



# Standard Test Procedures Manual

Section: ASPHALT MIXES

Subject: THEORETICAL MAXIMUM SPECIFIC  
GRAVITY

## 1. SCOPE

### 1.1. Description of Test

The method described is used to determine the theoretical maximum specific gravity of uncompacted asphalt-aggregate mixes using a vacuum saturation technique.

### 1.2. Application of Test

The value of theoretical maximum specific gravity is used to determine the air void content of Marshall compaction specimens.

### 1.3. Units of Measure

Specific gravity as determined by this method, is the ratio of the mass of a given volume of material at 25° C to the mass of an equal volume of water at the same temperature. Specific gravity is unitless.

## 2. APPARATUS AND MATERIALS

### 2.1. Equipment Required

Glass, plastic or metal container having a minimum capacity of 1 000 ml and capable of withstanding a full vacuum.

Cover for the container with suitable vacuum connection assembly fitted with a rubber gasket and release valve assembly for use with the previously mentioned container.

Oven capable of 50° C to 150° C

Scale with .01 g accuracy and equipped with a suitable suspension apparatus and holder to permit weighing the sample and container in a temperature controlled water bath.

Vacuum pump or water aspirator, capable of evacuating air from the container to a residual pressure of 4.0 kPa or less.

Manometer or vacuum gauge suitable for measuring the specified vacuum.

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A container filled with distilled water at 25° C suitable for immersion of the suspended glass, plastic or metal container and deaired sample. A temperature controlled water bath is recommended.

A suitable trap installed in the vacuum line is recommended to prevent water from entering the vacuum pump.

Use of a plastic twistcock valve in the line adjacent to the flask will minimize loss of water during shaking and provide quick disconnection in case of foaming or malfunction.

For use with glass containers, a rubber or resilient plastic mat is required as a safety precaution to avoid impact on a hard surface while under vacuum.

## 2.2. Materials Required

- Laboratory Samples: asphalt cement of the same grade and from the manufacturer as used for the field work shall be mixed in known proportions with the aggregates combined to meet the stockpile average gradation. An asphalt mix sample size of 600 to 1000 g is appropriate for the test.

- Distilled water

## 3. PROCEDURE

### 3.1. Test Procedure

Weigh the glass, plastic or metal container in air and in water to determine the tare weight for each case.

Cool the asphalt mix to room temperature, place in the container and weigh.

Add sufficient distilled water at 25° C to cover the asphalt mix sample.

Place the cover on the container and apply a partial vacuum, 4 kPa or less absolute pressure for 5 to 15 minutes. Lean mixes require less and rich mixes may require more time or agitation, or both. In general, the minimum time to dispel all of the free air is best. Additional time may induce error due to water getting under the bituminous coating. Agitate the container and contents either continuously by mechanical device or manually by vigorous shaking at intervals of about two minutes.

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Vacuum should be applied and released gradually by means of the release valve assembly.

Immediately after removal of entrapped air, remove cover and suspend the bowl and contents in the water bath and determine the weight after ten minutes of immersion.

#### 4. RESULTS AND CALCULATIONS

##### 4.1. Calculations

Calculate the specific gravity of the sample as follows:

$$\text{Theoretical Maximum Specific Gravity} = \frac{A}{A-C}$$

Where: A = Weight of the dry sample in air (g)

C = Weight of the sample in water (g)

##### 4.2. Reporting Results

Theoretical maximum specific gravities for asphalt mixes shall be reported on the appropriate Marshall Mix Design form for a range of asphalt contents including the optimum design asphalt content and at least two asphalt contents lower than the optimum design asphalt content and two asphalt contents higher.

Specific gravity of the asphalt mix shall be reported to three decimal places at 25/25° C.

#### 5. CALIBRATIONS, CORRECTIONS, REPEATABILITY

##### 5.1. Sources of Error

Not enough vacuum - sample not completely deaired

To much vacuum - asphalt cement stripped from the aggregate

Water temperature in bath other than 25° C - not using distilled water as specified

##### 5.2. Precision

For the purpose of Marshall Mix Designs, the Theoretical Maximum Specific Gravity shall check within  $\pm 0.003$  between two laboratories.