

State of Nevada  
Department of Transportation  
Materials Division

**METHOD OF TEST FOR THE DETERMINATION OF THEORETICAL MAXIMUM SPECIFIC GRAVITY OF UNCOMPACTED BITUMINOUS PAVING MIXTURES**

**SCOPE**

This test method covers the procedure to determine the theoretical maximum specific gravity of uncompacted bituminous paving mixtures using a vacuum pycnometer (Rice Pot) secured to a mechanical vibrating device.

**APPARATUS**

1. Aluminum volumetric canister (pycnometer bowl) equipped with a solid lid, **maximum 4000 g** capacity, **206 mm (8.125 in.)** x **238 mm (9.375 in.)**, solid-wall cylinder.
2. Plexiglas vacuum lid, fitted with a rubber gasket, release valve and a connection for the vacuum line.
3. Mechanical vibrating device, equipped with a timer, vibration speed control and a detachable collar to which the vacuum pycnometer can be fastened.
4. Vacuum pump, capable of  $27.5 \pm 2.5$  mm Hg and miscellaneous equipment necessary to evacuate air from the pycnometer **bowl**.
5. Manometer, capable of  $27.5 \pm 2.5$  mm Hg.
6. Balance, 12000 g minimum capacity, sensitive to 0.1 g.
7. Oven, capable of maintaining temperatures of  $110 \pm 5^{\circ}\text{C}$  ( $230 \pm 9^{\circ}\text{F}$ ).
8. Thermometer, to measure and maintain a water bath temperature of  $25 \pm 3^{\circ}\text{C}$  ( $77 \pm 5^{\circ}\text{F}$ ).
9. Sieve, 6.3 mm (1/4 in.).

NOTE: See Figure 1 for example of correct configuration of testing apparatus.

**SAMPLING**

Obtain a representative sample of bituminous paving mixture per Test Method Nev. T200.

## SAMPLE PREPARATION

1. Obtain a representative sample in accordance with Test Method Nev. T203. The size of the sample shall conform to the following requirements:

Table 1 – Minimum Sample Sizes

Nominal Maximum Aggregate Size, mm (in.)	Minimum Sample Size, g
19 to 25 (3/4 to 1)	2500
12.5 (1/2) or smaller	1500

2. Using a 6.3 mm (1/4 in.) sieve, separate the particles of the representative paving mixture sample by hand, taking care to avoid fracturing the aggregate, so that the finer aggregate portions will pass through the 6.3 mm (1/4 in.). If the paving mixture sample is not pliable enough to be separated manually, place the material in a large sample pan and warm it in an oven until it can be separated as described above.
3. Cool the sample to room temperature. Recombine the coarse and fine aggregate particles and record its weight to the nearest 0.1 g (Mass of sample in air).

## PROCEDURE

1. As necessary, clean and lightly lubricate the Plexiglas vacuum lid gasket using petroleum jelly.
2. On a smooth and level surface, completely fill the pycnometer bowl with water at  $25 \pm 3$  °C ( $77 \pm 5$  °F). Lightly place the pycnometer lid on the pycnometer bowl, allowing it to settle into place by its own weight. To remove any entrapped air, gently push the pycnometer lid down until water is ejected from the aperture on the top of the pycnometer lid. Thoroughly dry the outside of the pycnometer and record its weight to the nearest 0.1 g (Mass of pycnometer and water).

NOTE: This weight should be verified periodically. Perform step 2 if parts of the pycnometer have been replaced or altered in any way.

3. Empty the pycnometer bowl.
4. Place the room temperature paving mixture sample into the empty pycnometer bowl and fill the pycnometer bowl with a sufficient amount of water  $25 \pm 3$  °C ( $77 \pm 5$  °F) to completely submerge the sample (do not fill the pycnometer bowl full of water). Place the bowl onto the mechanical vibrating device, affix the Plexiglas vacuum lid onto the pycnometer bowl and fasten the assembly together using the detachable collar.

5. Turn on the vacuum pump and close both the bleeder and monometer valves to remove the entrapped air in the sample by applying  $27.5 \pm 2.5$  mm Hg of absolute pressure for  $15 \pm 2$  minutes. Constantly agitate the container and sample using the mechanical vibrating device during the vacuum period.

NOTE: The speed control adjustment should be closely monitored as to avoid over-agitation and stripping of asphalt in the sample and that water is not drawn into the vacuum line.

6. At the end of the vacuum period and before turning off the vacuum pump, **slowly** open the bleeder valve located on the Plexiglas vacuum lid and the monometer valve to release the pressure in the pycnometer. Remove the Plexiglas vacuum lid from the pycnometer bowl.
7. Adjust the contents of the pycnometer bowl by filling the pycnometer bowl with a sufficient amount of water at  $25 \pm 3$  °C ( $77 \pm 5$  °F). If the temperature of the pycnometer bowl is found to be above or below  $25 \pm 3$  °C ( $77 \pm 5$  °F), carefully remove a small amount of water and repeat the process until the contents of the pycnometer have stabilized to within the required tolerance.
8. The pycnometer bowl shall be completely filled with water at the end of step 7. Lightly place the pycnometer lid on the pycnometer bowl, allowing it to settle into place by its own weight. To remove any entrapped air, gently push the lid down until water is ejected from the aperture on the top of the pycnometer lid. Thoroughly dry the outside of the pycnometer bowl and pycnometer lid and **weigh**. Record **the** weight as (Mass of evacuated sample, pycnometer and water) within  $10 \pm 1$  minutes of completing the vacuum procedure to the nearest 0.1 g

## CALCULATIONS

Calculate the theoretical maximum specific gravity of the uncompacted bituminous paving mixture as follows:

$$\text{Specific Gravity} = A / [(A+B)-C]$$

Where:

A = Mass of sample in air

B = Mass of pycnometer and water

C = Mass of evacuated sample, pycnometer and water

## REPORT

**Apparent** Specific Gravity shall be reported to the nearest 0.001. **Density shall be reported to the nearest 0.001 Mg/m<sup>3</sup> (0.1 lbs/ft<sup>3</sup>).**

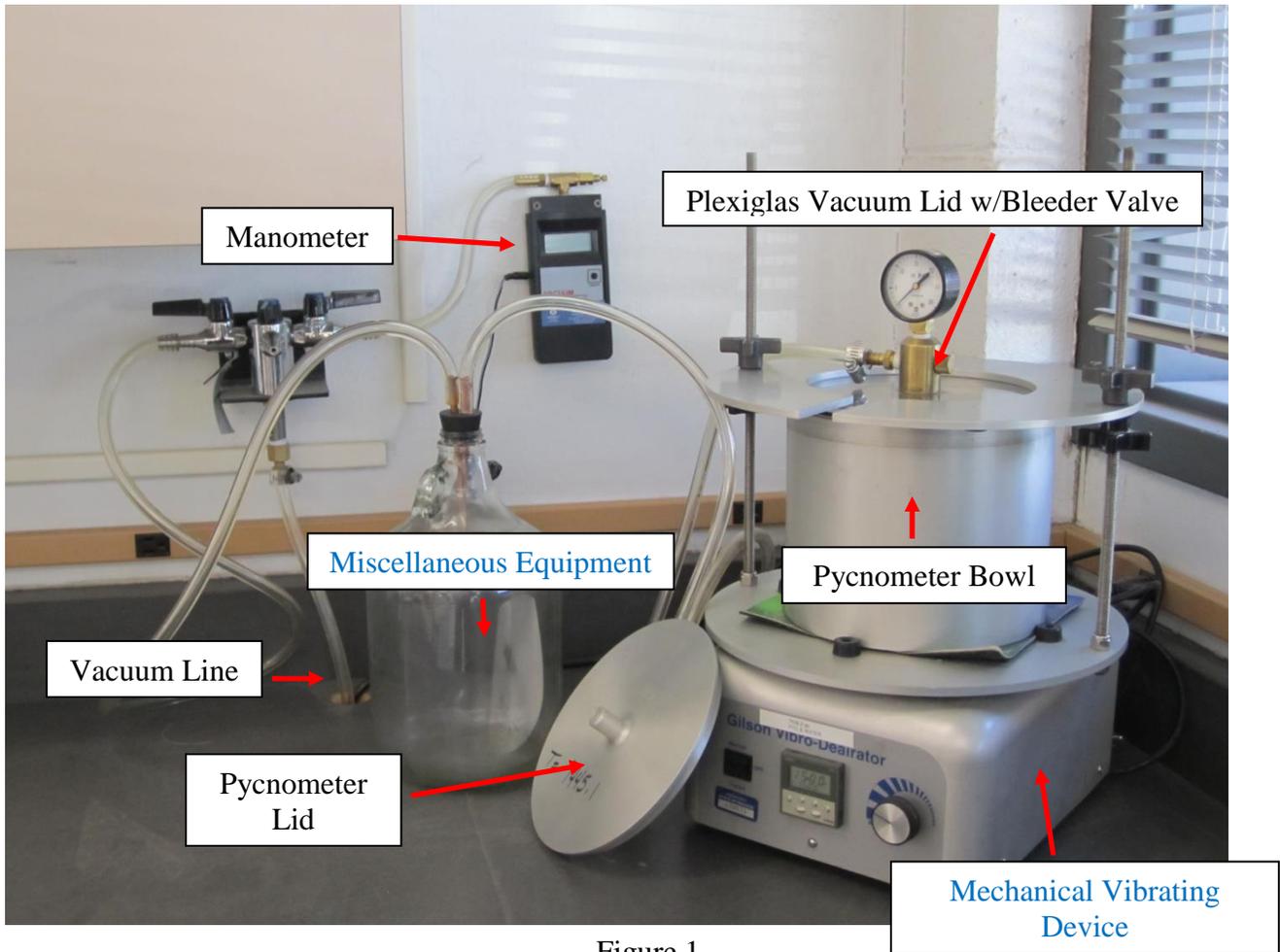


Figure 1