GDT 83

A. Scope

For a complete list of GDTs, see the Table of Contents.

Use this test method to determine the bitumen content of hot paving mixtures by using the vacuum extractor. You may use the aggregate remaining after extraction for sieve analysis.

B. Apparatus

The apparatus consists of the following:

1. Vacuum Extractor—Use a vacuum extractor complete with filter ring.
2. Vacuum Source— Use a source with a minimum vacuum of 5 psi (34 kPa).
3. Filter Paper—Use filter paper, medium grade, fast filtering, of the diameter required to fit inside the ring, normally either 11 in (29 cm) or 13 in (33 cm).
4. Oven or Hot Plate—Use an oven or hot plate for drying capable of maintaining a temperature of approximately 230° F (110° C).
5. Trowel—Use a trowel and/or quartering device —not necessary when testing cores.
6. Mixing Bowls—Use a 4qt (3.8 L) mixing bowl
7. Plastic Beakers—Use two plastic beakers, 34 oz (1000 ml) capacity *(Optional for Field Lab Testing)*
8. Mixing Spoon
9. Plastic Wash Bottle—Use two 1pt (0.47 L), plastic wash bottles
10. Spatula
11. Glass Stirring Rod—Use for stirring (*GDOT Laboratory Only)*
12. Drying Pans—Use two 18 in or 16 in (450 mm or 400 mm) diameter drying pans for filter,
13. Laboratory Balance—Use an approved laboratory balance with a capacity of at least 7.9 lb (3600 g) and readable to (0.1 g).
14. Solvent—Use Terpene Hydrocarbon.

Note: solvent used for extraction purposes must be on the GDOT QPL list.

Note: The use of terpene hydrocarbon may require the use of a rinsing agent.

15. Filtering Aid—Use a diatomaceous silica filtering aid.
16. No. 16 (1.18 mm) Sieve— **(Optional)** Use a 12 in (300 mm) diameter No. 16 (1.18 mm) Sieve (WS-12 #16).
17. No. 200 (75µm) Sieve—Use a 12 in (300 mm) diameter No. 200 (75µm) Sieve.
18. Thermometer.

C. Sample Size and Preparation

1. If the mixture is not soft enough to separate with a trowel or quartering device, place the sample in an oven at about 290° F (143° C) long enough to separate it.
2. If you took the sample before compaction, quarter it to the desired test size is accordance with the size requirement in Table1 :

Table 1

Superpave Mix	Min. Sample Weight lbs (g)	Max. Sample Weight lbs (g)
25 mm Superpave	5.5 (2500)	7.0 (3500)
19 mm Superpave	4.4 (2000)	5.9 (3000)
12.5 mm Superpave	3.3 (1500)	4.6 (2500)
9.5 mm Superpave	2.6 (1200)	3.7 (2200)
4.75 mm Mix	2.2 (1000)	3.3 (2000)
9.5 mm OGFC	2.2 (1000)	3.3 (2000)
12.5 mm OGFC	2.6 (1200)	3.7 (2200)
12.5 mm PEM	2.6 (1200)	3.7 (2200)
19 mm SMA	4.4 (2000)	5.9 (3000)
12.5 mm SMA	3.3 (1500)	4.6 (2500)
9.5 mm SMA	2.2 (1200)	3.7 (2200)

3. Allow the sample to cool to approximately 140° F (60° C) before adding any solvent.

D. Procedures

1. Place the warm sample into a bowl.
2. Add solvent and stir thoroughly.
3. Weigh a dry filter paper and place on the perforated support plate, which is centered on the vacuum extractor. (Care should be taken to see that the filter and support plate is centered)
4. Place the funnel ring over the filter and tighten the wing nuts.
5. Weigh a predetermined amount of diatomaceous filtering aid into a beaker and add enough solvent to suspend the amount of filtering aid into a solution after thoroughly mixing. ***Adding solvent is optional for field labs (See not Below)***
6. For mixes with a high percentage of minus No. 200 (75 µm) material or for mixes made with local material, the amount of diatomaceous earth may be increased to improve the filtering process.
7. Stir until the filtering aid is completely in suspension.
8. Immediately pour the solution onto the filter and start the vacuum pump.
9. Leave the vacuum on until the pad formed by the filtering aid is surface dry and begins to crack slightly.

Note: You may apply the diatomaceous filtering aid dry if you distribute it evenly.

10. **(Optional)**: Place nested No. 16 (1.18 mm) and No. 200 (75 µm) mesh 12 in (300 mm) sieves onto the funnel ring.

Note: You can use only the No. 200 (75 µm) mesh 12 in (300 mm) sieve if you carefully pour (decant) the solution to prevent larger aggregate particles from damaging the sieve.

11. Gently decant the solvent and asphalt solution from the sample container onto the No. 16 (1.18 mm) sieve or No. 200 (75 µm) sieve, whichever is applicable, being careful not to disturb the filtering pad.
12. Start the vacuum pump and adjust the vacuum to at least 5 psi (34 kPa).
13. Continue vacuuming until all of the solvent has disappeared through the filter, if a hard crust appears after vacuuming, gently pull a spatula rounded blade edge or similar device across the filter to break the crust.

a. Continue washing and decanting the sample three to five times (depending on the sample size).
    1) After vacuuming, pour approximately 17 oz (500 ml) of water over the aggregate in the mixing bowl and stir well with the mixing spoon. The water will turn milky-white.
    2) After the asphalt extractant/asphalt solution has completely vacuumed from the diatomaceous filtering aid, decant the water from the mixing bowl through the sieve or sieves onto the filter pad.
    3) Pour the water over the entire surface of the sieve.
    4) Repeat the water washing from 3 to 5 times until the water is clear.

Note: The additional water removes the solvent from the aggregate. Four to six washes should be sufficient , but with very large samples more water washes may be required.

14. Use a wash bottle with water and thoroughly rinse all aggregate particles from the sample container and spoon onto the sieve(s).
15. Remove the 12 in (300 mm) sieve(s) containing the plus No. 200 (75 µm) material and put them aside to dry.
16. After vacuuming all the liquid through the filter, use a spatula to transfer the filtering aid away from the edges of the filter and funnel ring toward the center.
17. Use the wash bottle to rinse the side of the funnel ring.
18. Allow the vacuum to run approximately 3-5 additional minutes to aid in drying the filter.
19. Carefully remove the filter and place it into a drying pan without losing any material.
20. Move the aggregate retained on the sieve(s) to another drying pan.
21. Dry each of the pans of material to a constant weight and record the weights.
22. If you need the aggregate gradation, use GDT 38 and always use "T" for total weight of extracted aggregate.

E. Calculations

1. Calculate the percent bitumen in the sample.

   Weight of extracted aggregate:

   $W_0 = W_1 + (F_2 - (F_1 + DE))$ where

   W_1 = Weight of aggregate retained..

   F_1 = Original weight of the filter placed in the vacuum extractor

   F_2 = Final weight of the filter (includes the diatomaceous earth and minus No. 200 (75 µm) materials)

   DE = Original weight of diatomaceous earth
2. Percent bitumen =

   $\frac{W - W_0}{W}(100) + R$ where

   W = Original weight of the sample

   W_0 = Weight of extracted aggregate

   R = Retention factor
3. Report the percent bitumen to the nearest 0.01.
4. Calculate the Retention Factor **(Only if applicable)**

   Most types of aggregate will retain a small amount of bitumen after being tested by the vacuum extractor. Take this into consideration when calculating the final percent bitumen in the mixture.

Note: Perform this test procedure separately on at least two samples of aggregate representative of the material to be used in the mix.

a. Use a test specimen weighing at least 2.6 lb (1200 g).

b. Dry the aggregate specimen to a constant weight.

c. Place the specimen in a tared metal container and weigh.

d. Heat the aggregate and asphalt cement to the temperature specified in the Asphaltic Concrete Mixture Control Temperature Charts.

e. Add the asphalt cement to the aggregate mixture at the amount prescribed by the Job Mix Formula.

f. Calculate the exact percentage of bitumen added to the nearest 0.01 percent.

g. Mix the bitumen and aggregate by hand as fast as possible until the aggregate is thoroughly coated. The fast mix reduces temperature loss.

h. Cool the specimen to approximately 140° F (60° C).

i. Add solvent and proceed as in Procedures.

5. Calculate the percentage of bitumen extracted as in Calculations, step 1 and determine the retention factor as follows:

$$P_2 = \frac{S - A}{S}(100) \text{ and } R = P_1 - P_2 \text{ where}$$

S =Total weight of mixture

A = Weight of extracted mineral aggregate

P_1 = Percent of bitumen added to mix

P_2 = Percent of bitumen extracted

R = Retention factor

F. Report

Report the percentage of bitumen extracted and the **retention factor**, **if applicable**, on Form 140 or similar document and retain for your records. QCT's will report test data on the 159 in the FDCS program and upload report to the database for verification.