1851 QUANTITATIVE EXTRACTION OF BITUMINOUS MIXTURES (COLORADO VACUUM)

AASHTO T 164, METHOD E (Mn/DOT Modified)

1851.1 SCOPE

This method of analysis quantitatively determines the asphalt content of bituminous mixtures using Colorado vacuum extraction apparatus and trichloroethylene.

1851.2 APPARATUS

A. Extraction Apparatus - A stainless steel vacuum extractor complete with vacuum pump, gasket, tubing, support plate, funnel ring, etc. Similar to that shown in AASHTO T 164.

B. Drying Oven - Thermostatically controllable to 110 ± 5 °C (230 ± 9 °F).

C. Filter Paper - 330mm, qualitative, or equivalent.

D. Filter Aid - Diatomaceous Silica (Celite). Perform a sieve analysis on each bag for gradation calculations.

E. Trichloroethylene, technical grade (or other approved solvent).

F. Balance - Conforming to AASHTO M 231 with readability and sensitivity of 0.1 gram and an accuracy of 0.1 gram or 0.1%. Balance shall be appropriate for the specific use and have a minimum capacity of 4000 grams.

G. Stock Pot - Stainless steel, approximately 3.79 liter (4 quart) with handle.

H. Spoon - Stainless steel, approximately 305mm (12") long. Grind the tip of the spoon flat for easier manipulation of the sample.

I. Pan - Aluminum or stainless steel, approximately 330 X 230 X 60mm (13 X 9 X 2 1/4").

J. Watch Glass - Approximately 100mm (4") in diameter.

K. Wash Bottle - Plastic, 500ml capacity.

L. Brush - Stiff bristled, approximately 25mm (1") wide.

1851.3 LABORATORY CONDITIONS

In addition to good, general lab ventilation the extraction work area should be well ventilated. Humidity control is recommended to prevent excessive water absorption by the dried aggregate.

1851.4 SAFETY

Celite contains crystalline silica, which is consider a hazard through inhalation. Goggles or safety glasses and a NIOSH approved respirator for particulates are recommended. Refer to the Material Safety Data Sheet for proper handling.

Trichloroethylene is a toxic chemical. It is a clear colorless liquid with a chloroform-like odor. Refer to the literature and your safety officer for proper handling procedures of this and any other solvent used. Do not wash hands with trichloroethylene.

Trichloroethylene is a hazard by ingestion, skin absorption and vapor inhalation. Repeated or excessive skin contact with its vapor or liquid may cause severe dermatitis. Wash thoroughly after handling. Use of a local exhaust ventilation system is recommended.

Eye protection is mandatory. If eye contact occurs flush eye with clean water for 10-15 minutes and consult a doctor. Full face shields with top and side shields provide the best protection. Chlorinated solvent resistant rubber gloves and protective apron should be worn at all times while performing extractions.

Passage of trichloroethylene over hot electrical coils or flames, including cigarettes, can cause the formation of phosgene gas and other decomposition products which may be more hazardous than trichloroethylene. Prolonged storage of waste solvent should be avoided because of MPCA regulations. Waste solvent should be periodically sent for recycling. Drums of waste solvent should be checked regularly for pressure build-up. Store in a cool, dry ventilated area.

Purchase of new and disposal of used trichloroethylene shall be in accordance with existing laws, contracts and procedures.

1851.5 FILTER AID (Diatomaceous Silica, Celite)

The use of a filter aid is optional; but may be beneficial for slow-filtering samples. The recommended amount is 50 grams. Other amounts may be used if deemed beneficial. The amount should be weighed to the nearest 0.1 gram and reflected in the calculation of the asphalt content. The gradation of the filter aid should be determined for each lot and that gradation and the weight used reflected in the gradation results.

NOTE 1: It has been found useful to sieve the diatomaceous silica (Celite) on the 75μm (#200) sieve and discard all that is retained on that sieve. This simplifies the calculation and eliminates any possibility of segregation of the material.

1851.6 SAMPLE PREPARATION

Heat sample in oven at 110 ± 5 °C (230 ± 9 °F) for four hours to dry and soften sample. Using the appropriate quartering sampling method (See Section 1201) obtain an extraction sample of 2000 grams (minimum).

NOTE 2: It is not necessary to dry samples that do not have moisture present. It is difficult to determine if there is no moisture in the sample; therefore, drying should be eliminated **only** when it is certain that moisture is not present.

1851.7 PROCEDURE

A. Accurately weigh 2000 grams (minimum) of the dried sample into a stock pot. Record weight of sample.

B. After sample cools to room temperature add trichloroethylene until the sample is covered by the solvent. Stir the sample until the asphalt is visually in solution.

C. Dry a filter in the oven at 110 ± 5 °C (230 ± 9 °F) to constant weight. Place dried filter in a clean metal pan and weigh together. Record weight.

D. Place filter on support plate and assemble extraction apparatus.

E. Weigh 50.0 grams of Celite into a beaker. Add about 500ml of trichloroethane, stir, and pour quantitatively and evenly over the filter.

F. Wash the beaker and stirring spoon with trichloroethane and the washings onto the filter.

G. Run the vacuum pump until the Celite surface layer dries and begins to crack. Stop the vacuum pump.

H. Place the watch glass on the Celite. Start the vacuum pump.

I. Decant the solvent in the pot onto the watch glass.

J. Add trichloroethylene to the pot until the sample is covered and stir.

K. Allow the sample to disintegrate for about five minutes. Decant the solvent onto the watch glass.

L. Repeat the solvent addition, stirring, and decanting until the solvent becomes a light, straw color.

M. Remove the watch glass. Wash any solids from the watch glass with solvent onto the Celite using the wash bottle.

N. Quantitatively pour the solids and solvent from the pot onto the Celite.

O. Using the wash bottle wash any solids remaining in the pot onto the Celite.

P. Carefully spread the aggregate evenly over the filter with the spoon.

Q. Wash down the inside surface of the apparatus ring with trichloroethylene. The solvent going through the sight glass should not be darker than a light, straw color. If darker, add more solvent to the aggregate until the solvent color in the sight glass is a light, straw color.

R. Allow the aggregate to dry with the vacuum pump running. Carefully scrape the aggregate toward the center of the filter away from the ring wall.

S. Remove the ring from the apparatus and brush any solids on the inside wall into the pan.

T. Remove filter and aggregate from apparatus and place in pan. Dry to constant weight at 110 ± 5 °C (230 ± 9 °F).

1851.8 CALCULATIONS

A. All weights are in grams.

B. (Weight Sample **+** Container) **-** (Weight container) **=** Sample Weight

C. (Weight of Aggregate **+** Pan **+** Paper **+** Filter aid) **-**
(Weight of Pan **+** Paper **+** Filter aid) **=** Extracted Aggregate Weight

D. $$\% \text{ Asphalt} = \frac{\text{Sample Weight - Extracted Aggregate Weight}}{\text{Sample Weight}} \times 100$$

E. Report Percent Asphalt to the nearest 0.1%.

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