

CITY OF COLUMBUS, OHIO

**SUPPLEMENT 1054
TEST METHOD FOR DETERMINATION
OF ASPHALT BINDER CONTENT BY
THE IGNITION METHOD**

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1054.1 Scope

This test method covers the determination of asphalt binder content of hot mixed paving mixtures by ignition of the asphalt binder in a furnace. The aggregate remaining can be used for sieve analysis.

1054.2 Safety

This standard may involve hazardous materials, operations, and equipment. This standard does not presume to address all of the safety problems associated with ignition oven's use. It is the responsibility of the user to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

Do not attempt to bypass the safety interlock on the oven door!!

1054.3 References

AASHTO Standards:

- T 248 - Practice for Sampling Asphalt Paving Mixtures
- T 30 - Mechanical Analysis of Extracted Aggregate

1054.4 Summary of Test Method

The asphalt binder in a sample of hot mixed paving material is burned by ignition at high temperature. The asphalt binder content is calculated from the mass of ignited aggregate, moisture content, and temperature compensation. The asphalt binder content is expressed as mass percentage of the moisture free mixture. This method may not be applicable to certain modified mixes. Contact the Laboratory if any question.

1054.5 Apparatus

- A. A forced air ignition furnace capable of maintaining a temperature of 1100 °F (600 °C). The oven may or may not have an internal balance. If so it must be thermally isolated from the furnace chamber. The internal balance must be accurate to 0.1 g. Ensure the balance is capable of weighing a 3500 gram sample in addition to the sample baskets. Ensure the furnace calculates 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. If the furnace has an internal balance provide a printed ticket with the initial specimen weight, specimen weight loss, temperature compensation, correction factor, corrected asphalt binder content (percent), test time and test temperature. As well ensure the furnace automatically determines weight loss and when weight is constant for two minutes signals the operator by an indicator light and audible alarm. Provide a method for reducing furnace emissions. Provide an automatic locking door.
- B. Two or more tempered stainless steel 2.36mm (No. 8) mesh or similar perforated baskets nested into a catch pan. Provide screening on the legs to confine the aggregate. Ensure a minimum surface area of 265mm (10.5 inch) x 265mm (10.5 inch) for one basket.
- C. One stainless steel catch pan.
- D. Ovens, balance and miscellaneous equipment as outlined in City Supplement 1041.
- E. Safety equipment: safety glasses or face shield, high temperature gloves, and long sleeve jacket or heat resistant sleeves. A heat resistant surface capable of withstanding 1200 °F (650 °C) and a protective cage appropriately labeled and capable of surrounding the sample baskets.
- F. Vent the furnace so no odors are noticeable in the laboratory. Ensure exhaust air moves by means of a fan on the furnace outlet. Ensure exhaust air movement is limited so as to not affect oven operation adversely.

1054.6 Sampling and Preparation

- A. Obtain the test sample in accordance with the appropriate specification. Plant samples may need to be quartered (AASHTO T 248). Testing road samples after testing in an asphalt binder content nuclear gauge will require quartering as well.
- B. Preparation of test specimens:

1. If the mix is too cold to separate, warm in an oven at less than 302 °F (150 °C) for sufficient time to soften.
2. The size of the test sample is governed by the type of asphalt concrete mix as shown in the table below. Conform to any existing requirements for sample size. Ensure no single oven test has a sample greater than 3000g. However, the test specimen may be divided into suitable increments, tested, and results recombined for calculation of the asphalt binder content (weighted average).

Minimum Sample Size by Mix Type

448 Type 1&2, 446 Type 1&2	2000g
301	2000g
302	2500g
Open Graded Friction Course	2500g
All other mixes	2000g

3. A 1000g minimum sample is required for a moisture determination for each mix sample per 9.0. Do not use the specimen for moisture determination for asphalt binder content determination.

1054.7 Calibration (if required)

Test mixes containing any limestone coarse aggregate (including reclaimed asphalt concrete pavement) at 930 °F (500 °C) unless otherwise approved by the Laboratory. Test all other mixes at 1000 °F (540 °C) provided no indication of aggregate breakdown by erroneous data exists.

Obtain the asphalt binder content of reclaimed asphalt concrete pavement determinations by averaging results from ignition oven testing on three separate samples.

A. Three Sample Calibration

1. Prepare three calibration specimens conforming to 1054.6.B.2 at the design asphalt binder content and include the appropriate specification for cure time. Prepare a butter mix as above and discard prior to mixing calibration samples. Sample aggregate used for the calibration specimens from the most recently available aggregate source or pile. Batch and grade an additional blank sample to verify gradation meets the JMF.
2. Preheat the oven to the required test temperature. Record the oven temperature prior to the start of the test.
3. Enter a correction factor of 0.00 in the ignition oven if applicable.
4. Weigh the sample basket assembly.

5. With the sample in the baskets weigh and record the sample, baskets, catch pan, and basket guards. Calculate and record the initial weight of the sample specimen (total weight - the weight of the sample basket assembly).
6. Input the initial weight of the sample in whole grams into the oven if applicable. Verify that the correct weight has been entered.
7. Zero the balance if applicable. Place the sample in the oven. Verify that the sample weight (including baskets) equals the total weight in 1054.7.A.6 within 5 g. Differences greater than 5 grams or failure of the oven balance to stabilize may indicate that the sample basket assembly is touching the oven wall. Begin the test.

For internal balance ovens:

8. Allow the test to continue until the oven indicates the test is complete. Stop the test.
9. Remove the baskets to a safe location allowing to cool 20 minutes.
10. Record all data on the Mixture Calibration form.

For ovens with no internal balance:

8. Test the sample for 75 to 85 minutes for the 930 °F test and 60 minutes for the 1000°F test. Stop the test and visually check the sample appearance. If any dark sooty ash remains on the aggregate or in the tray restart the test. Check the appearance every 5 minutes until no dark ash remains. Weigh the basket assembly recording the weight at 20 seconds. Restart the test and weigh again after 5 minutes recording the weight at 20 seconds. If the difference in hot weight is less than 1 gram the test is complete.
9. Calculate the difference in beginning weight and final hot weight.
10. Record all required data on the Mixture Calibration form.

B. Blank Aggregate Sample Calibration (if required)

1. Prepare two calibration samples conforming to 1054.6.B.2 in the lab or taken from the plant belt or hot bins. Any batching method may be used to prepare the samples. Grade one sample to verify the gradation conforms reasonably to the JMF. Extract reclaimed asphalt concrete pavement before incorporation into the blank sample.
2. Dry the blank sample before test. This can be done by drying in an oven (at least 230°F (110 °C)) for 20 minutes (with some stirring).
3. Preheat the ignition oven to the required temperature. Record the oven temperature set point prior to the initiation of the test.

4. Enter a correction factor of 0.00 in the ignition oven if applicable.
5. Weigh the sample basket assembly.
6. With the sample in the basket assembly weigh and record the specimen and entire basket assembly. Calculate and record the initial weight of the sample (total weight - the weight of the sample basket assembly).
7. Input the initial weight of the sample in whole grams into the ignition oven, if applicable. Verify that the correct weight has been entered.
8. Zero the balance if applicable. Place the sample into the oven. Verify that the sample weight (including basket assembly) equals the total weight in 7B6 within 5 grams. Differences greater than this or failure of the scale to stabilize may indicate the basket assembly is touching the oven wall. Begin the test.

For internal balance ovens:

9. Allow the test to continue until the oven indicates the test is complete. Stop the test.
10. Remove the basket assembly to a safe location allowing to cool 20 minutes.
11. Record all required data on the Mixture Calibration form.

For ovens with no internal balance:

9. Test the sample for 75 minutes for the 930 °F test and 60 minutes for the 1000 °F test. Stop the test and visually check the sample appearance. If any dark sooty ash remains on the sample or in the tray restart the test. Check the sample every 5 minutes until no dark ash remains. Weigh the basket assembly recording the weight at 20 seconds. Restart the test and weigh again after 5 minutes recording the weight at 20 seconds. If the difference in hot weight is less than 1 gram the test is complete.
10. Calculate the difference in beginning weight and final hot weight.
11. Record all required data on the Mixture Calibration form.

1054.8 Oven Test Procedure

1. Preheat the ignition oven to the required temperature. Record the oven temperature prior to starting the test.
2. Perform a moisture correction test in accordance with 1054.6.B.3 and 1054.9
3. Weigh and record the weight of the sample basket assembly.

4. With the sample in the basket assembly weigh and record the weight of the sample and basket assembly. Calculate and record the initial weight of the sample (total weight - weight of the basket assembly).
5. Input the initial weight of the sample in whole grams into the oven, if applicable. Verify that the correct weight has been entered.
6. Place the sample and basket assembly into the oven. Verify that the sample and basket weight equals the sample and basket weight from 1054.8.4 within 5 grams. Differences greater than this or failure of the balance to stabilize may indicate that the sample is touching the oven wall. Begin the test.

For internal balance ovens:

7. Allow the test to continue until the oven indicates the test is complete. Stop the test.
8. Remove the sample and basket assembly to a safe location allowing to cool for 20 minutes.

For ovens with no internal balance:

7. Test the sample for 75 to 85 minutes for the 930 °F test and 60 minutes for the 1000 °F test. Stop the test and visually check the sample appearance. If any dark sooty ash remains on the sample or in the tray restart the test. Check the sample every 5 minutes until no dark ash remains. Weigh the basket assembly recording the weight at 20 seconds. Restart the test and weigh again after 5 minutes recording the weight at 20 seconds. If the difference in hot weight is less than 1 gram the test is complete.
8. Calculate the difference in beginning weight and final hot weight as percent total mix (percent).

1054.9 Determining Moisture Content

1. Determine and record the combined weight of the empty sample pan and stirrer to the nearest 0.1 gram (pan weight).
2. Place the sample of asphalt concrete and stirrer in the sample pan. Determine and record the weight of the filled sample pan to the nearest 0.1 gram (initial weight).
3. Place the filled sample pan in an oven for a minimum of 2 hours. Use an oven temperature of 355 °F (180 °C) \pm 10 °F (6 °C).
4. Remove the filled sample pan from the oven. Determine and record the weight of the filled pan to the nearest 0.1 gram. Stir the sample and place the filled sample pan back in the oven.

5. Repeat step 1054.9.4 every 15 minutes until the total weight loss between 2 consecutive 15 minute readings is less than 0.1 percent. The last 15 minute reading is the final weight.
6. Calculate the moisture content (expressed as a percent) as follows:

A = Initial weight

B = Final weight

C = Pan weight

$$\mathbf{F = Moisture\ content\ (percent) = \frac{(A - B) \times 100}{(B - C)}}$$

1054.10 Final Calculations

The final asphalt binder content is a result of combining the oven test loss, correction factor and moisture content for the sample.

D = Weight loss of ignition oven tested sample (percent)

E = Correction factor from the Mixture Calibration form (percent)

F = Moisture content from Section 9.6 (percent)

Final corrected asphalt binder content (percent) = D - E - F