



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

This standard is issued under the fixed designation D4887/D4887M; 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 [D2172](#) and Test Method [D1856](#) (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 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.5 *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.*

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee [D04](#) on Road and Paving Materials and is the direct responsibility of Subcommittee [D04.25](#) on Analysis of Asphalt Mixtures.

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

## 2. Referenced Documents

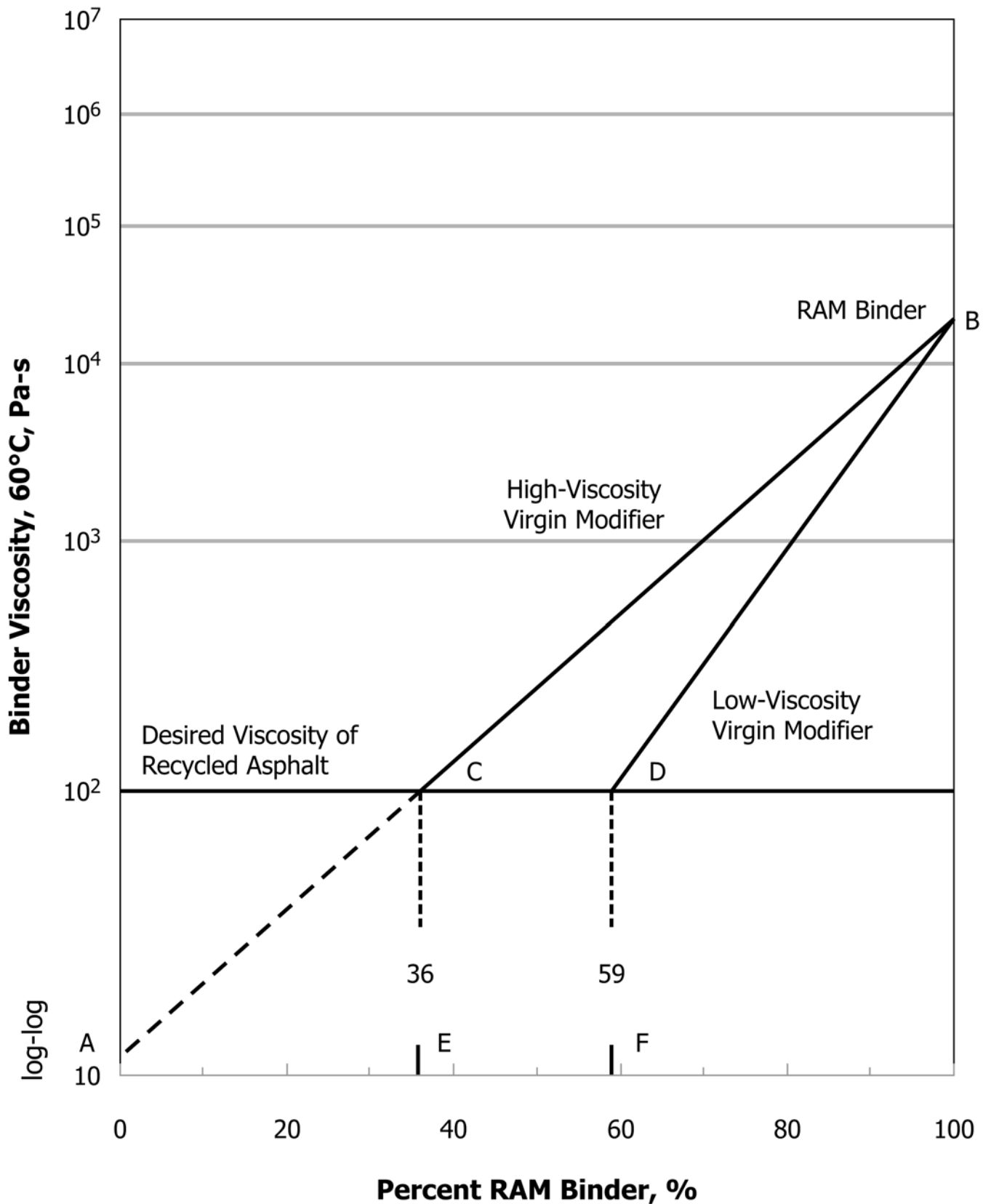
### 2.1 *ASTM Standards*:<sup>3</sup>

- [D1856](#) Test Method for Recovery of Asphalt From Solution by Abson Method
- [D2171](#) Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer
- [D2172](#) Test Methods for Quantitative Extraction of Bitumen From Bituminous Paving Mixtures
- [D3381](#) Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction
- [D6373](#) Specification for Performance Graded Asphalt Binder
- [D6816](#) Practice for Determining Low-Temperature Performance Grade (PG) of Asphalt Binders
- [D7175](#) Test Method for Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer

## 3. Summary of Practice

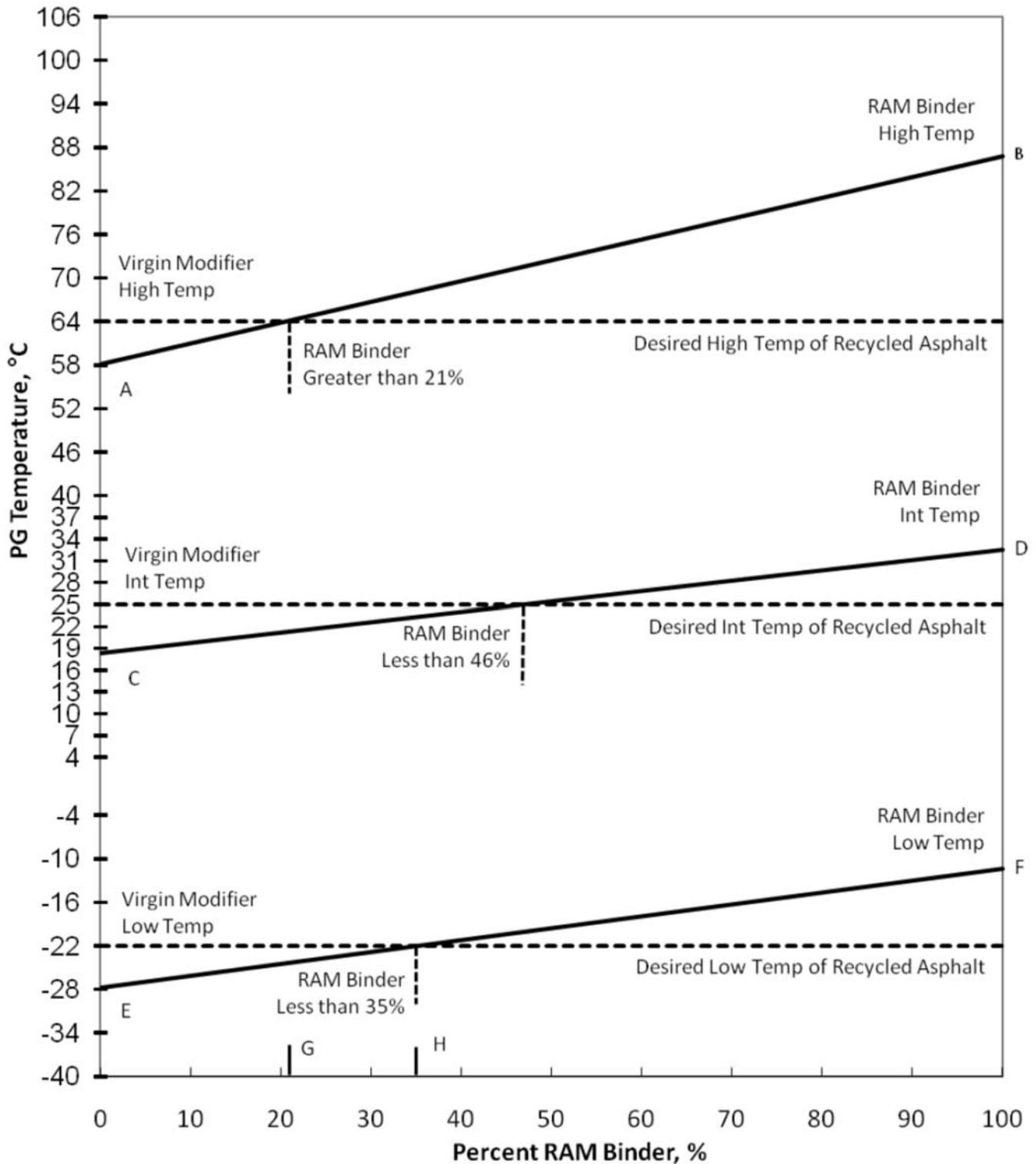
3.1 This specification covers the use of a viscosity blending chart shown in [Fig. 1](#) or by a Performance Grade (PG) temperature blending chart shown in [Fig. 2](#) to determine the percentage of a recycling agent, rejuvenating agent or pavinggrade- asphalt (hereafter referred to as virgin modifier) required to meet the target viscosity or PG temperature. The blending chart based on viscosity is based upon results from [D2171](#) compared to the limits of [D3381](#). The PG blending chart is based upon the results from [D6816](#) and [D7175](#) which are compared to the limits of [D6373](#). The procedure consists of determining the asphalt binder grade of reclaimed asphalt binder (hereafter referred to as RAM binder), estimating the blend by graphical methods and preparing a blend of virgin modifier and the RAM binder in the laboratory. The measured properties of the blend are compared to the target values. If the

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.



NOTE 1—Calculations using ordinate viscosity ( $\eta$ ) values (scales A and B) can be simplified by using  $\log\log(100 \times \eta_A$  or  $\eta_B$  (Pa·s)) such that ordinates and abscissa axes become linear.

FIG. 1 Percent RAM Binder Allowed based on Viscosity



**FIG. 2 Percent RAM Binder Allowed based on PG Temperatures**

blend properties do not meet the requirements and are not within the limits of Specification **D3381** or **D6373**, another trial blend is prepared using adjusted proportions of the same or an alternate virgin modifier, or both, and the RAM 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 D2171 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 D2171 is not significantly affected by the change in sample size.

NOTE 2—How to Use Figure 1:

- (1) Plot high viscosity virgin modifier's viscosity at  $60^{\circ}\text{C}$  ( $140^{\circ}\text{F}$ ) on left ordinate (A).
- (2) Plot RAM binder viscosity at  $60^{\circ}\text{C}$  ( $140^{\circ}\text{F}$ ) 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 BD (binder viscosity not shown for low viscosity virgin modifier) for another candidate virgin modifier.
- (6) The projections of points E and F yield estimates of percent RAM binder allowed 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 3—How to Use Figure 2:

Procedure to determine the allowable percent RAM binder to reach a target binder PG.

- (1) Determine target binder PG high, intermediate and low temperatures.
- (2) Plot virgin modifier high PG temperature on left ordinate (A)
- (3) Plot RAM binder high PG temperature on right ordinate (B)
- (4) Connect points A and B with a straight line.
- (5) Draw a horizontal line through the target (blend) high PG temperature intersecting the component high PG temperature through line (AB).
- (6) Plot virgin modifier intermediate PG temperature on left ordinate (C)
- (7) Plot RAM binder intermediate PG temperature on right ordinate (D)
- (8) Connect points C and D with a straight line.
- (9) Draw a horizontal line through the target (blend) intermediate PG temperature intersecting the component intermediate PG temperature through line (CD).
- (10) Plot virgin modifier low PG temperature on left ordinate (E)
- (11) Plot RAM binder low PG temperature on right ordinate (F)
- (12) Connect points E and F with a straight line.
- (13) Draw a horizontal line through the target (blend) low PG temperature intersecting the component low PG temperature through line (EF).
- (14) The projections of points G and H yield estimates of the allowable percent RAM binder that may be used to meet the target blend PG.

#### 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 4—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.

6.2 Place the container with the  $10.0 \pm 0.1$ -g target blend sample on a hot plate at  $93$  to  $121^{\circ}\text{C}$  ( $200$  to  $250^{\circ}\text{F}$ ) and continually stir by hand using a glass rod until the material becomes fluid. Place the container with the sample in an oven at  $135^{\circ}\text{C}$  ( $275^{\circ}\text{F}$ ) for 10 min and stir for 30-s durations at 5-min intervals. Transfer the sample to viscosity tubes for viscosity testing at  $60^{\circ}\text{C}$  ( $140^{\circ}\text{F}$ ) as prescribed in Test Method D2171. 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  $135^{\circ}\text{C}$  ( $275^{\circ}\text{F}$ ) 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 5—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  $60^{\circ}\text{C}$  ( $140^{\circ}\text{F}$ ),

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; RAM binder; reclaimed or recycled asphalt material (RAM); recycled asphalt; recycled bituminous material



## **D4887/D4887M – 11 (2016)**

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