

DEPARTMENT OF TRANSPORTATION
ENGINEERING SERVICE CENTER
 Transportation Laboratory
 5900 Folsom Blvd.
 Sacramento, California 95819-4612



METHOD OF TEST BULK SPECIFIC GRAVITY AND DENSITY OF BITUMINOUS MIXTURES

CAUTION: Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read "**SAFETY AND HEALTH**" in Section H of this method. It is the responsibility of the user of this method to consult and use departmental safety and health practices and determine the applicability of regulatory limitations before any testing is performed.

A. SCOPE

These methods, which are modifications of AASHTO Designation: T 166, cover the procedures for determining the mass per cubic meter and the bulk specific gravity of specimens of compacted bituminous mixtures.

Method "A" is used for specimens pervious to water. It shall also serve as a referee procedure for Method C in case of disputes.

Method "B" is used for determining the bulk specific gravity of compacted open graded asphalt concrete for the purpose of estimating construction quantities only.

Method "C" is used for laboratory compacted test specimens, slabs cut from the pavement, and cores.

B. APPARATUS

1. Balance, 5 kg capacity, accurate to 1 g, fitted with a suitable suspension apparatus and basket to permit weighing specimens immersed in water (Methods "A" and "C").
2. Container, approximately 300 by 300 by 300 mm for immersing specimens in water (Methods "A" and "C").
3. Device for measuring the height of specimens to the nearest 0.5 mm.
4. Oven capable of maintaining temperatures between 105 and 110°C.

C. PREPARATION OF SAMPLE

1. Cool any laboratory compacted specimen to room temperature prior to testing.
2. If a compacted slab or core is obtained, dry it at $40 \pm 2^\circ\text{C}$ to a constant mass prior to testing.

D. TESTS AND CALCULATIONS

1. Method "A" for Bulk Specific Gravity:
 - a. Weigh the specimen in air to the nearest 1 g.
 - b. Paint all surfaces of the specimen with a coat of paraffin thick enough to seal all surface voids.
 - c. Weigh the paraffin-coated specimen in air to the nearest 1 g.
 - d. Weigh the paraffin-coated specimen immersed in water to the nearest 1 g.
 - e. Calculate the bulk specific gravity as follows:

Bulk Specific Gravity =

$$\frac{A}{(D - E) - \frac{(D - A)}{F}}$$

Where:

- A = Mass in grams of specimen in air.
- D = Mass in grams of paraffin-coated specimen in air.
- E = Mass in grams of paraffin-coated specimen in water.
- F = 0.90 (Bulk specific gravity of paraffin).

2. Method "B" for Bulk Specific Gravity of Open Graded Mixes:

- a. Weigh out 400 g of mix to the nearest 1 g.
- b. Heat the sample to $107.5 \pm 2.5^\circ\text{C}$.
- c. Place it in a 101.6-mm diameter mold (pre-heated to approximately 110°C).
- d. Apply a 111.8 kN load using a ram rate of 6.4 mm/min.
- e. Obtain the height of the specimen to the nearest 0.5 mm.
- f. Refer to the conversion chart, Section F of this test method, for the bulk specific gravity, or calculate the bulk specific gravity as follows:

$$\text{Bulk specific gravity} = 49.2/\text{height of the specimen.}$$

3. Method "C" for Bulk Specific Gravity:

- a. Weigh the specimen in air to the nearest 1 g.
- b. Weigh the specimen immersed in water to the nearest 1 g. The maximum immersion time is 10 s.
- c. Calculate the bulk specific gravity as follows:

$$\text{Bulk specific gravity} = A/(A - C)$$

Where:

- A = Mass in grams of specimen in air.
- C = Mass in grams of specimen in water.

E. NOTES

Except for material intended to be used for open graded asphalt concrete or 37.5 mm maximum dense graded asphalt concrete specimens, the test for specific gravity is usually performed on specimens previously used for the stabilometer test.

F. CONVERSION CHART FOR OPEN GRADED ASPHALT CONCRETE

Mass per cubic meter = Bulk specific gravity x 1000 kg/m³.

The following chart is used to convert the height of a compacted specimen to bulk specific gravity and mass per cubic meter for open graded mixes.

Based on a 400 g sample		
Height of Specimen (in mm)	Bulk Specific Gravity	kg/m ³
23.0	2.14	2140
23.5	2.09	2090
24.0	2.05	2050
24.5	2.01	2010
25.0	1.97	1970
25.5	1.93	1930
26.0	1.89	1890
26.5	1.86	1860
27.0	1.82	1820
27.5	1.79	1790
28.0	1.76	1760
28.5	1.73	1730
29.0	1.70	1700
29.5	1.67	1670
30.0	1.64	1640
30.5	1.61	1610
31.0	1.59	1590
31.5	1.56	1560
32.0	1.54	1540

G. REPORTING OF RESULTS

Report the bulk specific gravity and/or kilogram per cubic meter.

H. SAFETY AND HEALTH

Personnel should use heat resistant gloves when working with hot materials. Use proper lifting techniques when handling bags of aggregate. Reasonable care

should be exercised to avoid being burned by hot asphalt, aggregate or equipment.

Caution must be exercised in the heating of the paraffin. The paraffin should only be heated under a hood to approximately 6°C above the melting point. Over heating of the paraffin can cause ignition. Avoid inhaling the fumes of the melted paraffin.

Prior to sampling, handling materials or testing, Caltrans personnel are required to read Part A (Section 5.0), Part B (Section 5.0, 6.0 and 10.0) and Part C (Section 1.0) of Caltrans Laboratory Safety Manual and the Materials Safety Data Sheets (MSDS) for all materials used. Users of this method do so at their own risk.

REFERENCE:

AASHTO Designation: T 166

End of Text (California Test 308 contains 3 pages)