

Out Lines For Theoretical Maximum Specific Gravity and Density of Hot-Mix Asphalt Paving Mixtures

This method covers the determination of the maximum specific gravity of un-compacted HMA paving mixtures. Test results are used to compute air voids and density in the compacted mix.

1. *Do not warm sample to a temperature any higher than 110°C (230°F).*
2. *While subjected to vacuum, vacuum container shall be struck with a rubber mallet at intervals of two (2) minutes.*
3. *Distilled or de-mineralized water shall be used.*
4. *Only the “weighing in air method” shall be used.*
5. *Obtain enough sample material to prepare at least two complete tests.*
6. *One sample shall be tested in two portions to verify precision.
(Note: Each portion shall be approximately 1500 – 2000 grams.)*

Steps:

1. **Obtain sample.** Sample in accordance with AASHTO T-168 (Modified). The size of the sample shall be governed by the nominal maximum size of the aggregate in the mix, and enough material shall be obtained to prepare at least two complete tests. One test sample shall be hand-split into two approximately equal portions with each portion possessing similar characteristics. Both sample portions shall be tested. For the test to be valid, the two tests must meet the precision requirements as stated in step 13. If the required precision is not achieved, discard and re-run the second sample in the two halves to verify precision.

Note: If the required minimum sample size is smaller than the vessel rating, the sample must still be split into two portions in order for the sample precision to be verified.

2. **Separate material.** After obtaining the proper sample size, warm if needed, at a temperature not to exceed 110°C (230°F), and separate fine aggregate, taking care not to fracture the mineral particles, so that they are not larger than 6.3 mm (1/4 in.). Cool to room temperature $25 \pm 5^\circ\text{C}$ ($77 \pm 9^\circ\text{F}$) making sure that the particles remain separated.
3. **Calibrate vessel.** Calibrate vacuum container by accurately determining the mass of water at $25 \pm 0.5^\circ\text{C}$ ($77 \pm 0.9^\circ\text{F}$) required to fill it. Accurate filling of the flask and elimination of air bubbles must be ensured. Use only distilled or demineralized water. Record calibrated weight.
4. **Weigh empty vacuum container in air.** Weigh to the nearest 0.1 g and record.

5. **Place cooled sample into vacuum container and weigh.** Do not place more material in vessel than it is rated for. Determine actual weight of material in air to nearest 0.1 g and record weight.
6. **Add distilled or demineralized water and wetting agent.** Add sufficient water at approximately 25°C (77°F) to cover the sample. Do not fill the vessel completely. Adding a small amount of suitable wetting agent to the mixture prior to applying the vacuum facilitates the release of entrapped air.
7. **Subject sample to partial vacuum.** Apply a partial vacuum of 3.7 ± 0.3 kPa (27.5 ± 2.5 mm Hg manometer) directly to the vessel for 15 ± 2 minutes. Agitate the vessel and contents either continuously by a mechanical device or vigorous shaking. Regardless of method used, the vessel shall be struck with a rubber mallet at two (2) minute intervals, with 25 blows at 5 blows per 1/5 rotation.
8. **Remove from vacuum, immediately start 10-minute soak period.** Turn off vacuum, remove lid, and add distilled water to fill vessel $\frac{3}{4}$ full and bring water temperature to approximately 25°C (77°F).
9. **Completely fill vacuum container with distilled or demineralized water.** Determine the temperature of water immediately prior to weighing. The temperature must be within specifications $25 \pm 1^\circ\text{C}$ ($77 \pm 1.8^\circ\text{F}$). The use of temperature curves is not permitted. All air bubbles must be removed. Place lid on vessel, ensuring water is expelled through hole in the lid.
10. **Determine the weight of the filled vacuum container and contents in air.** Complete steps 8 through 10 within 10 ± 1 minutes after completion of step No. 7. Record the weight to the nearest 0.1 g.
11. **Calculate the maximum specific gravity.** Use the equation

Maximum Specific Gravity:

$$\frac{\text{Material}}{\text{Material} + (\text{Vessel, Water}) - (\text{Vessel, Water, Material})} = 0.000$$

12. **Report results.** The resulting average of the two sample portions shall be reported to three decimal places (0.001).
13. **Precision.** When a test sample is tested in two approximately equal increments, the acceptable range of the two increments shall be within 0.011 for single-operator precision.