

ITEM 334

**HOT-MIX COLD-LAID ASPHALT CONCRETE PAVEMENT**

**334.1. Description.** Construct a cold-laid pavement layer composed of a compacted mixture of aggregate and asphalt material mixed hot in a mixing plant.

This Item governs mixtures designed for cold placement, defined as placement temperatures below 175°F. If the mixture placement temperature is greater than 175°F, then design, produce, place, and compact the mixture in accordance with the applicable hot-mix asphalt specification.

**334.2. 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 assure specification compliance.

**A. Aggregate.** Furnish aggregates from sources that conform to the requirements shown in Table 1 and on the plans. Unless otherwise directed, the Engineer will obtain the aggregate samples from materials produced for the project and perform the tests in Table 1. Mechanically crushed gravel or stone aggregates must meet the definitions in Tex-100-E. The Engineer will designate the plant or the quarry as the sampling location, and will 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 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 surface aggregate classification (SAC) shown on the plans. SAC requirements apply only 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.

- 2. Fine Aggregate.** Fine aggregates consist of manufactured sands, screenings, and field sands. 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. No more than 15% of the total aggregate may be field sand or other uncrushed fine aggregate. With the exception of field sand, use fine aggregate from coarse aggregate sources that meet the requirements shown 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
<b>Coarse Aggregate</b>		
SAC	AQMP	As shown on the plans
Deleterious material, %, max	Tex-217-F, Part I	1.5
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	40
Magnesium sulfate soundness, 5 cycles, %, max	Tex-411-A	30 <sup>2</sup>
Coarse aggregate angularity, 2 crushed faces, %, min	Tex-460-A, Part I	85 <sup>3</sup>
Flat and elongated particles @ 5:1, %, max	Tex-280-F	10
<b>Fine Aggregate</b>		
Linear shrinkage, %, max	Tex-107-E	3
<b>Combined Aggregates<sup>4</sup></b>		
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. Unless otherwise shown on the plans.
3. Unless otherwise shown on the plans. Only applies to crushed gravel.
4. Aggregates, without added mineral filler or additives, combined as used in the job-mix formula (JMF).

**Table 2**  
**Gradation Requirements for Fine Aggregates**

Sieve Size	% Passing by Weight or Volume
3/8"	100
#8	70–100
#200	0–15

- B. Mineral Filler.** Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, hydrated lime, cement, or fly ash. Mineral filler is allowed unless otherwise shown on the plans. Do not use more than 2% hydrated lime or cement, unless otherwise shown on the plans. The plans may require or disallow specific mineral fillers. When used, provide mineral filler that:
- is sufficiently dry, free-flowing, and free from clumps and foreign matter;
  - does not exceed 3% linear shrinkage when tested in accordance with Tex-107-E; and
  - meets the gradation requirements in Table 3.

**Table 3**  
**Gradation Requirements for Mineral Fillers**

Sieve	% 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. Binder Material.** Furnish asphalt, primer, additives, and water, unless otherwise shown on the plans.
1. **Asphalt.** Provide the asphalt shown on the plans, meeting the requirements of Item 300, “Asphalts, Oils, and Emulsions.”
  2. **Primer.** Provide an approved asphalt primer consisting of a blend of asphalt cement and hydrocarbon volatiles.
  3. **Water.** Provide water that meets the requirements of Item 204, “Sprinkling.”
  4. **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.  
If lime or a liquid antistripping agent is used, add 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.

- E. Tack Coat.** Unless otherwise shown on the plans or approved, furnish CSS-1H, SS-1H, or a performance-graded (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 Department may sample the tack coat to verify specification compliance.

**334.3. Equipment.** Provide required or necessary equipment in accordance with Item 320, "Equipment for Asphalt Concrete Pavement."

**334.4. Construction.** Design, produce, store, transport, place, and compact the specified paving mixture in accordance with the requirements of this Item. Unless otherwise shown on the plans, provide the mix design. The Department will perform quality assurance (QA) testing. Provide quality control (QC) testing as needed to meet the requirements of this Item.

**A. Mixture Design.**

- 1. Design Requirements.** Unless otherwise shown on the plans, use the typical weight design example given in Tex-204-F, Part I, to design a paving mixture that consists of a uniform mixture of aggregate, asphalt material, primer, additives, and water if allowed, which meets the requirements shown in Tables 4 and 5. Ensure that the mixture leaves the plant in a workable condition. Provide materials that remain workable in a stockpile for at least 6 mo.

At any time during the project, the Contractor may submit a new mixture design. The Engineer must approve all mixture designs before the Contractor can begin production.

- 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 mixture production. JMF1 is the original laboratory mixture design used to produce the trial batch. The Engineer 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. Provide the Engineer with split samples of the mixtures and blank samples used to determine the ignition oven correction factors. The Engineer will determine the aggregate and asphalt correction factors from the ignition oven using Tex-236-F.

**Table 4**  
**Master Gradation Bands (% Passing by Weight or Volume)**  
**and Volumetric Properties**

Sieve Size	A Coarse Base	B Fine Base	C Coarse Surface	D Fine Surface	F Fine Mixture
1-1/2"	98.0–100.0	–	–	–	–
1"	78.0–94.0	98.0–100.0	–	–	–
3/4"	64.0–85.0	84.0–98.0	95.0–100.0	–	–
1/2"	50.0–70.0	–	–	98.0–100.0	–
3/8"	–	60.0–80.0	70.0–85.0	85.0–100.0	98.0–100.0
#4	30.0–50.0	40.0–60.0	43.0–63.0	50.0–70.0	80.0–86.0
#8	22.0–36.0	29.0–43.0	32.0–44.0	35.0–46.0	38.0–48.0
#30	8.0–23.0	13.0–28.0	14.0–28.0	15.0–29.0	12.0–27.0
#50	3.0–19.0	6.0–20.0	7.0–21.0	7.0–20.0	6.0–19.0
#200	2.0–7.0	2.0–7.0	2.0–7.0	2.0–7.0	2.0–7.0
<b>Design VMA<sup>1</sup>, % Minimum</b>					
–	12.0	13.0	14.0	15.0	16.0
<b>Plant-Produced VMA<sup>1</sup>, % Minimum</b>					
–	11.0	12.0	13.0	14.0	15.0

1. Voids in mineral aggregates.

**Table 5**  
**Laboratory Mixture Design Properties**

Property	Test Method	Requirement
Target laboratory-molded density, % <sup>1</sup>	Tex-207-F	92.5 ±1.5
Hveem stability, min	Tex-208-F	35
Hydrocarbon-volatile content, %, max	Tex-213-F	0.6
Moisture content, %, max <sup>2</sup>	Tex-212-F	1.0
Boil test, %, max <sup>3</sup>	Tex-530-C	10

1. Unless otherwise shown on the plans.

2. Unless otherwise approved.

3. Limit may be increased or eliminated when approved by the Engineer.

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

- 1. Stockpiling of Aggregates.** Provide a smooth and well-drained area, cleared of trash, weeds, and grass. Build stockpiles in a manner that will minimize aggregate degradation and segregation. Avoid contamination and mixing of stockpiles. Provide aggregate stockpiles for a minimum of 2 days' production before beginning plant operations. Maintain at least a 2-day aggregate supply through the course of the project unless otherwise directed. Stockpile aggregate for each source and type separately. The Engineer may reject stockpiled materials that come in contact with the earth or other objectionable material.
- 2. Storage and Heating of Asphalt Materials.** Provide enough asphalt material storage capacity to meet the requirements of the plant. Do not heat the asphalt binder above the temperatures specified in Item 300, "Asphalts, Oils, and Emulsions," or from the manufacturer's recommended values. Keep all equipment used in the storage and handling of asphalt material clean at all times and operate the equipment in a manner that will prevent contamination with foreign matter.
- 3. Storage of the Asphalt Mixture.** Store the asphalt mixture in a surge-storage system or in a stockpile. If the asphalt mixture is stored in a stockpile, provide a smooth and well-drained area, cleared of trash, weeds, and grass. Build stockpiles in a manner that will minimize aggregate degradation and segregation. Avoid contamination and mixing of stockpiles.
- 4. Mixing and Discharge of Materials.** Produce the mixture at a discharge temperature between 145°F and 275°F, as directed. Do not allow the temperature to vary from the selected temperature by more than 25°F. The Department will not pay for or allow placement of any mixture produced at more than 300°F.

- 5. Moisture Content.** Furnish the mixture at a moisture content of at most 1% by weight when discharged from the mixer, unless otherwise shown on the plans or approved. Cease operations at moisture contents above 1% until corrective actions reduce moisture content.
- C. Hauling Operations.** Before use, clean all truck beds to ensure mixture is not contaminated. When a release agent is necessary to coat truck beds, use a release agent on the approved list maintained by the Construction Division.
- D. 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 mixture on the road below 175°F. Place the mixture to produce a smooth, finished surface with a uniform appearance and texture that meet typical section requirements. Offset longitudinal joints of successive courses of mixture 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.

Unless otherwise shown on the plans, the asphalt mixture may be dumped in a windrow and then placed in the finishing machine with windrow pickup equipment. Prevent the windrow pickup equipment from contaminating the mixture.

After placing the paving mixture, defer compaction, as directed by the Engineer, to allow for volatilization. When placing more than 1 pavement course, allow the previous course to dry and cure before placing the next course. Unless otherwise directed, the course will be considered cured if the hydrocarbon volatile content of the mixture is 0.4% or less by weight of the mixture when tested according to Tex-213-F.

When shown on the plans or as approved, a motor grader may be used to spread the mixture. Thoroughly aerate the mixture and spread into place with a power motor grader in a uniform layer. Placement in narrow strips or small irregular areas may require hand spreading.

- 1. Weather Conditions.** Place the mixture when the roadway surface temperature is 60°F or higher unless otherwise approved. 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 joints. Prevent splattering of the 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.
- E. Compaction.** Furnish the type, size, and number of rollers required for compaction, as approved. Furnish at least 1 medium pneumatic-tire roller (minimum 12-ton weight). Use the control strip method given in Tex-207-F, Part IV, to establish rolling patterns that achieve maximum compaction. Follow the selected rolling pattern unless changes that affect compaction occur in the mixture or placement conditions. When such changes occur, establish a new rolling pattern. Compact the pavement to the cross section of the finished paving mixture meeting the requirements of the plans and specifications. Unless otherwise directed, operate vibratory rollers in static mode when not compacting, when changing directions, or when the plan depth of the pavement mat is less than 1-1/2 in.

When rolling with the 3-wheel tandem or vibratory rollers, start by first rolling the joint with the adjacent pavement and then continue by rolling longitudinally at the sides. Proceed toward the center of the pavement, overlapping on successive trips by at least 1 ft., unless otherwise directed. Make alternate trips of the roller slightly different in length. On superelevated curves, begin rolling at the low side and progress toward the high side unless otherwise directed.

Avoid displacement of the mixture. If any displacement occurs, correct to the satisfaction of the Engineer. Ensure pavement is fully compacted before allowing rollers to stand on the pavement.

Unless otherwise directed, use only water or an approved release agent on rollers, tamps, and other compaction equipment. Keep diesel, gasoline, oil, grease, and other foreign matter off the mixture.

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 the 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.

**F. Production Testing and Operational Tolerances.** The aggregate gradation and the asphalt binder content of the produced mixture must not vary from the JMF by more than the percentage point tolerances shown in Table 6. The gradation of the produced mixture may fall outside the master grading limits for any of the sieve sizes from the 1-1/2 in. through the No. 50 sieve if it is within the JMF tolerances. The aggregate gradation of the No. 200 sieve may not exceed the master gradations shown in Table 4. Any sieve size shown in Table 4 with 100% passing requirements will be allowed a 2% tolerance before the material is considered out of specification.

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.

If during production, 3 consecutive tests indicate that the material produced exceeds the tolerances shown in Table 6 for any individual sieve or for laboratory-molded density, cease production until corrective actions are taken and the results approved. If 2 consecutive tests indicate that the asphalt binder content tolerances shown in Table 6 are exceeded, cease production until corrective actions are taken and the results approved.

If the Hveem stability shown in Table 5 is not met for 3 consecutive tests, cease production until corrective actions are taken and the results approved.

**Table 6  
Operational Tolerances**

Property	Test Method	Operational Tolerance From JMF
Individual % retained for sieve sizes smaller than 1-1/2" and larger than #8	Tex-200-F	±5.0
Individual % retained for sieve sizes smaller than #8		±3.0
Asphalt binder content, %	Tex-236-F	±0.3
Laboratory-molded density, %	Tex-207-F	±1.0

**G. 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 suspend production or placement operations until the problem is corrected.

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.

**H. Ride Quality.** Use Surface Test Type A to evaluate ride quality in accordance with Item 585, "Ride Quality for Pavement Surfaces," unless otherwise shown on the plans.

**334.5. Measurement.** This Item will be measured by the by the ton of composite asphalt concrete mixture of the type used in the completed and accepted work.

Measurement will be made on scales in accordance with Item 520, "Weighing and Measuring Equipment."

For mixture produced by a weigh-batch plant or a modified weigh-batch plant, measurement will be determined on the batch scales unless surge-storage or stockpiling is used. Keep records of the number of batches, batch design, and the weight of the composite asphalt concrete mixture. The composite asphalt concrete mixture is defined as the asphalt, primer, aggregate, additives, and any residual moisture that is not designated to be deducted. Where surge-storage or stockpiling is used, measurement of the material taken from the surge-storage bin or stockpile will be made on truck scales or suspended hopper scales.

**334.6. Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under Article 334.5, "Measurement," will be paid for at the unit price bid for "Hot-Mix Cold-Laid Asphalt Concrete Pavement" of the type, surface aggregate classification, and asphalt binder specified.

This price is full compensation for surface preparation, materials including tack coat, placement, equipment, labor, tools, and incidentals.

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