



# Standard Practice for Preparation of Viscosity Blends for Hot Recycled Bituminous Materials<sup>1</sup>

This standard is issued under the fixed designation D 4887; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice covers the procedure for preparation of hot recycled bituminous blends for testing in the laboratory. The procedure involves an iterative trial blend process followed by the preparation of batch blends.

1.2 The batch blends can be used for extensive evaluation such as viscosity, penetration, ductility, aging properties (such as Rolling Thin Film Oven or Thin-Film Oven tests, or both (RTFO/TFO)), composition analysis, solubility analysis, and other user-selected tests.

1.3 This practice assumes that a representative reclaimed asphalt pavement (RAP) sample is extracted and the aged binder recovered using Test Methods D 2172 and D 1856 (this practice may be modified by using a rotary evaporator which is extensively evaluated in the minutes of the *18th Pacific Coast Conference on Asphalt Specifications*<sup>2</sup>) or any other acceptable test method.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:

- D 1856 Test Method for Recovery of Asphalt from Solution by Absorb Method<sup>3</sup>
- D 2171 Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer<sup>3</sup>
- D 2172 Test Methods for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures<sup>3</sup>
- D 3381 Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction<sup>3</sup>

## 3. Summary of Practice

3.1 The percentage of a recycling agent or paving-grade-

asphalt required to meet a target viscosity is initially determined on a weight basis by the use of a viscosity blend chart as illustrated in Fig. 1. A  $10.0 \pm 0.1$ -g (minimum) trial blend consisting of the recycling agent or paving grade asphalt and reclaimed RAP binder is prepared in the laboratory. The viscosity of the trial blend at  $60^\circ\text{C}$  ( $140^\circ\text{F}$ ) is compared to the target viscosity. If the blend viscosity is not within the limits of Specification D 3381 about the target value, another trial blend is prepared using adjusted proportions of the same or an alternate grade modifier, or both, and the RAP binder. A batch blend larger than the trial blend can then be prepared after the target viscosity is achieved to facilitate additional tests.

NOTE 1—It is recognized that Test Method D 2171 requires 20 mL (minimum) of asphalt sample; however, due to enormous resources involved in extraction and recovery plus conducting a number of iterations, a  $10.0 \pm 0.1$ -g (minimum) sample is suggested to be adequate for this practice. The accuracy of Test Method D 2171 is not significantly affected by the change in sample size.

## 4. Significance and Use

4.1 A standard procedure for blend preparation is essential to ensure material quality, specification compliance, and procedural uniformity.

## 5. Apparatus

- 5.1 *Beakers*, 50-mL, 600-mL capacity or other suitable containers.
- 5.2 *Hot plate*.
- 5.3 *Glass stirring rod*.

## 6. Procedure

6.1 Weigh the RAP binder and recycling agent or paving-grade-asphalt in appropriate proportions in accordance with 3.1 in a  $10.0 \pm 0.1$ -g specimen or larger for a trial blend. Prepare the  $10.0 \pm 0.1$ -g trial blend in the 50-mL container while preparing a larger batch (if required) in the 600-mL container or other suitable containers.

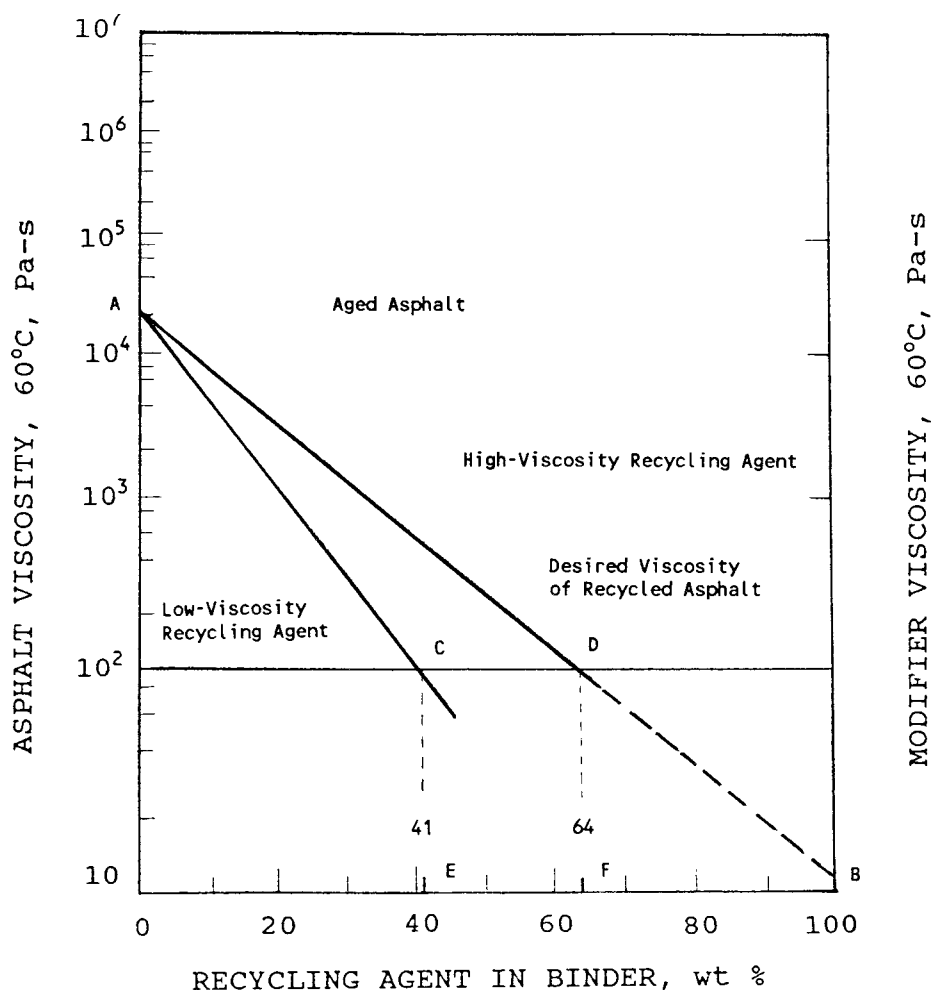
NOTE 2—For ease of handling during proportioning, the RAP binder and recycling agent or paving grade asphalt may be frozen ( $6 \pm 1^\circ\text{F}$  is suggested) for 1 to 2 h. Aromatic oils may not require freezing. The frozen state facilitates chipping and weighing the desired quantities with relative ease. Weighing should be executed quickly because cold specimens may attract moisture especially in humid environments that may result in bubbly action during heating.

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D-4 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.25 on Analysis of Bituminous Mixtures.

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<sup>2</sup> Asphalt Recovery Subcommittee Report, San Francisco, CA, May 17–18, 1983.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.03.



NOTE 1—How to Use the Chart:

- (1) Plot reclaimed asphalt viscosity 60°C (140°F) on left ordinate (A).
- (2) Plot recycling agent viscosity 60°C (140°F) on right ordinate (B).
- (3) Connect points A and B with a straight line.
- (4) Draw a horizontal line through the target (blend) viscosity intersecting the component viscosity line (AB).
- (5) Repeat steps 2 through 4 to form line AC for another candidate recycling agent or paving-grade asphalt.
- (6) The projections of points C and D yield estimates of percent recycling agent or paving-grade asphalt required to meet the target blend viscosity.
- (7) The estimate in step 6 can be scaled back and forth to establish the exact blend that will produce the desired viscosity or other target property within the limits of the test material.

NOTE 2—Calculations using ordinate viscosity ( $\eta$ ) values (scales A and B) can be simplified by using  $\log(100 \times \eta_A \text{ or } \eta_B(\text{Pa}\cdot\text{s}))$  such that ordinates and abscissa axes become linear.

FIG. 1 Percent Recycling Agent Required Depends on Viscosity

6.2 Place the container with the  $10.0 \pm 0.1$ -g target blend sample on a hot plate at 93 to 121°C (200 to 250°F) and continually stir by hand using a glass rod until the material becomes fluid. Place the container with the sample in an oven at 135°C (275°F) for 10 min and stir for 30-s durations at 5-min intervals. Transfer the sample to viscosity tubes for viscosity testing at 60°C (140°F) as prescribed in Test Method D 2171. Repeat the procedure until the desired viscosity is achieved.

6.3 Once the desired viscosity is achieved, prepare a batch blend sample. About 200 g is normally sufficient. Weigh in a 600-mL container and place in a 135°C (275°F) oven and stir, using a glass rod, for 1 min at every 10-min interval until the mixture melts. After the material is thoroughly melted, keep it

in the oven for another 30 min while stirring for 1 min at every 5-min interval. Remove the batch blend sample from the oven for subsequent testing.

NOTE 3—Larger quantities of blended material may be prepared by combining two or more  $200.0 \pm 0.1$ -g batch blends. Alternatively, single large batches may be made provided uniform mixing is achieved.

6.4 The batch blend prepared in 6.3 can be divided into smaller quantities for physical or chemical tests to meet the various test requirements of the investigator.

## 7. Report

7.1 The report shall include the following information:

- 7.1.1 The target blend viscosity,
- 7.1.2 The type of materials blended and the viscosity of

each component material at 60°C (140°F),

- 7.1.3 The proportions of the blended materials, and
- 7.1.4 The properties of the batch blend if the latter is made.

## **8. Keywords**

8.1 asphalt viscosity; binder viscosity; RAP binder; reclaimed asphalt pavement (RAP); recycled asphalt; recycled bituminous material

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