

Tex-236-F, Determining Asphalt Content from Asphalt Paving Mixtures by the Ignition Method

Overview

Effective date: August 1999 to October 2004

Use this method to determine the asphalt content of hot mixed paving mixtures by ignition of the asphalt cement.

The remaining aggregate can be used for sieve analysis according to Test Method "Tex-200-F, Sieve Analysis of Fine and Coarse Aggregates."

Apparatus

The following apparatus is required:

- ◆ a forced air ignition furnace, capable of maintaining a temperature of 650 °C (1202 °F), with an internal balance thermally isolated from the furnace chamber accurate to 0.1 g. The balance must be capable of weighing a 3500 g sample in addition to the sample baskets. The furnace must calculate a temperature compensation factor for the change in weight of the sample baskets and provide for the input of a correction factor for aggregate loss. The furnace must have the means for providing the following information:
 - Initial specimen weight
 - Specimen weight loss
 - Temperature compensation
 - Correction factor
 - Corrected asphalt content (%)
 - Test time
 - Test temperature.
- ◆ The sample chamber dimensions must be at least 305 x 254 x 305 mm (W x H x D) (12 x 10 x 12 in.). There must be a method for reducing furnace emissions. The furnace must provide an audible alarm and indicator light when the sample reaches constant weight. The furnace door must automatically lock when the test procedure begins and must remain locked until the test procedure is completed.
- ◆ a tempered stainless steel 2.36 mm (No. 8) mesh or otherwise perforated basket, or combination of baskets capable of handling at least a 1500 g sample. The basket must incorporate a design which confines the sample during testing.
- ◆ a tempered stainless steel catch pan, to fit under the basket assembly.
- ◆ oven capable of maintaining 121 ± 3 °C (250 ± 5 °F)

- ◆ balance, 8 kg (17.6 lbs.) or greater capacity, accurate to 0.1 g for weighing sample in baskets.

Safety Equipment

- ◆ safety glasses or face shield, high temperature gloves, and long sleeve jacket.
- ◆ a heat resistant surface capable of withstanding 650 °C (1,202 °F).
- ◆ a protective cage capable of surrounding the sample baskets.

Miscellaneous Equipment

Pan for transferring samples after ignition, spatulas, bowls and wire brushes.

Report Format

The following Microsoft Excel program may be used for reporting purposes.

- ◆ QC/QA worksheets for the Ignition Oven Method (used in conjunction with Hot Mix specification) ([newqcqa3](#)). (Refer to the 'Help' tab for detailed instructions on how to use this program.)

Preparing Samples

Quarter a test sample out of a larger sample taken according to Test Method "Tex-222-F, Sampling Bituminous Mixtures."

Preparing Test Specimens

If the mixture is not sufficiently workable to separate with a spatula or trowel, place it in a large flat pan and warm to 121 ± 3 °C (250 ± 5 °F) for 30 minutes. Do not heat sample for more than 1 hour.

Govern the size of the test sample by the nominal maximum aggregate size of the mixture and must conform to the mass requirement shown in the 'Sample Size' table (see NOTE 1).

Use this table to gauge size of sample.

Sample Size		
Nominal Maximum Aggregate Size, mm	Sieve Size	Minimum Mass of Sample, g
4.75	No. 4	1200
9.5	3/8 in.	1200
12.5	½ in.	1500

Sample Size		
Nominal Maximum Aggregate Size, mm	Sieve Size	Minimum Mass of Sample, g
19.0	3/4 in.	2000
25.0	1 in.	3000
37.5	1-1/2 in.	4000

NOTE 1: Define 'Nominal Maximum Aggregate Size' as the largest sieve that retains 10% or more of the total aggregate mixture.

Sample sizes should not be more than 400 g greater than the minimum recommended sample mass. Large samples of fine mixes tend to result in incomplete ignition of the asphalt. When the mass of the test specimen exceeds the recommended maximum capacity of the equipment used, the test specimen may be divided into suitable increments, tested, and the results appropriately combined for calculation of the asphalt content (weighted average).

Make a test specimen for moisture determination as is necessary. The specimen used for moisture determination must not be used for asphalt content determination.

Calibration

Determine an asphalt content calibration factor for each mixture.

For mixtures containing RAP, sample enough to accurately estimate the binder content, and to provide that the RAP is used in the mix calibration.

Estimate the binder content of the RAP from the average of four samples (RAP only) burned in the furnace. The RAP must be heated at 60 °C (140 °F), broken apart until friable and quartered to obtain a representative sample.

Mixture Calibration

The type of aggregate in the mixture may effect the ignition procedure. Accordingly, to optimize accuracy, establish a calibration factor by testing a set of samples for each mix type. Perform the mixture calibration during the mixture design process.

Use the steps in this table to calibrate mixture quantities.

Mixture Calibration	
Step	Action
1	<ul style="list-style-type: none"> ◆ Prepare six calibration specimens conforming to the mass requirements of the 'Sample Size' table. <ul style="list-style-type: none"> • two at the design asphalt content • two each at $\pm 0.5\%$ of the design asphalt content.

Mixture Calibration	
Step	Action
	<ul style="list-style-type: none"> ◆ A 'butter batch mix' must be prepared for the 'design asphalt content' specimen, mixed and discarded prior to mixing any of the calibration specimens to ensure an accurate asphalt content. ◆ Sample aggregate used for the calibration specimens according to Test Method "Tex-221-F, Sampling Aggregate for Bituminous Mixtures, Surface Treatments and Limestone Rock Asphalt." ◆ Aggregate must be combined according to the procedure outlined in Test Method "Tex-204-F, Design of Bituminous Mixtures."
2	◆ Batch two additional 'blank' samples and test according to 'Part II, Washed Sieve Analysis' of Test Method "Tex-200-F, Sieve Analysis of Fine and Coarse Aggregates."
3	<ul style="list-style-type: none"> ◆ Average both 'blank' samples for each sieve size. ◆ The average washed gradation must fall within the JMF (mix design) tolerances.
4	Weigh and record the weight of the basket assembly to the nearest 0.1 g.
5	Place the freshly mixed specimens directly into the sample baskets. <ul style="list-style-type: none"> ◆ If specimens cool, reheat in a 121 °C (250 °F) oven for 30 minutes. ◆ Do not preheat the sample baskets.
6	<ul style="list-style-type: none"> ◆ Preheat the ignition furnace to 500 °C (932 °F). ◆ Certain aggregate types (softer aggregates) may result in an unusually high correction factor and erroneous gradation results. Such mixtures should be calibrated and tested at a lower temperature. ◆ Record the furnace temperature (set point) prior to starting the test.
7	Enter an asphalt correction factor of 0.00 in the ignition furnace.
8	Evenly distribute the calibration specimen in the basket assembly taking care to keep the material away from the edges of the basket.
9	Weigh and record the sample and basket assembly to the nearest 0.1 g.
10	Calculate and record the initial weight of the sample (total weight - the weight of the sample basket assembly).
11	<ul style="list-style-type: none"> ◆ Input the initial weight of the sample specimen into the ignition furnace controller. ◆ Verify that the correct weight has been entered.
12	Open the chamber door and place the sample and basket assembly in the furnace. <ul style="list-style-type: none"> ◆ Failure of the furnace scale to stabilize may indicate that the sample basket assembly is contacting the furnace wall. ◆ If this occurs, adjust the sample basket inside the furnace.
13	Close the chamber door and start the test. <ul style="list-style-type: none"> ◆ This should lock the furnace chamber for the duration of the test.
14	Allow the test to continue until the stable light and audible stable indicator indicate the test is complete.
15	Press the start/stop button. <ul style="list-style-type: none"> ◆ This should unlock the sample chamber door.

Mixture Calibration	
Step	Action
16	Open the chamber door, remove the sample and allow it to cool to room temperature (approx. 45 minutes). ♦ Do not use a fan to assist in cooling the specimen to room temperature due to the possibility of losing fines.
17	♦ Perform a gradation analysis on the residual aggregate according to 'Part II, Washed Sieve Analysis' of Test Method "Tex-200-F, Sieve Analysis of Fine and Coarse Aggregates." ♦ The aggregate gradation must be compared to the washed sieve analysis performed in Step 2 and a correction factor established for each sieve size. ♦ Each gradation correction factor is the average of the six measured differences.
18	Once all six of the calibration specimens have been burned, determine the difference between the actual and measured asphalt contents for each sample. ♦ The asphalt content correction factor is the average of the six measured differences.

Procedure

Follow these steps to determine asphalt content from asphalt paving mixtures by the ignition method.

Determining Asphalt Content from Asphalt Paving Mixtures by the Ignition Method	
Step	Action
1	Preheat the ignition furnace to the temperature established from the calibration section of the procedure.
2	Enter the correction factor for the specific mix to be tested as determined in the 'Calibration' section of this procedure.
3	Weigh and record the weight of the sample basket assembly.
4	Prepare the sample as described under 'Preparing Test Specimens.'
5	Evenly distribute the specimen in the basket assembly taking care to keep the material away from the edges of the basket.
6	Weigh and record the sample and basket assembly to the nearest 0.1 g.
7	Calculate and record the initial weight of the sample specimen (total weight minus the weight of the sample basket assembly).
8	♦ Input the initial weight of the sample specimen into the ignition furnace controller. ♦ Verify that the correct weight has been entered.
9	Open the chamber door and place the sample and basket assembly in the furnace. ♦ Failure of the furnace scale to stabilize may indicate that the sample basket assembly is contacting the furnace wall. ♦ If this occurs, adjust the sample basket inside the furnace.
10	Close the chamber door and start the test. ♦ This should lock the furnace chamber for the duration of the test.
11	♦ Allow the test to continue until the stable light and audible stable indicator indicate the test is complete. ♦ Press the start/stop button. (This should unlock the furnace chamber.)
12	♦ Open the chamber door, remove the sample and allow it to cool to room temperature (approx.

Determining Asphalt Content from Asphalt Paving Mixtures by the Ignition Method	
Step	Action
	45 minutes). ◆ Do not use a fan to assist in cooling the specimen to room temperature due to the possibility of losing fines.

Gradation

The following steps detail determining gradation.

Determining Gradation	
Step	Action
1	Empty the contents of the baskets into a flat pan.
2	◆ Use a small wire sieve brush to ensure that any residual fines are removed from the basket. ◆ Add those fines to the contents in the flat pan.
3	Perform the gradation analysis according to 'Part II, Washed Sieve Analysis' of Test Method "Tex-200-F, Sieve Analysis of Fine and Coarse Aggregates."
4	◆ Apply the gradation correction factor for each sieve size as determined in the 'Calibration' section of this procedure. ◆ The gradation must fall within the JMF (mix design) tolerances.

Report

Always report corrected asphalt content, mix correction factor, temperature compensation factor, total percent loss, sample mass, and test temperature. Attach any original printed ticket to the report. An example data sheet is attached.

Link to Excel ([Newqcqa3](#)) for the 'Ignition Method of Extraction' worksheet and the 'Sieve Analysis Worksheet for Calibration Samples/Correction Factor Determination.'