Test Procedure for

DETERMINING ASPHALT CONTENT FROM ASPHALT PAVING MIXTURES BY THE IGNITION METHOD

TxDOT Designation: Tex-236-F

Effective Date: June 2024

1. SCOPE

1.1 Use Part I of this test method to determine the asphalt content of hot mix asphalt (HMA) paving mixtures, reclaimed asphalt pavement (RAP) stockpiles, and recycled asphalt shingles (RAS) stockpiles using an ignition oven. Use the remaining aggregate for sieve analysis in accordance with Tex-200-F.

1.2 Use Part II of this test method to determine aggregate gradation and asphalt content correction factors before the start of production. The type of aggregate in the mixture may affect the ignition procedure. Establish correction factors by testing a set of samples for each mix type produced to optimize accuracy.

1.3 Use Part III of this test method to witness the batching and mixing of material for determination of correction factors.

1.4 The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.

2. APPARATUS

2.1 *Ignition oven,* capable of:

2.1.1 Maintaining a temperature to cause combustion with an internal balance thermally isolated from the chamber accurate to 0.1 g. The balance must be capable of weighing a 4,000 g sample in addition to the sample baskets.

2.1.2 Providing an audible alarm and indicator light when the sample reaches constant weight.

Note 1—The oven door must automatically lock when the test procedure begins and must remain locked until the test procedure is completed.

2.1.3 Providing initial sample weight, sample weight loss, correction factor, corrected asphalt content (percent), and test time.

2.2 *Tempered stainless steel No. 8 (2.36 mm) mesh basket,* otherwise perforated basket, or combination of baskets. The basket must incorporate a design that confines the sample during testing.

2.3 *Tempered stainless steel catch pan*, to fit under the basket assembly.

2.4 *Oven*, capable of attaining a temperature of at least 325°F (163°C).

2.5 *Balance,* Class G2, in accordance with Tex-901-K, with a minimum capacity of 17.6 lb. (8 kg) for weighing sample in baskets.

3. SAFETY EQUIPMENT

3.1 *Safety glasses or face shield.*

3.2 *High temperature gloves.*

3.3 *Long sleeve jacket.*

3.4 *Heat-resistant surface,* capable of withstanding heat from the sample baskets.

3.5 *Protective cage,* capable of surrounding the sample baskets.

4. MISCELLANEOUS EQUIPMENT

4.1 *Pan for transferring samples after ignition.*

4.2 *Spatulas.*

4.3 *Bowls.*

4.4 *Wire brushes.*

5. REPORT FORMAT

5.1 The Correction Factor Calculation Report is an Excel template containing the following worksheets:

- Asphalt Content and Combined Aggregate Gradation (Tx236) and
- Summary Sheet (Summary).

5.2 For HMA mixtures, use the QC/QA Excel template for the Ignition Oven Method in conjunction with the HMA specification. Refer to the Instructions tab for guidelines on how to use the template.

5.3 Use the Mix Design Excel template to prepare blank samples when establishing correction factors.

6. SAMPLE PREPARATION

6.1 *Asphalt Paving Mixtures:*

6.1.1 Produce a sample in accordance with Tex-205-F or quarter a sample in accordance with Tex-222-F.

6.1.1.1 When the mixture is not sufficiently workable to separate the mix with a spatula or trowel, place it in a large flat pan and warm to 250 ± 5°F (121 ± 3°C) for 30 min.

Note 2—Do not heat sample for more than 1 hr.

6.1.1.2 For microsurfacing production mix, place the mixture in a large flat pan and dry to constant weight at 230 ± 10°F.

6.1.1.3 The mixture type controls the required sample size, as shown in Table 1.

Table 1
Required Weight of Sample

Mixture Type	Required Weight of Sample, g
Type A, SP-A	3,000–4,000
Type B, SP-B	2,000–3,000
Type C, PFC (PG 76), SP-C, CMHB-C, SMA-C, SMA-D, SMAR-C, UTBWC-C, TBPFC (PG 76)	1,000–2,000
Type D, PFC (A-R), SP-D, CMHB-F, SMA-F, UTBWC-B, TBPFC (A-R)	1,200–1,500
Type F, SMAR-F, Microsurfacing, CAM, UTBWC-A, TOM-C, TOM-F	1,000–1,200

6.1.2 Sample sizes should not be more than 400 g greater than the maximum required sample mass as shown in Table 1. Large samples of fine mixes tend to result in incomplete ignition of the asphalt.

Note 3—When the mass of the sample exceeds the capacity of the equipment used, divide the sample into suitable increments. Appropriately combine the results for calculating the asphalt content (weighted average).

6.1.3 Verify that the mixture contains no more than 0.2% of moisture by weight in accordance with Tex-212-F, Part II. Do not use the same sample used for moisture determination as used for asphalt content determination.

6.2 *Recycled Materials Samples:*

6.2.1 Take a representative sample from the recycled material stockpile in accordance with Tex-222-F.

6.2.2 Oven-dry the sample to constant weight at 140 ± 5°F (60 ± 3°C).

6.2.3 Quarter a test sample to the required size shown in Table 2.

6.2.4 Verify that the mixture contains no more than 0.2% of moisture by weight in accordance with Tex-212-F, Part II. Do not use the same sample used for moisture determination as used for asphalt content determination.

Table 2
Required Weight of Recycled Material Sample

Recycled Material Type	Required Weight of Sample, g
Reclaimed Asphalt Pavement (RAP)[1]	1,000–4,000
Recycled Asphalt Shingles (RAS)[2]	500–700

1. Refer to Table 1 for required sample weights.
2. Sample size exceeding the required weight above may not completely ignite the asphalt.

PART I—DETERMINE ASPHALT CONTENT BY IGNITION METHOD

7. SCOPE

7.1 Use this procedure to determine the asphalt content of HMA paving mixtures using an ignition oven. Use the remaining aggregate for sieve analysis in accordance with Tex-200-F.

8. PROCEDURE

8.1 Pre-heat the ignition oven according to the manufacturer's recommendations.

8.2 Determine and record the weight of the basket assembly to the nearest 0.1 g.

8.3 Place the loose mixture directly into the sample baskets.

Note 4—Reheat the sample in a 250°F (121°C) oven for 30 min. if it gets cold. Do not reheat microsurfacing, limestone rock asphalt (LRA), or hot-mix cold-laid samples. Do not preheat the sample baskets.

8.4 Evenly distribute the sample in the basket assembly, keeping the material away from the edges of the basket.

8.5 Weigh and record the sample and basket assembly to the nearest 0.1 g.

8.6 Calculate and record the initial weight of the sample (total weight minus the weight of the sample basket assembly) and designate as W_S in Section 13.1.

8.7 Input W_S into the ignition oven controller. Verify entry of the correct weight.

8.8 Open the chamber door and place the sample and basket assembly in the ignition oven.

Note 5—Failure of the oven scale to stabilize may indicate that the sample basket assembly is contacting the oven wall. If this occurs, adjust the sample basket inside the oven.

8.9 Close the chamber door and start the test.

Note 6—This should lock the oven chamber for the duration of the test.

8.10 Allow the test to continue until the stable light and audible stable indicator indicate the test is complete.

8.11 Press the stop button.

Note 7—This should unlock the oven chamber.

8.12 Open the chamber door, remove the sample, and allow it to cool to room temperature (approximately 45 min.)

Note 8—Do not use a fan to assist in cooling the sample to room temperature due to the possibility of losing fines.

8.13 Weigh the sample and basket assembly after ignition to the nearest 0.1 g.

8.14 Calculate and record the final weight of the sample (total weight from Section 8.13. minus the weight of the sample basket assembly) and designate this weight as W_A in Section 13.1.

8.15 Calculate the asphalt content of the sample according to Section 13.1.

Note 9—Asphalt content reported by the ignition oven may be used if proven accurate.

8.16 Empty the contents of the basket into a flat pan. Use a small wire sieve brush to ensure removal of any residual fines from the basket. Add those fines to the contents in the flat pan.

8.17 Use the remaining aggregate for the sieve analysis in accordance with Tex-200-F.

PART II—DETERMINE CORRECTION FACTORS

9. SCOPE

9.1 Use this test method to determine aggregate gradation and asphalt content correction factors before the start of production. The type of aggregate in the mixture may affect the ignition procedure. Establish correction factors by testing a set of samples for each mix type produced to optimize accuracy.

10. PROCEDURE

10.1 A Level 2-certified technician must prepare one blank sample in the laboratory in accordance with Tex-205-F, using the Blank Weigh Up worksheet in the Mix Design Excel template. Determine the sample size for the blank sample in accordance with Tex-200-F, Table 1.

Note 10—Do not add any asphalt binder, fibers, or any recycled materials to the blank sample. Do not perform the ignition oven procedure with the blank sample.

10.2 Perform a washed sieve analysis on the blank sample in accordance with Tex-200-F, Part II.

Note 11—Enter the individual or cumulative weight of aggregate retained on each sieve on the Asphalt Content and Combine Aggregate Gradation worksheet.

10.3 When applicable, enter the gradation of any recycled material used in the mixture design, such as RAP or RAS, in the Asphalt Content and Combined Aggregate Gradation worksheet, under the Recycled Materials Section. Use the gradation of the recycled material determined for the mixture design in accordance with Tex-204-F.

Note 12—The Asphalt Content and Combined Aggregate Gradation worksheet calculates the combined gradation of the blank sample and recycled materials, when applicable.

Note 13—The combined gradation, including the use of any recycled materials, must fall within the master gradation limits of the specification used for the project.

10.4 Prepare a "butter batch mix" at the design optimum asphalt content and discard before mixing any other samples for determining correction factors.

Note 14—A "butter batch mix" is a trial batch of asphalt and aggregate design mixture used to coat the mixing bowl and whips with asphalt. This helps prevent a loss of asphalt due to adhesion on the bare walls of the bowl or in the mixing whips to ensure an accurate asphalt content of the samples used to determine correction factors.

10.5 Use the Weigh Up worksheet in the Mix Design Report to prepare two samples in the laboratory at the design optimum asphalt content in accordance with Tex-205-F. Determine the sample size in accordance with Section 6.1.1.3.

Note 15— Add the recycled material when preparing the samples if applicable.

10.6 Perform the ignition oven procedure as described under Section 8 with the samples prepared in Section 10.5.

10.7 Perform a dry gradation sieve analysis in accordance with Tex-200-F, Part I, on the residual aggregate for each ignited sample from Section 10.6.

Note 16—Enter the individual or cumulative weight of aggregate retained on each sieve on the Asphalt Content and Combine Aggregate Gradation worksheet.

10.8 *Determining Asphalt Content Correction Factor:*

10.8.1 Determine the asphalt content for each ignited sample in Section 10.6. in accordance with Section 13.1.

10.8.2 Use the Asphalt Content and Combined Aggregate Gradation worksheet to subtract the measured asphalt content for each ignited sample determined in Section 10.8.1. from the actual asphalt content. Average the two measured differences to determine the asphalt content correction factor.

Note 17—When fibers are added to the mixture, the asphalt content correction factor takes into account the percent fibers in the mixture so that the fibers are excluded from the binder content determination.

10.8.3 If Section 10.8. yielded an asphalt correction factor that was greater than 0.3%, use the Back Calculated Rice Method in Section 10.9. to verify the asphalt content.

Note 18—The type of aggregate in the mixture may affect the ignition procedure. Establish standard Rice values by testing a set of known asphalt contents from a laboratory produced sample. Compare production samples to these standards for verification.

10.9 *Verifying Asphalt Content using the Back Calculated Rice Method:*

10.9.1 Using the current design, produce a laboratory mixture at the design optimum asphalt content in accordance with Tex-205-F. Prepare enough material to test three G_r samples in accordance with Tex-227-F.

10.9.2 During production, compare the production G_r to the average G_r obtained in part 10.9.1.

10.9.3 Use Asphalt Content and Combined Aggregate Gradation (Tx236) to enter these values and verify asphalt contents.

10.10 *Determining Aggregate Gradation Correction Factors:*

10.10.1 Use the Asphalt Content and Combined Aggregate Gradation worksheet to subtract the gradation determined in Section 10.7. (ignited samples) for each sieve size from each corresponding sieve size of the combined gradation determined in Section 10.3. (blank samples and recycled material).

10.10.2 Average the two measured differences for each sieve size to determine the aggregate gradation correction factor for each sieve size. Report the correction factors in percent passing.

10.11 Use the Summary worksheet to report the asphalt content and aggregate gradation correction factors.

Note 19—A correction factor of zero can be used if the aggregate correction factor for a sieve has historically been less than 0.5%.

PART III—WITNESS THE BATCHING AND MIXING OF MATERIAL FOR DETERMINATION OF CORRECTION FACTORS

11. SCOPE

11.1 Use this test method to witness the batching and mixing of material for determination of asphalt correction factors in accordance with Tex-205-F.

12. PROCEDURE

12.1 Ensure that the correction factors are being performed with the materials designated for this project using the combined gradation sheet from the mix design excel template, Figure 1. Ensure the design ID is clearly

identified. Reference documentation for material sources including but not limited to asphalt binder, aggregate, recycled materials, antistrip, fiber, and additives.

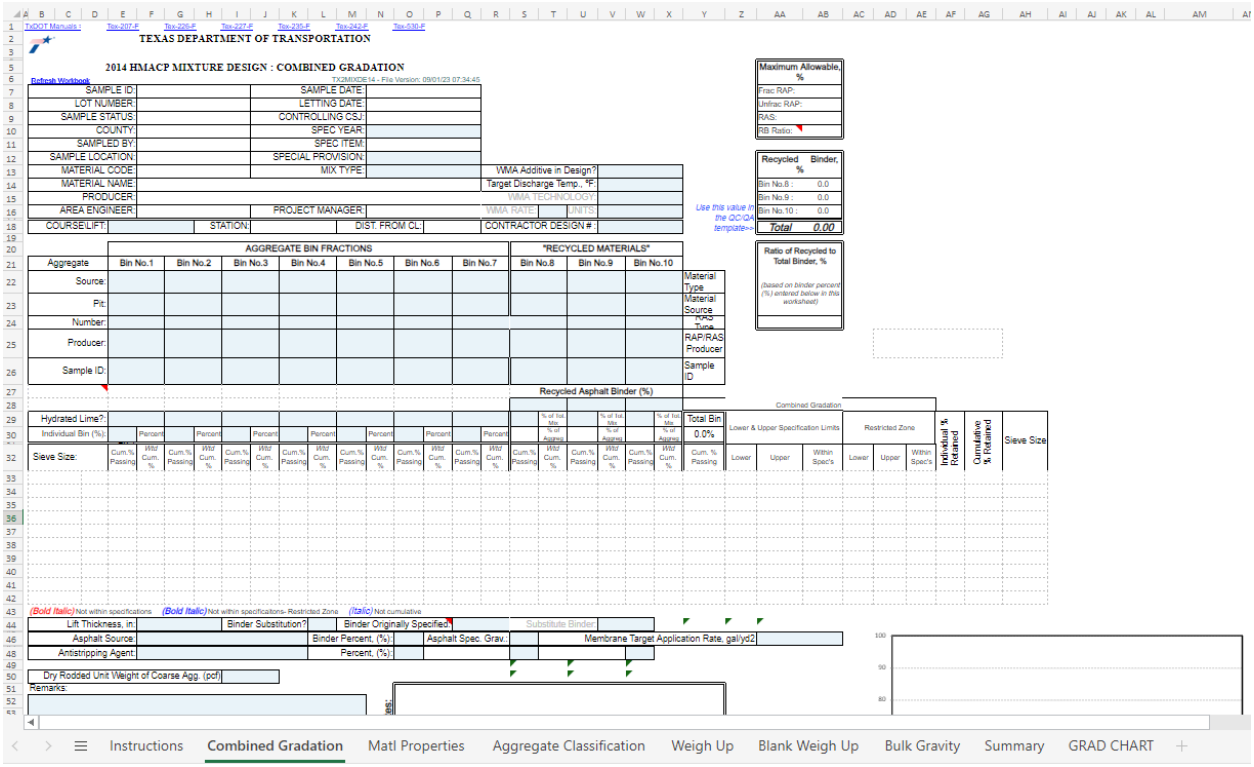

Figure 1
Combined Gradation Template

12.2 Review a copy of the Weigh Up worksheet in the Mix Design Excel template and ensure the design ID is clearly identified, Figure 2.

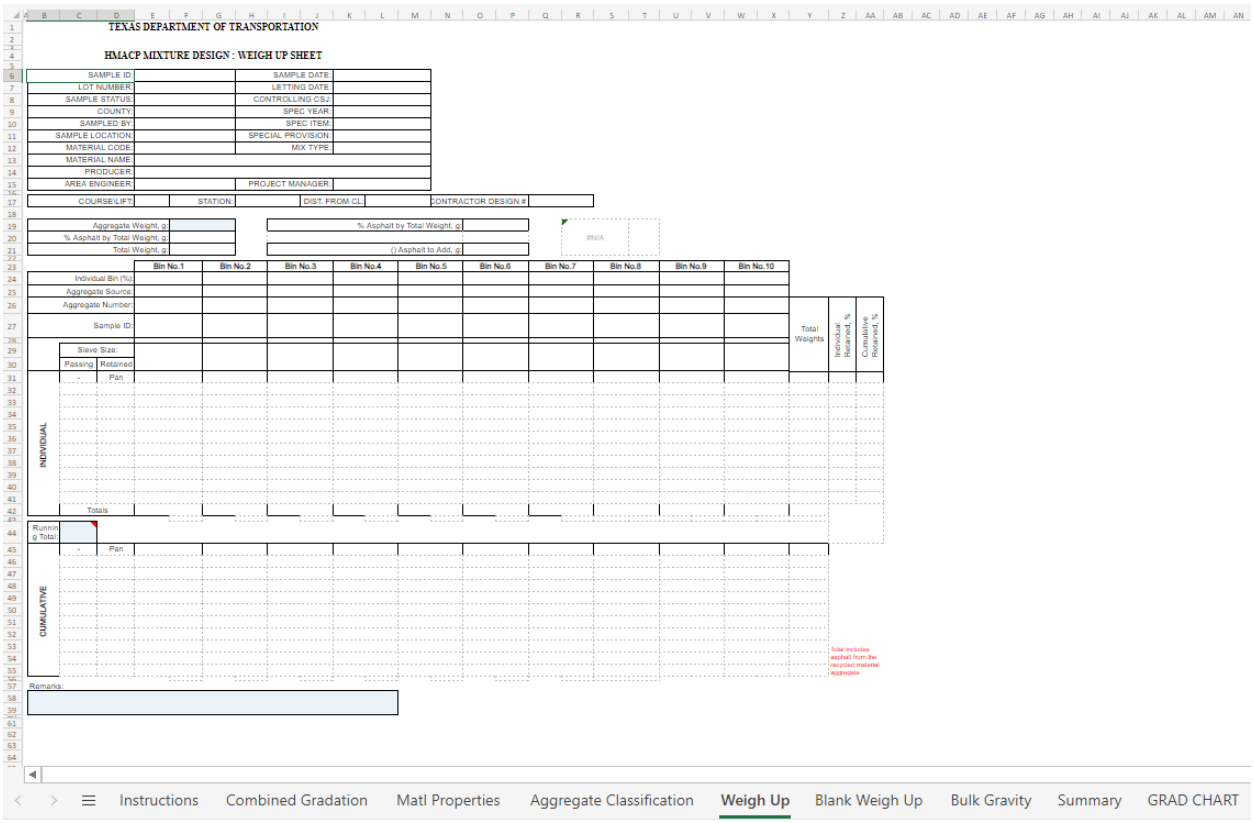

Figure 2
Weigh Up Template

12.3 *Witness Mixing of Material for Asphalt Correction Factors:*

12.3.1 Verify the following information is distinctly specified for asphalt correction factors:

12.3.1.1 Pans are labeled with source information and aggregate bin size according to the governing specification,

12.3.1.2 The proper weight of combined aggregate,

12.3.1.3 The proper weight of recycled materials and additives used,

12.3.1.4 The amount of liquid asphalt used for each batch.

12.3.2 Ensure a "butter batch mix" is performed at the designs optimum asphalt content and discarded before mixing any other samples for determining correction factors.

12.3.3 Ensure samples are prepared in the laboratory at the designs optimum asphalt content in accordance with Tex-205-F and verify the sample size.

12.3.4 Witness the continuous mixing of the aggregate and asphalt until materials are coated thoroughly.

12.3.5 Take immediate possession of the Engineer's sample.

12.4 *Witness Mixing of Material for Blank Samples:*

12.4.1 Verify the following information is distinctly specified for blank samples:

12.4.1.1 Pans are labeled with source information and size fraction according to the governing specification,

12.4.1.2 The proper weight of each individual aggregate size fraction,

Note 20—Ensure that asphalt binder, fibers, or recycled materials are not added to the blank samples.

12.4.2 Take immediate possession of the Engineer's sample.

Note 21—Ensure material is not lost when transporting to the Engineer's laboratory.

13. CALCULATIONS

13.1 Calculate the asphalt binder content of the sample.

13.1.1 For HMA, LRA, hot-mix cold-laid, and recycled materials:

$$AC\% = \left[\frac{W_S - W_A}{W_S}\right] * 100$$

13.1.2 For microsurfacing mixtures:

$$AC\% = \left[\frac{W_S - W_A}{W_A}\right] * 100$$

Where:

$AC\%$ = measured asphalt content

W_A = total weight of aggregate remaining after ignition, g

W_S = total weight of the HMA sample before ignition, g

13.2 Report ignition oven test results to the nearest 0.1%.

14. ARCHIVED VERSIONS

14.1 Archived versions are available.