Binder Ignition
COURSE CONTENT

BINDER IGNITION OVEN TEST

Module 1
Appendix

AASHTO T308
Binder Ignition
BINDER IGNITION

UPDATES

- **2024** - No updates in Methods
- **2023** - Module 1 – Binder Ignition Oven AASHTO T308- Updates
  - Thermometers for measuring temperature See Appendix Item Equipment for more information on Thermometers.
  - Ignition furnace updates on temperature control, see Appendix Item Equipment
- **2022** – New manual, but no method updates.
This test method AASHTO T308:

- Covers the determination of asphalt binder content of asphalt mixtures by ignition at temperatures that reach the flashpoint of the binder in a furnace.
- Heating may be convection method or direct infrared (IR) irradiation method.
- Two Methods,
  - Method A requires an ignition furnace with an internal balance.
  - Method B requires an ignition furnace with an external balance.

This method can be used for:

- Quantitative determinations of asphalt binder content.
- Gradation in asphalt mixture and pavement specimens for quality control.
- Specification acceptance.
- Mixture evaluation studies.
- For gradation analysis according to AASHTO T30.
EQUIPMENT

- **Ignition Furnace** – A forced air oven that heats by convection or direct IR irradiation. The convection type must be capable of maintaining 538 ± 5°C (1000 ± 9°F).
  - For Method A the oven shall have an internal balance.
  - Specimen basket assembly consisting of
    - Specimen Baskets
    - Catch Pan
    - Assembly guard
  - See appendix, Item #7 for more information on equipment.

Oven Verification:

- The oven must be “verified” every 12 months and after each move.
  - Temperature
  - Balance

Methods:

- Yearly outside service (usually along with gyro and mold calibrations, etc.)
- In-house

Ignition Oven Basics:

- **% Binder**: Loss in mass of specimen
- **Problem**: Other materials also burn off
  - Moisture
  - Aggregate
  - Miscellaneous
## CORRECTIONS

1. **Moisture**  
   - Moisture Content “MC”

2. **Aggregate Burn Loss**  
   - Aggregate Correction Factor “Cf”

3. **Temperature effects on weighing**  
   - Temperature Correction Factor “TCF”

### 1. Moisture

- Moisture in mix will evaporate.
- This will count as binder unless corrected.
- There are two methods to correct for moisture:
  - **Method 1:**
    - Dry mix to a constant mass at 110 ± 5°C (230 ±9°F) prior to testing.
    - “Aging”—must still verify that constant mass has been achieved.
  - **OR**
  - **Method 2:**
    - Determine moisture content of mix (AASHTO T 329), subtract it from the apparent binder content.

### Moisture Content (AASHTO T 329): Method 2

- **Temperature:** *(See BT Manual for T329)*
  - Within the JMF mixing temperature range.
  - If unavailable, use 163 ±14°C (325 ±25°F)
- ≥1,000g sample, Initial drying time is 90 ± 5 min.
- Continue drying checking at 30 ± 5 min intervals until the mass changes less than 0.05% (1g per sample) from the previous mass = Constant Mass.
- **Report to nearest 0.01%**
- Moisture is calculated based on dry weight of HMA.
Calculate the **PERCENT CHANGE** as follows:

\[
\% \text{ Change} = \frac{(A - B)}{A} \times 100
\]

- **A** = Previous mass determination
- **B** = Newest mass determination
- **REPORT** = To the nearest **0.01%**

**Reminder from BT certification:**
First subtract the container weight from the total weight for A and B then record the weights to the nearest **0.01 g** before calculating % change.

**Moisture Content (AASHTO T 329):**

Where:
- \( M_i \) = Mass of initial, moist test sample
- \( M_f \) = Mass of the final, dry test sample

**Report** = % Moisture to the nearest **0.01%**

\[
\text{Moisture Content} = \frac{(M_i - M_f)}{M_f} \times 100
\]

**Classroom Practice**

- \( M_i = 1134.9 \)
- \( M_f = 1127.3 \)

\[% \text{ Moisture} = \underline{0.67} \%
\]

Report to the nearest 0.01%
Rounding:

- When calculating, moisture content, binder content, and Cf, round to nearest 0.01%.

Side note:
Binder Content: When comparing to specification, round binder content to nearest 0.1%.

Moisture Testing Frequency:

"Common Wisdom" as needed...
- High RAP/RAS mixtures especially prone to moisture.
- Rainy weather
- "Warm mix"
- New aggregate
- If plant operator reports burning more fuel to maintain temperature.
- Fluctuating volumetrics or binder contents
- Watering piles per DNR.
- Same stockpiles
- Dry weather
- No moisture when tested

Aggregate Burn Loss

Aggregate Correction Factor:
- To correct for loss of mass during the mix ignition due to aggregate burn-off.
- Determined during mix design by mix designer (usually QC).
- Re-determined if mix design changes (e.g. >5% change in stockpiled aggregate proportions).
- Re-determined if a different oven is used (QA or QC).
**C_F Procedure:**
- Mix specimen in lab with dry aggregate at a known (actual) % binder.
- Input “zero” for the C_F
- Burn, obtain measured (apparent) % binder.
- The difference between the measured and the actual % binder is the Asphalt Binder Correction Factor (C_F).
- If the C_F is > 1.0%, re-determine at a lower temperature.

**Definitions:**
- M = mass (g)
- Mi(dry) = Mass of mix before burning, dry already.
- Mf = Final mass of mix after burning (binder and some aggregate burned off).
- (Mi(dry) – Mf) = Binder & aggregate burned off.
- Magg = Initial unburned mass of just the aggregate, dry.
- (Mi(dry) – Mi(agg)) = Mix mass minus aggregate mass is the mass of binder, initially.

**C_F Calculations:**
\[ C_F = \frac{M_i(dry) - M_f}{M_i(dry)} - \frac{M_i(dry) - M_i(agg)}{M_i(dry)} \]
- The difference is the aggregate mass loss
- The Measured binder content can be from the oven ticket
- The Actual binder content can be from a bench scale
- If the C_F is > 1.0%, re-determine at a lower temp.
- Report to the nearest 0.1%
Two types of Ovens

Infrared Oven

Convention Oven

Convection Oven Temperatures:

• AASHTO:
  • Normal: 538 °C (1000.4 °F)
  • High C_f’s (>1.0%): 482 °C (899.6 °F)

• MoDOT:
  • Normal: 538 °C (1000.4 °F)
  • High C_f’s: if >1.0% try 482 C (899.6 °F)
  • Very high C_f’s: if >1.0% at 482 C, use 427 C
    Very high C_f’s: if >1.0% at (899.6 °F), use (800.6°F)

Cf Determination:

Number of Replicate Specimens

• Use two
  • If the difference in measured asphalt contents is > 0.15%, test two more replicates.
  • For the four replicates, discard the high and low results.
### Asphalt Binder Correction Factor (Aggregate Correction Factor) Data Sheet

#### ASPHALT CONTENT IGNITION METHOD
AASHTO T 308
METHOD A

<table>
<thead>
<tr>
<th>Sample</th>
<th>Lab No.</th>
<th>Date</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replicate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Test Temperature</td>
<td>538</td>
<td>538</td>
<td></td>
</tr>
<tr>
<td>Tare (basket, etc.) Mass (g)</td>
<td>3000.0</td>
<td>3000.0</td>
<td></td>
</tr>
<tr>
<td>Total Dry Mass (g)</td>
<td>5000.1</td>
<td>5005.2</td>
<td></td>
</tr>
</tbody>
</table>

**Initial Dry Specimen Mass (g)**

| Loss in Weight (g) | 125.2 | 126.1 |
| %AC<sub>i</sub>, measured = M | 6.26 | 6.29 |
| %AC<sub>a</sub>, actual = A | 6.00 | 6.01 |
| %AC<sub>diff</sub> (M<sub>1</sub> - M<sub>2</sub>) | > 0.15%? If so, 2 more replicates |
| CF = M - A | 0.26 | 0.28 |
| CF Average | 0.27 |

**Total Dry Mass – Tare Basket Mass = Initial Dry Specimen Mass**

**%AC<sub>i</sub>, measured = M = \( \frac{\text{Loss in weight}}{\text{Initial Dry Mass}} \times 100 \)**
# Asphalt Content Ignition Method

**AASHTO T 302**

**Method A**

## Aggregate Correction Factor

[Asphalt Binder Correction Factor] Determination

<table>
<thead>
<tr>
<th>Sample</th>
<th>Lab No.</th>
<th>Date</th>
<th>Initials</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Replicate</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Temperature</td>
<td>538</td>
<td>538</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tare (basket, etc.) Mass (g)</td>
<td>3000.0</td>
<td>3000.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Dry Mass (g)</td>
<td>4129.2</td>
<td>4123.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Dry Specimen Mass (g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss in Weight (g)</td>
<td>65.7</td>
<td>62.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>%AC, measured = M</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%AC, actual = A</td>
<td>5.25</td>
<td>5.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>%AC$_{diff}$ (M$_1$ – M$_2$)</td>
<td></td>
<td>&gt; 0.15%? If so, 2 more replicates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CF = M – A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CF, average</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

New Slide
Use of Cf:

- Before production, when Cf is the unknown:
  \[ \text{Cf} = \text{Measured Content} - \text{Actual Content} \]

- During production, when Actual Content is unknown:
  \[ \text{Actual} = \text{Measured Content} - \text{Cf} \]

Infrared Burn Profiles:

- **“Default”**
  Most mixes

- **“Option 1”**
  (Less) - For \( \text{Cf} > 1.0\% \) e.g., RAP containing dolomite.

- **“Option 2”**
  (More) – Hard to burn mixes

RAP Aggregate Correction Factor:

(Asphalt Binder Correction Factor)

- **Follow TM-77:**
  - Assumes aggregate \( \text{Cf} \) for RAP aggregate is same as \( \text{Cf} \) for virgin aggregate.
  - Follow the standard procedure as if there was no RAP, i.e., use only the virgin aggregate, and only the binder content associated with the virgin aggregate portion when fabricating the specimen.
  - So, the Cf from the virgin materials test is used as the Cf for the whole mix.
3. Temperature Effects on Weighing
Temperature Compensation Factor (TCF)

Convection Oven:
- Material “weighs” differently at elevated temperatures.
- Mass loss shown on the oven printout must be corrected.
- Oven calculates and prints the “Temperature Correction Factor (TCF)” for the particular test run.
- \( TCF = \text{Apparent loss in mass due to heating.} \)

Use of Temperature Correction Factor:
- When determining the Aggregate Correction Factor, if the oven printout is used for determination of the Measured Asphalt Content, include the Temperature Correction Factor (TCF).
- If all weighing is performed outside of the oven and specimen is cooled to room temperature, do not use the TCF.

Second Generation Infrared oven:
- No Temperature Correction Factor
- \textbf{Anecdotally:} Scale is better insulated from the chamber.
PROCEDURE FOR T308

Determining the Asphalt Binder Content of Asphalt Mixtures by the Ignition Method

Test Methods

- Method A – Furnace with internal scale
- Method B – Furnace without internal scale

SAMPLING/REHEATING

EPG 403.1.5 Link: Engineering_Policy_Guide (modot.org)

Sampling:
- Obtain samples of Loose Mix according to AASHTO R97. (See Module 5 on Sampling)

Reheating:
- Place the box or bucket of sample in an oven 110 ± 5°C (230 ± 9°F) gently warm the sample until workable.
- Remove the sample from box or bucket.
Reducing:

- Reduce the sample per AASHTO R47 (see module 6) to amount listed on Table 1.
- Spread sample in a large pan or two.
  If needed, reheat the pan just until sample is workable. 110 ± 5°C (230 ± 9°F)

NOTE: Monitor the heating, do not leave sample in the oven too long.

<table>
<thead>
<tr>
<th>Sampling</th>
<th>34</th>
</tr>
</thead>
</table>

**Ignition Oven Specimen Size (TABLE 1)**

<table>
<thead>
<tr>
<th>Mix</th>
<th>NMS, in.</th>
<th>Specimen Size, g</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP048 &amp; BP-3</td>
<td>#4</td>
<td>1200-1700</td>
</tr>
<tr>
<td>SP095</td>
<td>3/8</td>
<td>1200-1700</td>
</tr>
<tr>
<td>SP125, BP-1 &amp; BP-2</td>
<td>1/2</td>
<td>1500-2000</td>
</tr>
<tr>
<td>SP190 &amp; Bit Base</td>
<td>3/4</td>
<td>2000-2500</td>
</tr>
<tr>
<td>SP250</td>
<td>1</td>
<td>3000-3500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sampling</th>
<th>35</th>
</tr>
</thead>
</table>

**PROCEDURE**

**Method A**

Using the Convection Oven

- Preheat the furnace to 538±5°C (1000±9°F), or use temperature determined by the correction factor.
- Enter the **chamber set point**.
**At the bench...**

- Record weight of empty basket assembly. (0.1g)
- Place ~ half of the mix in each basket.
- Use a spatula or trowel to level and move the mix about **one inch** away from the edges of the basket.

**Method A**

- Cool to room temp.
- Weigh the test specimen and basket on external bench scale. (0.1g)
- Calculate and record the initial weight of the sample.
- Record to nearest 0.1g

**Method A**

- Input the initial sample weight in whole grams into the ignition furnace controller.
- Enter the **asphalt correction factor \(C_A\).**
- Reset the internal scale to zero.
• Put on safety gear.
• Open the chamber door and place the specimen basket with sample in the furnace.
  • Make sure basket is not touching the walls.
• Close the door.

• Verify that the specimen weight is displayed on the furnace scale equals the \textit{total mass}_{\text{initial}} weighed on bench scale \pm 5 \text{ grams}.
• Start the oven. "Burn"

• Oven will stop when burn is complete.
• Tare off ticket of burn results.
• Put on safety gear, open the door, carefully pull out the basket and place it on a cooling plate.
• Place a protective cage on top of the basket assembly.
• Allow to cool to room temperature. \sim 60\text{min}.
• Move the basket assembly with sample to a scale and record the total weight after ignition. (0.1g)
• Calculate and record the final weight of the specimen to nearest 0.1g

**CALCULATION/REPORTING**

• The furnace will calculate % binder based on the:
  • Original specimen weight entered
  • Total loss
  • Asphalt correction factor \( (C_F) \) that you entered.
  • “Temperature Compensation Factor” that the oven calculates = apparent loss in weight due to heating.
• **You** must then correct (subtract) for moisture if started with a wet sample.
### TEST RESULTS PRINT OUT FROM IGNITION OVEN

**Elapsed Time:** 39:00h
**Sample Weight:** 1270g
**Weight Loss:** 79.8g
**Percent Loss:** 6.28%
**Temp Comp:** 0.17%
**Calib. Factor:** 0.26%
**Bitumen Ratio:** 6.27%

**Calibrated Asphalt Cnt:** 5.85%

<table>
<thead>
<tr>
<th>Value</th>
<th>Weight (g)</th>
<th>%</th>
<th>Value</th>
<th>Weight (g)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>494</td>
<td>79.6</td>
<td>37</td>
<td>495</td>
<td>79.7</td>
</tr>
<tr>
<td>35</td>
<td>497</td>
<td>79.3</td>
<td>34</td>
<td>499</td>
<td>79.1</td>
</tr>
<tr>
<td>32</td>
<td>506</td>
<td>78.2</td>
<td>31</td>
<td>509</td>
<td>77.7</td>
</tr>
<tr>
<td>29</td>
<td>516</td>
<td>76.2</td>
<td>28</td>
<td>519</td>
<td>75.4</td>
</tr>
<tr>
<td>26</td>
<td>524</td>
<td>73.5</td>
<td>25</td>
<td>526</td>
<td>72.2</td>
</tr>
<tr>
<td>23</td>
<td>529</td>
<td>69.5</td>
<td>22</td>
<td>530</td>
<td>68.0</td>
</tr>
<tr>
<td>20</td>
<td>533</td>
<td>63.2</td>
<td>19</td>
<td>533</td>
<td>63.2</td>
</tr>
<tr>
<td>16</td>
<td>556</td>
<td>59.0</td>
<td>15</td>
<td>557</td>
<td>59.3</td>
</tr>
<tr>
<td>13</td>
<td>562</td>
<td>54.8</td>
<td>12</td>
<td>563</td>
<td>50.9</td>
</tr>
<tr>
<td>9</td>
<td>556</td>
<td>22.1</td>
<td>8</td>
<td>459</td>
<td>11.7</td>
</tr>
<tr>
<td>6</td>
<td>433</td>
<td>4.0</td>
<td>5</td>
<td>427</td>
<td>2.9</td>
</tr>
<tr>
<td>3</td>
<td>416</td>
<td>1.4</td>
<td>2</td>
<td>409</td>
<td>0.9</td>
</tr>
</tbody>
</table>

**Probable Ignition**

**Starts Here**

- **You Entered 1270**
  - $=79.8/1270 \times 100 = 6.28\%$
  - Apparent loss of wt. due to heat 0.17%
  - Aggregate Loss; you entered 0.26%
  - % AC by wt. of Aggregate 6.27%
  - 3 consecutive readings w/in 0.01% loss

- **You set, (Factory Default)**
  - Filter Set Pt: 750°C
  - Chamber Set Pt: 538°C

- **You set, (Typically 538°C)**
  - % AC by wt. of Mix 5.85%
  - 6.28
  - -0.17
  - -0.26
  - 5.85%
# Asphalt Content Ignition Method (AASHTO T 308-10) Method A

**Reproducing Oven Ticket Values**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty Basket Assembly Weight (g), ([T_c])</td>
<td>3000.2</td>
</tr>
<tr>
<td>Basket Assembly + Wet (or dry) Sample Weight (g), ([T_i])</td>
<td>4270.2</td>
</tr>
<tr>
<td>Wet (or dry) Sample Weight (g), ([W_i = (T_i - T_c)])</td>
<td></td>
</tr>
<tr>
<td>Loss in Weight (g), ([L]) (from tape)</td>
<td></td>
</tr>
<tr>
<td>Total % Loss, ([P_i = (L / W_i) \times 100])</td>
<td></td>
</tr>
<tr>
<td>Temperature Compensation (%), ([C_\text{Ac}]) (from tape)</td>
<td></td>
</tr>
<tr>
<td>% AC, uncorrected, ([P_{\text{Ac}} = P_i - C_\text{Ac}])</td>
<td></td>
</tr>
<tr>
<td>Aggregate Correction (Calibration) Factor (%), ([C_d]) (from tape)</td>
<td></td>
</tr>
<tr>
<td>Calibrated %AC (from ignition oven tape), ([P_{\text{Ac\text{cal}}} = P_{\text{Ac}} - C_d])</td>
<td></td>
</tr>
<tr>
<td>% Moisture Content, ([MC]) (previous test)*</td>
<td>0.13</td>
</tr>
<tr>
<td>% AC, corrected (by weight of mix), ([P_o = P_{\text{Ac\text{cal}}} - MC]^*)</td>
<td></td>
</tr>
</tbody>
</table>

*If \(W_i = \text{wet}\)
### Asphalt Content Ignition Method (AASHTO T 308-10) Method A

**Reproducing Oven Ticket Values**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty Basket Assembly Weight (g), [E]</td>
<td>3000.2</td>
</tr>
<tr>
<td>Basket Assembly + Wet (or dry) Sample Weight (g), [T]</td>
<td>4270.2</td>
</tr>
<tr>
<td>Wet (or dry) Sample Weight (g), [W]</td>
<td></td>
</tr>
<tr>
<td>Loss in Weight (g), [%] (from tape)</td>
<td></td>
</tr>
<tr>
<td>Total % Loss, [P_L] = (W x 100)</td>
<td></td>
</tr>
<tr>
<td>Temperature Compensation [%], [C_T]</td>
<td></td>
</tr>
<tr>
<td>% AC, uncorrected, [P_B] = [P_L] - [C_T]</td>
<td></td>
</tr>
<tr>
<td>Aggregate Correction (Calibration) Factor [%], [C_f]</td>
<td></td>
</tr>
<tr>
<td>Calibrated %AC (From ignition oven tape), [P_b]</td>
<td></td>
</tr>
<tr>
<td>% Moisture Content, [MC]</td>
<td></td>
</tr>
<tr>
<td>% AC, corrected by weight of mix, [P_b] = [P_b] - [MC]</td>
<td></td>
</tr>
</tbody>
</table>

**Method A**

- 0.13

### Asphalt Binder Correction Factor (Formerly Aggregate Correction Factor) Calculation

If final weighing is performed on bench top scale, calculation:

\[ P_b = \left( \frac{M_i - M_f}{M_i} \times 100 \right) - C_f - MC \]

Where:

- \( M_i \) = initial weight of mix, wet or dry
- \( M_f \) = final mass of mix
- MC = % moisture
- \( C_f \) = Asphalt Binder Correction Factor (old Aggregate Correction Factor)
PROCEDURE
Method B

• Note the special heat resistant shirt.

Use SAFETY gear!

Dr. Richardson

PROCEDURE
Method B

• Note the special heat resistant shirt.

Use SAFETY gear!

Dr. Richardson

Method B - No internal scale – Manual Weigh

• Weigh out specimen.
• Burn for about 45 minutes.
• Remove, cool, weigh.
• Burn for another 15 minutes.
• Remove, cool, weigh.
• Keep repeating the 15-minute burn intervals until 2 consecutive mass weighings do not change by > 0.05%.
• Subtract moisture % if necessary.

Method B - No internal scale – Manual Weigh

Information needed for the report:
• Moisture = 0.05%
• C_i = 0.22%
• Initial wet mass = 5400.2 g
• Final burned mass (after cooling to room temperature) = 5256.2 g

Method B - No internal scale – Manual Weigh

Information needed for the report:
• Moisture = 0.05%
• C_i = 0.22%
• Initial wet mass = 5400.2 g
• Final burned mass (after cooling to room temperature) = 5256.2 g

Method B - No internal scale – Manual Weigh

Information needed for the report:
• Moisture = 0.05%
• C_i = 0.22%
• Initial wet mass = 5400.2 g
• Final burned mass (after cooling to room temperature) = 5256.2 g

Method B - No internal scale – Manual Weigh

Information needed for the report:
• Moisture = 0.05%
• C_i = 0.22%
• Initial wet mass = 5400.2 g
• Final burned mass (after cooling to room temperature) = 5256.2 g
Reporting binder content of mix

Binder Portion

- Technician
- Moist Tim Sample
- Weight
- Background
- Counts
- Gauge % AC
- T308 (Ignition)
- Gauge % AC
- Nuclear or Ignition
- % Moisture
- % AC by Ignition or Nuclear

RAP Binder Content

- Per Spec 403.19.3: RAP binder content must be determined.
- QC: 1 per 4 sublots
- QA: 1 per project
- T164 (solvent extraction)
- Can use T308 (ignition) if a correction factor is determined which is the difference between T164 & T308 (best to use your own oven when T164 is determined by another lab).
### SUPERPAVE MIXTURE PROPERTIES

#### SUBLOT

<table>
<thead>
<tr>
<th>JOB</th>
<th>ROUTE</th>
<th>MIX NO.</th>
<th>#VALUE!</th>
<th>LOT NO.</th>
</tr>
</thead>
</table>

#### DATE

AASHTO T 209

#### TECHNICIAN

**Nuclear gage**

- A = Wt. of sample:
- A2 = Wt. of sample (dry-back):
- D = Wt. of flask filled with water:
- X = A + D (A2 used in lieu of A for dry-back):
- E = Wt. of flask filled with water and sample:
- Y = X - E
- Gmm = MAX. SPECIFIC GRAVITY = A / Y

#### AASHTO T 308 (IGNITION)

<table>
<thead>
<tr>
<th>GAUGE % AC</th>
<th>NUCLEAR OR IGNITION % MOISTURE</th>
<th>% AC BY IGNITION OR NUCLEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.35</td>
<td>0.12</td>
<td>5.2</td>
</tr>
</tbody>
</table>

#### AASHTO T 166

<table>
<thead>
<tr>
<th>TECHNICIAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>MoDOT TM54 (NUCLEAR)</td>
</tr>
</tbody>
</table>

#### BACKGROUND

<table>
<thead>
<tr>
<th>COUNTS</th>
</tr>
</thead>
</table>

#### GAUGE % AC

<table>
<thead>
<tr>
<th>SAMPLE WEIGHT</th>
</tr>
</thead>
</table>

#### JET COUNTS

<table>
<thead>
<tr>
<th>NUCLEAR OR IGNITION % MOISTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.12</td>
</tr>
</tbody>
</table>

#### SUBLOT

FOR 2ND CORE SUBLOT WHEN DENOTED IN QC PLAN

<table>
<thead>
<tr>
<th>TECHNICIAN</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>A = Gmm (FIELD)</th>
<th>B = Gmb (FIELD) (Avg.)</th>
<th>C = Gsb (Job Mix)</th>
<th>D = Ps = Percent Agg. in mix</th>
<th>VMA = 100 - (B X D / C)</th>
<th>Va = 100 X ((A - B) / A)</th>
<th>VFA = (VMA-Va) / VMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.339</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2.557</td>
<td>2.557</td>
<td>2.557</td>
<td>2.557</td>
<td>2.557</td>
<td>2.557</td>
<td>2.557</td>
</tr>
<tr>
<td>94.8</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>13.3</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>5.4</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>59</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

#### SUBLOT

FOR 2ND CORE SUBLOT WHEN DENOTED IN QC PLAN

<table>
<thead>
<tr>
<th>TECHNICIAN</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>A = Weight of sample in air:</th>
<th>B = Weight in water:</th>
<th>C = Weight of surface dry sample:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.282</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
</tbody>
</table>

#### SUBLOT

<table>
<thead>
<tr>
<th>THICKNESS</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SUBLOT</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>A = Weight of sample in air:</th>
<th>B = Weight in water:</th>
<th>C = Weight of surface dry sample:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
</tbody>
</table>

#### SUBLOT

<table>
<thead>
<tr>
<th>THICKNESS</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SUBLOT</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>A = Weight of sample in air:</th>
<th>B = Weight in water:</th>
<th>C = Weight of surface dry sample:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
</tbody>
</table>

#### SUBLOT

<table>
<thead>
<tr>
<th>THICKNESS</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SUBLOT</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>A = Weight of sample in air:</th>
<th>B = Weight in water:</th>
<th>C = Weight of surface dry sample:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2.472</td>
<td>2.472</td>
<td>2.472</td>
</tr>
</tbody>
</table>
## Binder Portion

<table>
<thead>
<tr>
<th>TECHNICIAN</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MoDOT TM54 (NUCLEAR)</td>
<td></td>
</tr>
<tr>
<td>SAMPLE WEIGHT</td>
<td></td>
</tr>
<tr>
<td>BACKGROUND</td>
<td></td>
</tr>
<tr>
<td>COUNTS</td>
<td></td>
</tr>
<tr>
<td>GAUGE % AC</td>
<td></td>
</tr>
<tr>
<td>AASHTO T 308 (IGNITION)</td>
<td></td>
</tr>
<tr>
<td>GAUGE %AC</td>
<td></td>
</tr>
<tr>
<td>NUCLEAR OR IGNITION</td>
<td></td>
</tr>
<tr>
<td>% MOISTURE</td>
<td>0.12</td>
</tr>
<tr>
<td>% AC BY IGNITION OR NUCLEAR</td>
<td>5.2</td>
</tr>
</tbody>
</table>

5.35
Some contractors stockpile RAP & RAS, prepare (grind) it, and sample it. Send sample to a commercial lab to have extractions run (T164), obtain binder content & gradation. This is what is submitted to MoDOT during mix design. During production, RAP is sampled, and ignition oven used to get binder content & gradation.

MoDOT allows gradation sample testing to be satisfied by using the residue from the HMA ignition oven sample. An aggregate (gradation) correction factor (AGCF) may be necessary to account for the breakdown in rock. RAP gradation in the field is determined with ignition oven.

Not recommended to use T308 on RAS (too dangerous). Fan will suck fines out. Use extraction to get gradation or use the standard gradation.
**Aggregate Gradation**

**RAS Gradation**

- Ground to minus 3/8 inch.
- Gradation from solvent extraction, or assumed from table:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8&quot;</td>
<td>100</td>
</tr>
<tr>
<td>#4</td>
<td>95</td>
</tr>
<tr>
<td>#8</td>
<td>85</td>
</tr>
<tr>
<td>#16</td>
<td>70</td>
</tr>
<tr>
<td>#30</td>
<td>50</td>
</tr>
<tr>
<td>#50</td>
<td>45</td>
</tr>
<tr>
<td>#100</td>
<td>35</td>
</tr>
<tr>
<td>#200</td>
<td>25</td>
</tr>
</tbody>
</table>

**Aggregate Gradation**

**Mix Gradation Samples**

- When determining the *aggregate (gradation) correction factor* (AGCF), prepare an aggregate blank (no binder) specimen.
- Do a washed gradation analysis (*AASHTO-T 30 Test for Mechanical Analysis of Extracted Aggregate*) of the blank.
- Do a washed gradation analysis of the burned HMA specimen (T 30): Two replicates.
**Gradation Samples**
Burned and Unburned
Plus #200 Portion

* Determine a difference for each sieve, each replicate, say, for the #4 sieve:

\[
\left(\% \text{ - #4}\right)_{\text{blank}} - \left(\% \text{ - #4}\right)_{\text{burned}, \text{ replicate #1}}
\]
\[
\left(\% \text{ - #4}\right)_{\text{blank}} - \left(\% \text{ - #4}\right)_{\text{burned, replicate #2}}
\]

* Calculate the average difference for that sieve (#4).
* The difference is called the AGCF for #4 sieve material.

---

**Gradation Samples**
Burned and Unburned
Plus #200 Portion

* If the difference on *any* sieve exceeds the allowable (see below), then each sieve must have its own AGCF applied to the result.

**Allowable differences:**

* ≥ #8: ± 5.0%
* ≥ #200 to < #8: ± 3.0%
* ≤ #200: ± 0.5%

---

**Gradation Samples**
Passing the #200 Portion

* If only the #200 sieve exceeds the limit, apply the AGCF only to the #200 sieve

---
**Example**
Adapted From FHWA “Addendum T308”

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Burned Rep#1</th>
<th>Burned Rep#2</th>
<th>Unburned Blank</th>
<th>Rep#1 Diff</th>
<th>Rep#2 Diff</th>
<th>Avg Diff +/− 0.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1”</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>±5.0</td>
</tr>
<tr>
<td>½”</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>±5.0</td>
</tr>
<tr>
<td>5/8”</td>
<td>86.5</td>
<td>89.5</td>
<td>89.7</td>
<td>3.2</td>
<td>0.2</td>
<td>±5.0</td>
</tr>
<tr>
<td>3/8”</td>
<td>69.3</td>
<td>72.1</td>
<td>70.4</td>
<td>1.1</td>
<td>-1.7</td>
<td>±5.0</td>
</tr>
<tr>
<td>#4</td>
<td>52.1</td>
<td>55.6</td>
<td>53.9</td>
<td>1.8</td>
<td>-1.7</td>
<td>±5.0</td>
</tr>
<tr>
<td>#8</td>
<td>38.5</td>
<td>42.3</td>
<td>41.0</td>
<td>2.5</td>
<td>-1.3</td>
<td>±3.0</td>
</tr>
<tr>
<td>#30</td>
<td>27.0</td>
<td>37.0</td>
<td>34.4</td>
<td>1.7</td>
<td>-2.5</td>
<td>±3.0</td>
</tr>
<tr>
<td>#50</td>
<td>12.6</td>
<td>13.4</td>
<td>14.5</td>
<td>1.9</td>
<td>1.1</td>
<td>±3.0</td>
</tr>
<tr>
<td>#200</td>
<td>6.8</td>
<td>7.4</td>
<td>7.1</td>
<td>0.3</td>
<td>-0.3</td>
<td>±0.5</td>
</tr>
</tbody>
</table>

For #4 sieve:
Rep#1: 53.9-52.1 = 1.8
Rep#2: 53.9-55.6 = -1.7
Avg diff = (1.8 + (-1.7)) / 2 = 0.05 = 0.1 (rounded)
Compare to ±5.0: 0.1 < 5.0 OK

---

**Common Testing Errors**

**of**

**Non-Comparison/Early Shut-off**

- Starting test when oven is cold: incomplete burn; can affect TCF.
- Neglecting to push “Start” (binder burns but is not recorded).
- Not cleaning oven & vents often enough.
  - Tip: Perform “Lift” test regularly to verify clean oven.
- Using vent pipe less than 4 in, diameter.

---

- Asphalt correction factor ($C_F$) not used.
- Not cleaning baskets.
- Allowing scale plate or support tubes to rub.
- Not spreading specimen out.
- Not tearing off ticket before opening oven door.
- Allowing door to not latch correctly.
- Not correcting for moisture (e.g., when plant speed increases, etc.).
Example
Adapted from FHWA “Addendum T308”

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Burned Rep#1</th>
<th>Burned Rep#2</th>
<th>Unburned Blank</th>
<th>Rep#1 Diff</th>
<th>Rep#2 Diff</th>
<th>Avg Diff= AGCF</th>
<th>Allowable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1”</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>±5.0</td>
</tr>
<tr>
<td>¾”</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>±5.0</td>
</tr>
<tr>
<td>½”</td>
<td>86.5</td>
<td>89.5</td>
<td>89.7</td>
<td>3.2</td>
<td>0.2</td>
<td>1.7</td>
<td>±5.0</td>
</tr>
<tr>
<td>3/8”</td>
<td>69.3</td>
<td>72.1</td>
<td>70.4</td>
<td>1.1</td>
<td>-1.7</td>
<td>-0.3</td>
<td>±5.0</td>
</tr>
<tr>
<td>#4</td>
<td>52.1</td>
<td>55.6</td>
<td>53.9</td>
<td>1.8</td>
<td>-1.7</td>
<td>0.1</td>
<td>±5.0</td>
</tr>
<tr>
<td>#8</td>
<td>38.5</td>
<td>42.3</td>
<td>41.0</td>
<td>2.5</td>
<td>-1.3</td>
<td>0.6</td>
<td>±3.0</td>
</tr>
<tr>
<td>#30</td>
<td>32.7</td>
<td>37.0</td>
<td>34.4</td>
<td>1.7</td>
<td>-2.6</td>
<td>-0.5</td>
<td>±3.0</td>
</tr>
<tr>
<td>#40</td>
<td>16.1</td>
<td>17.9</td>
<td>18.3</td>
<td>2.2</td>
<td>0.4</td>
<td>1.3</td>
<td>±3.0</td>
</tr>
<tr>
<td>#50</td>
<td>12.6</td>
<td>13.4</td>
<td>14.5</td>
<td>1.9</td>
<td>1.1</td>
<td>1.5</td>
<td>±3.0</td>
</tr>
<tr>
<td>#200</td>
<td>6.8</td>
<td>7.4</td>
<td>7.1</td>
<td>0.3</td>
<td>-0.3</td>
<td>0.0</td>
<td>±0.5</td>
</tr>
</tbody>
</table>

For #4 sieve:

Rep#1: 53.9-52.1 = 1.8

Rep#2: 53.9-55.6 = -1.7

Avg diff = [1.8 + (-1.7)] / 2 = 0.05 = 0.1 (rounded)

Compare to ±5.0: 0.1 < 5.0 OK
• Using an oversize specimen.
• Not using the same size specimen for asphalt correction factor (C_f) determination and all production tests.
• Using a plant-made specimen instead of a lab-made specimen for (C_f) determination.
• Not double-checking specimen weight on oven scale against exterior scale weight.

Common Testing Errors

• Materials used for (C_f) determination not the same as project materials.
• Inaccurate asphalt contents used for (C_f) determination.
• QA & QC starting with different temperature specimens.
• Door left open too long between loadings.
• Wrong chamber set point.
• Wrong burn profile.
• Weighing on bench balance when specimen is hot.

Operation Problems

• Oven won’t shut itself off—it’s OK to manually shut off as long as 3 consecutive readings show less than 0.01% loss, and the sample appears to be completely burned (EPG 403.1.5).
### Premature Burn Stop

- Vibrations
- Basket or strap up against wall or top of chamber.
- Clogged port

More information on Binder Ignition in the Appendix item #5.

---

### Incomplete Burn Pattern: Shingle Mix

---

### Soot

---
AASHTO T 308: Asphalt Content by Ignition; Method A

<table>
<thead>
<tr>
<th>Trial#</th>
<th>1</th>
<th>2</th>
<th>R</th>
</tr>
</thead>
</table>

**Pre-Production Oven Parameters Checklist:** *(Demonstrate oven setup)*

Input required parameters for routine production of a particular mix:

1. Enter TEMP setpoint [chamber temperature]
2. Enter CALIB. FACTOR [binder (aggregate) correction factor]

**Routine Production Ignition Oven Procedure:** *(Demonstrate test procedure with proctor instruction)*

3. Obtain weight of empty basket assembly
4. Place ~½ of hotmix sample in each basket; move mix ~¾" away from sides; re-assemble basket. Cool to room temperature.
5. Obtain total weight of sample plus basket then calculate initial weight of hotmix sample
6. Enter initial sample WEIGHT
7. Zero oven scale (push the number 0)
8. After putting on safety gloves, face shield, etc., carefully load sample into oven, making sure basket is not touching walls; close door
9. Check total weight: oven vs. exterior scale: No good if > 5 grams difference: Is it?
10. Initiates burn-off program by pressing START/STOP
11. After burn-off stops, remove and examine paper readout
12. Again, with safety gear on, open oven door, remove basket & place on cooling rack. Cool to room temperature.
13. Determine and record basket + specimen weight, then calculate and record final specimen weight (for manual calculations and/or verification of %AC).
14. Obtain Calibrated %AC through calculations (NOTE: in the field, this value will automatically be on the printout tape)
15. Correct the Calibrated %AC for moisture

<table>
<thead>
<tr>
<th>PASS?</th>
<th>FAIL?</th>
</tr>
</thead>
</table>

Proctor__________________________________________Date__________________
Reviewer________________________________________Date__________________
Appendix

Items:

1. Ignition Oven Test Cookbook
2. Equipment Information
ASPHALT CONTENT IGNITION METHOD
(AASHTO T 308-18) METHOD A
Asphalt Binder Correction Factor (CF) Determination
(formerly “aggregate correction factor”)

1. Run a butter mix through the mixing equipment.

2. For a given mix, prepare two asphalt binder correction factor (CF) specimens at the design asphalt content using oven dry aggregate. It is recommended that the CF and field verification specimen sizes be the same.

3. Obtain the tare weight of the baskets, pan, and lid.

4. Place the hot mix into the sample basket. If the mix has cooled, oven dry at 110 ± 5°C to constant mass prior to placing in the basket. Spread the mix in the basket, being careful to keep the mix away from the sides. Allow at least ¾” clearance.

5. Test (burn) the specimens as discussed in “Test Procedure.”

6. If the difference between the measured binder contents of the two replicate specimens is more than 0.15%, test two more specimens. Discard the high and low values.

7. Calculate the CF by determining the difference between the actual and measured asphalt binder contents [Actual %AC – Measured %AC] for each sample, and averaging the two differences. The “Actual %AC” is the amount weighed out in the batching process, expressed as a percent by weight of the mix.

8. If the CF exceeds 1.0%, MoDOT Standard Specification Section 403.19.3.1.1 modifies AASHTO T 308-18 in the following manner:

   A. According to AASHTO T 308-18, if the CF exceeds 1.0% at the typical chamber temperature of 538°C (1000°F), lower the chamber temperature to 482 ± 5°C (900 ± 8°F). If the CF determined at this lower temperature is less than or equal to 1.0%, use that CF for subsequent testing on that particular mix.

   B. However, according to MoDOT Standard Specification Section 403.19.3.1.1, if the CF determined at 482 ± 5°C (900 ± 8°F) exceeds 1.0%, lower the chamber temperature to 427 ± 5°C (800 ± 8°F). Use the CF obtained at 427°C even if it exceeds 1.0%.
ASPHALT CONTENT IGNITION METHOD  
(AASHTO T 308-18)  
METHOD A

Asphalt Binder Correction Factor (CF) Determination

<table>
<thead>
<tr>
<th>Replicate</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Temperature</td>
<td>538</td>
<td>538</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tare (basket, etc.) Mass (g)</td>
<td>3000.0</td>
<td>3000.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Dry Mass (g)</td>
<td>4530.0</td>
<td>4517.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Dry Specimen Mass (g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss in Weight (g)</td>
<td>82.5</td>
<td>81.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>%AC, measured = M</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%AC, actual = A</td>
<td>5.00</td>
<td>5.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>%AC\text{diff} (M_1 – M_2)</td>
<td>&gt; 0.15%? If so, 2 more replicates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CF = M – A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CF, average</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ASPHALT CONTENT IGNITION METHOD  
(AASHTO T 308-18)  
METHOD A

Specimen size: Use the following table. It is recommended that the field verification specimen size be the same as the correction factor specimen size.

<table>
<thead>
<tr>
<th>NMS (mm)</th>
<th>Sieve Size</th>
<th>Minimum Specimen Size* (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.75</td>
<td>#4</td>
<td>1200</td>
</tr>
<tr>
<td>9.5</td>
<td>3/8&quot;</td>
<td>1200</td>
</tr>
<tr>
<td>12.5</td>
<td>1/2&quot;</td>
<td>1500</td>
</tr>
<tr>
<td>19.0</td>
<td>3/4&quot;</td>
<td>2000</td>
</tr>
<tr>
<td>25.0</td>
<td>1&quot;</td>
<td>3000</td>
</tr>
<tr>
<td>37.5</td>
<td>1 ½&quot;</td>
<td>4000</td>
</tr>
</tbody>
</table>

*Specimen sizes shall not be more than 500g greater than the minimum.

POSSIBLE SETTING CHANGES

1. To change the Stability Threshold:
   
   A. With oven off, press the “Calibration Factor” key while simultaneously pressing the Power Switch “on.”
   
   B. Enter new Stability Threshold value. Observe the Percent Loss window for the new value. Maximum allowable = 0.02.
   
   C. Press the Power Switch “off” then “on” to return oven to normal operation.

2. To change filter (afterburner) temperature (750°C typically):
   
   A. Press #5 key while simultaneously pressing the Power Switch “on.”
   
   B. Enter new temperature.
   
   C. Press “Enter.”
   
   D. New setpoint will be displayed.
MAINTENANCE
1. To check to see if the venting system is clogged, use the “Lift Test” procedure while the oven is at room temperature. With the power on, initiate a test (push “Start” button) without anything in the oven chamber. The blower fan will turn on. Watch the balance display. The display should read between -4 and -6 grams if the venting is adequate.

2. Burn accumulated soot out of the chamber by running the testing procedure at an elevated temperature without a sample.

TEST PROCEDURE
1. To change setpoint (furnace) temperature (538°C is typical):
   A. Press “Temp”
   B. Enter new setpoint
   C. Press “Enter”
   D. Press “Temp” again to verify new setpoint

2. To change the Asphalt Binder Correction Factor (C_F):
   A. Press “Calib. Factor”
   B. Enter new C_F
   C. Press “Enter”
   D. Press “Calib. Factor” again to verify

3. Preheat the oven to the setpoint, typically 538°C.

4. If the moisture content will not be determined, oven-dry the specimen at 110 ± 5°C to a constant mass.

5. Weigh the empty basket, etc. on an external scale to the nearest gram.

6. Place half the sample in the bottom basket and the other half in the top. Keep the specimen at least ¾” away from the basket sides. For larger samples, some operators make a hole in the middle of the mix.

7. Cool the loaded assembly to room temperature.

8. Weigh the loaded assembly. Calculate the mass of the specimen.
9. Press the “Weight” key and enter the specimen mass. Press “Enter.”

10. Press the “Weight” key again to verify specimen mass entry.

11. Press the “0” (zero) key to tare the internal balance.

12. Don your clean gloves, safety face shield, and safety attire.

13. Carefully load the specimen into the oven by inserting the basket until the handle tines touch the back of the oven. Make sure the basket is centered and is not touching the walls. Shut the door.

14. Observe the internal scale reading. The displayed value should check with the external scale value of basket assembly + dry specimen within ± 5 grams.

15. Press the “Start/Stop” key to initiate the ignition procedure.

16. When weight loss stabilizes (the change in %AC readings will not exceed 0.01% for three consecutive minutes), the oven will automatically end the test and print out the results. Depending on the oven setup, an alarm may sound and one may have to press the “Start/Stop” key to unlock the door.

17. Remove the printed results before opening the door as the tape is heat-sensitive.

18. Again don the safety gear, open the door, and remove the basket and mount it on the cooling plate. Cover with the cooling cage and allow to cool to room temperature.

19. Determine and record the final mass of the specimen, M_f.

20. From the total % loss, the oven will automatically subtract the C_F and the Temperature Compensation to give the %AC (by weight of mix). The %AC by weight of aggregate is the “Bitumen Ratio.”

21. Check for unburned asphalt (coke). If present, start with a new specimen.

NOTE: Read the manufacturer’s manual for additional information on safety and more detailed instructions on maintenance and operation.
## ASPHALT CONTENT IGNITION METHOD (AASHTO T 308-18)

### METHOD A

**Manual Weighing Method**

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Job No.</th>
<th>Route</th>
<th>County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technician</td>
<td>Date</td>
<td>Sublot No.</td>
<td>Mix No.</td>
</tr>
</tbody>
</table>

- Empty Basket Assembly Weight (g), \([T_e]\)
- Initial Basket Assembly + Wet (or dry) Sample Weight (g), \([T_i]\)
- Initial Wet (or dry) Sample Weight (g), \([W_i = T_i - T_e]\)
- Final Basket Assembly + Burned Sample Weight (g), \([T_f]\)
- Loss in Weight (g), \([L = T_i - T_f]\)
- % Loss, \([P_L = (L / W_i) \times 100]\)
- Aggregate Correction (Calibration) Factor (%), \([C_f]\)
- Calibrated %AC, \([P_{bcal} = P_L - C_f]\)
- % Moisture Content, \([MC]\)
- % AC, corrected (by weight of mix), \([P_b = P_{bcal} - MC]\)

*Ignition Ovens Forms.doc (11-24-06;12-28-06;12-12-08;3-9-10;12-14-10;4-14-11; 12-18-13; 4-22-15;12-9-15; 12-28-16; 12-26-18)*
Equipment Information

for

AASHTO T 308

Determining the Asphalt Binder Content of asphalt Mixtures by the Ignition Method

- M 339M/M 339, Thermometers Used in the Testing of Construction Materials

5. APPARATUS

5.1. Ignition Furnace—A forced-air ignition furnace that heats the specimens by either the convection or direct IR irradiation method. The convection-type furnace must be capable of maintaining a temperature of 538 ± 5°C (1000 ± 9°F). The furnace chamber dimensions shall be adequate to accommodate a specimen size of 3500 g. The furnace door shall be equipped so that the door cannot be opened during the ignition test. A method for reducing furnace emissions shall be provided. The furnace shall be vented into a hood or to the outside and, when set up properly, shall have no noticeable odors escaping into the laboratory. The furnace shall have a fan capable of pulling air through the furnace to expedite the test and reduce the escape of smoke into the laboratory. The ignition furnace shall be capable of operation at the temperatures required, between at least 530 and 545°C (986 and 1013°F), and have a temperature control accurate within ±5°C (±9°F) as corrected, if necessary, by standardization. More than one furnace may be used, provided each is used within its proper operating temperature range. When measuring temperature during use, the thermometer for measuring the temperature of materials shall meet the
requirements of M 339/M 339 with a temperature range of at least 530 to 545°C (986 to 1013°F) and an accuracy of ±1.25°C (±2.25°F) (Note 1).

**Note 1**—Thermometer types suitable for use include ASTM E1 mercury thermometers; ASTM E230/E230M thermocouple thermometer, Type J or K, Special Class; or IEC 60584 thermocouple thermometer, Type J or K, Class 1.

5.1.1. For Method A, the furnace shall also have an internal balance thermally isolated from the furnace chamber and accurate to 0.1 g. The balance shall be capable of weighing a 3500-g specimen in addition to the specimen baskets. A data collection system will be included so that the mass can be automatically determined and displayed during the test. The furnace shall have a built-in computer program to calculate the change in mass of the specimen baskets and provide for the input of a correction factor for aggregate loss. The furnace shall provide a printed ticket with the initial specimen mass, specimen mass loss, temperature compensation, correction factor, corrected asphalt binder content (percent), test time, and test temperature. The furnace shall provide an audible alarm and indicator light when the specimen mass loss does not exceed 0.01 percent of the total specimen mass for 3 consecutive min. The furnace shall also allow the operator to change the ending mass loss percentage to 0.02 percent.

5.2. **Specimen Basket Assembly**—Consisting of specimen basket(s), catch pan, and an assembly guard to secure the specimen basket(s) to the catch pan.

5.2.1. **Specimen Basket(s)**—Of appropriate size to allow the specimens to be thinly spread and allow air to flow through and around the specimen particles. Sets with two or more baskets shall be nested. The specimen shall be completely enclosed with screen mesh, perforated stainless steel plate, or other suitable material.

**Note 2**—Screen mesh or other suitable material with maximum and minimum openings of 2.36 mm (No. 8) and 0.600 mm (No. 30), respectively, has been found to perform well.

5.2.2. **Catch Pan**—Of sufficient size to hold the specimen basket(s) so that aggregate particles and melting asphalt binder falling through the screen are caught.

5.3. **Oven**—Capable of maintaining 110 ± 5°C (230 ± 9°F). The oven(s) for heating shall be capable of operation at the temperatures required, between 100 and 120°C (212 and 248°F), within ±5°C (±9°F) as corrected, if necessary, by standardization. More than one oven may be used, provided each is used within its proper operating temperature range. The thermometer for measuring the oven temperature shall meet the requirements of M 339/M 339 with a temperature range of at least 90 to 130°C (194 to 266°F) and an accuracy of ±1.25°C (±2.25°F) (Note 3).

**Note 3**—Thermometer types suitable for use include ASTM E1 mercury thermometers; ASTM E2877 digital metal stem thermometer; ASTM E230/E230M thermocouple thermometer, Type J or K, Special Class, Type T any Class; IEC 60584 thermocouple thermometer, Type J or K, Class 1, Type T any Class; or dial gauge metal stem (bi-metal) thermometer.

5.4. **Balance**—Of sufficient capacity and conforming to the requirements of M 231, Class G 2.

5.5. **Safety Equipment**—Safety glasses or face shield, dust mask, high-temperature gloves, long-sleeved jacket, a heat-resistant surface capable of withstanding 650°C (1202°F), and a protective cage capable of surrounding the specimen baskets during the cooling period.

5.6. **Miscellaneous Equipment**—A pan larger than the specimen basket(s) for transferring the specimen after ignition, spatulas, bowls, and wire brushes.