	Minimum Engineer Testing Frequency	Operational Tolerance from JMF
Individual % retained for sieve sizes larger than #200	Tex-200-F	1 per subplot	1 per 12 sublots	±5.0 ¹
% passing the #200				±2.0 ¹
Laboratory-molded density, %	Tex-207-F, Part VI	1 per subplot	1 per lot	Table 4
Binder content, %	Tex-236-F	1 per subplot	1 per lot ²	±0.3
Drain-down, %	Tex-235-F	1 per subplot	1 per 12 sublots	Table 4
Boil test ³	Tex-530-C	1 per project	1 per project	N/A
Asphalt Binder Sampling ³	Tex-500-C	1 per subplot (sample only)	1 per project	N/A
Thermal profile	Tex-244-F	1 per subplot	Optional	N/A

1. Aggregate gradation will not exceed limits shown in Table 3.

2. May be obtained from asphalt meter readouts.

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

- (3) **Authorizing Trial Batch.** After conditionally approving JMF1, the Engineer will authorize the Contractor to produce a trial batch.
- (4) **Ignition Oven Correction Factor.** 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.
- (5) **Testing the Trial Batch.** Within 1 full working day, the Engineer will sample and test the trial batch to ensure that the gradation, binder content, and laboratory molded density meet the requirements listed in Table 5.

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

- Tex-235-F to verify that drain-down meets the requirement shown in Table 4.
- Tex-461-A to determine the need for additional magnesium sulfate soundness testing.
- Tex-530-C to retain and use for comparison purposes during production.
- Tex-245-F to verify the Cantabro loss meets the requirement shown in Table 4.

- (6) **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, and laboratory-molded density confirm that the trial batch meets the requirements in Table 5.

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.

- (7) **Approval of JMF2.** The Engineer will approve JMF2 within 1 working day if it meets the master grading limits shown in Table 3 and is within the operational tolerances of JMF1 listed in Table 5.
- (8) **Approval of Lot 1 Production.** The Engineer will authorize the Contractor to proceed with Lot 1 production after approving JMF2.
- (9) **Approval of JMF3.** The Engineer will approve JMF3 within 1 working day if it meets the master grading limits shown in Table 3 and is within the operational tolerances of JMF2 listed in Table 5.

2. **JMF Adjustments.** Produce the mixture within the operational tolerances listed in Table 5. The Engineer may suspend production if corrective actions are not taken when operational tolerances are exceeded. With approval from the Engineer, the JMF target values may be adjusted as needed. Document any changes to the JMF with a subsequent JMF number. The Engineer may adjust the target asphalt percentage or fiber percentage within the operational tolerances of the JMF.

- E. Production Operations.** Perform a new trial batch when the plant or plant location is changed. Perform QC at the frequency and within the tolerances listed in Table 5. Take corrective action and receive approval to proceed after any production suspension for noncompliance to the specification. At any time during production, the Engineer may require the Contractor to verify the following based on quantities used:
- lime content (within $\pm 0.1\%$ of JMF), when PG binder is specified;
 - fiber content (within $\pm 0.03\%$ of JMF), when PG binder is specified; and
 - CRM content (within $\pm 1.5\%$ of JMF), when A-R binder is specified.
- When A-R binder is specified, maintain the in-line measuring device to verify the A-R binder viscosity of at least 2,500 centipoise at 350°F unless otherwise approved.
- 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.
- 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.** Notify the Engineer of the target discharge temperature and produce the mixture within 25°F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed 350°F. The Department will not pay for or allow placement of any mixture produced at more than 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 mixture is not contaminated. When a release agent is necessary to coat the truck bed, use a release agent on the approved list maintained by the Construction Division.
- G. Placement Operations.** 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 longitudinal joints on the surface course coincide with lane lines, or as directed. Ensure that all finished surfaces will drain properly.
- 1. Weather Conditions.** Place mixture when the roadway surface temperature is 70°F or higher unless otherwise approved. Measure the roadway surface temperature with a handheld infrared thermometer. Unless otherwise shown on the plans, place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable in the opinion of the Engineer.
 - 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. 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.** Measure the temperature of mixture delivered to the paver and take corrective action if needed to ensure the temperature does not drop below 280°F. For each subplot use a handheld infrared thermometer to obtain a thermal profile of the uncompacted mat immediately behind the paver.

Record the information on Department QC/QA forms and submit the forms to the Engineer.

- a. **Thermal Profile.** For each subplot, obtain a thermal profile using 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 to have thermal segregation. Take corrective action to eliminate areas that have thermal segregation. Unless otherwise directed, suspend operations if maximum temperature differential exceeds 50°F. Resume operations when the Engineer determines that subsequent production will meet the requirements of this Item.
- 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.** Roll the freshly placed PFC with a steel-wheeled roller, operated in static mode, to seat the mixture without excessive breakage of the aggregate and to provide a smooth surface and uniform texture. Do not use pneumatic rollers. Thoroughly moisten the roller drums with a soap-and-water solution to prevent adhesion. Unless otherwise directed, use only water or an approved release agent on rollers, tamps, and other compaction equipment.

The Engineer may use or require the Contractor to use Tex-246-F to test and verify that the compacted mixture has adequate permeability. Adjust the mixture design or construction methods if the compacted mixture does not exhibit adequate permeability.

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 subplot basis. A production lot consists of 4 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 and 4,000 tons. The Engineer may change the lot size before the Contractor begins any lot. If the production or placement test results are not within the acceptable tolerances listed in Table 5, 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.

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 tolerances shown in Table 5 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 subplot in question and only for the particular test in question. Allow 10 working days from the time the samples are received at the referee laboratory for test results to be reported. The Department may require the Contractor to reimburse the Department for referee tests if more than 3 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.

2. **Asphalt Binder Sampling.** Obtain a 1-qt. (1-gal. for A-R binder) sample of the asphalt binder for each subplot of mixture produced. Obtain the sample at approximately the same time the mixture random sample is obtained. Sample from a port located immediately upstream from the mixing drum or pug mill. Take the sample in accordance with the pipeline sampling procedure given in Tex-500-C, Part II. Label the can with the corresponding lot and subplot 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 1 asphalt binder sample per project to verify compliance with Item 300, "Asphalts, Oils, and Emulsions."

3. **Operational Tolerances.** Control the production process within the operational tolerances listed in Table 5. When production is suspended, the Engineer will allow production to resume when test results or other information indicates the next mixture produced will be within the operational tolerances.
4. **Recovered Asphalt 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 PG 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 using Tex-211-F.
5. **Irregularities.** Immediately take appropriate corrective actions 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.
6. **Ride Quality.** Unless otherwise shown on the plans, measure ride quality in accordance with Item 585, "Ride Quality for Pavement Surfaces."

342.5. Measurement. PFC will be measured by the ton of composite PFC. The composite PFC is defined as the asphalt, aggregate, and additives. The weights of asphalt and aggregate will be calculated based on the measured weight of PFC 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 PFC. 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 unless the measured asphalt binder percentage is more than 0.3 percentage points below the JMF target asphalt percentage. Volumetric meter readings will be adjusted to 140°F and converted to weight.
 2. **Measured Percentage.** The measured asphalt percentage will be used for payment for that lot's production when the measured percentage 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 PFC less the weight of the asphalt.

342.6. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "PFC (Asphalt)" of the binder specified and for "PFC (Aggregate)" of the grade and surface aggregate classification specified. 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."