

DIVISION C400 –BITUMINOUS PAVEMENTS

SECTION C400 – ASPHALT, BITUMINOUS MATERIALS, AND HOT-MIX ASPHALT PAVEMENTS

C400.01 Summary. Bituminous materials are used in many aspects of roadway construction. Hot-mix asphalt pavement sections are used for both new construction and overlaying existing roadway and bridge facilities while other bituminous materials are used as maintenance tools for pavement preservation. The widespread use of bituminous materials in DeIDOT projects results in the need to properly monitor production and placement of materials.

C400.02 Production and Operations. Bituminous materials, including asphalt cement, emulsions, and cutbacks, are typically accepted on the basis of producer certification. However, some occasions require that testing be performed on a sample of the bituminous material for verification. Check samples, which are used to verify accuracy of the producer's test results and to check on contamination and other problems, are taken on a regular basis from production facilities.

Prior to use on a project, all sources of materials and Job Mix Formulas (JMF) used for the production of hot-mix asphalt at a production plant must be approved. A record of the approval is maintained in both the Materials & Research Laboratory files and at the plant laboratory file. Approval for material sources may be either a blanket approval for the construction season or a single project approval.

In addition to approval of material sources, an inspection of the production plant including the equipment used, the on-site laboratory, and other items must occur. A report documenting the findings of the inspection is typically completed at the beginning of the construction season. An example of this type of report, Form LB-21, is provided in Part E.

Before hot-mix asphalt can be sent to a project, the project inspector must authorize the shipment. When authorization is given, the plant inspector documents this in the Plant Diary. An example of a plant activity report is provided in Part E (Form LB-24).

To ensure that production of hot-mix asphalt conforms to the specifications, all plant scales must be checked and approved prior to use. Documentation of this must be done in accordance with the hot mix asphalt Quality Assurance/Quality Control specifications. A scale check is performed at the beginning of the construction season by the producer and verified by the Engineer. Truck platform scales are certified by the Delaware Department of Agriculture, Weights & Measures Section at the beginning of each construction season as well. Truck scales can also be tested at the discretion of the Engineer.

It is imperative, when working with bituminous materials, that all safety precautions are taken to prevent bodily injury. Many bituminous materials are placed at extremely high temperatures that can cause extensive burns when contact with exposed skin is made. Plant personnel and those working with bituminous materials should wear protective clothing to prevent accidental injury.

C400.03 Obtaining Samples. There are multiple locations where bituminous materials, asphalt, and hot-mix asphalt are sampled.

(a) *Bituminous Materials.* All asphalt cement is sampled daily from the storage tank. The quantities of bituminous materials sampled depends on the intended use of the material. For Bituminous Surface Treatments and RS-1, RS-2, CRS-1, and CRS-2, the materials are sampled (Form LB-36) at the following minimum rates:

- (1) Bituminous material: 1 sample per source
- (2) Coarse Aggregate: 1 sample per 550 tons (500 metric tons)
- (3) Fine Aggregate: 1 sample per 550 tons (500 metric tons)

The procedures to be followed for obtaining the samples are listed in Table C-10. Identification numbers are assigned to each bituminous material sample obtained according to the system described in Table C-11. A sample identification tag (LB-36) is provided in Part E. Form LB-29 is used to record information for box samples.

In addition to this sampling, adequate quantities of material must be obtained to allow for testing at the following minimum rates:

- (1) Specific Gravity of Mixture: 2 tests per 500 tons (450 metric tons)
- (2) Asphalt Content: 1 test per 500 tons (450 metric tons)
- (3) Gradation of Mixture: 1 test per 500 tons (450 metric tons)
- (4) Air Voids of Mixture: 3 tests per 500 tons (450 metric tons)

Sample information is recorded on Form LB-29. Samples are assigned identification numbers according to the system described in Table C-11.

(b) *Asphalt Cement.* All asphalt cement is sampled daily, either from the storage tank or the carrier, to ensure that the material shipped to the plant conforms to the specifications required for the project. The sample identification tag must indicate specifics concerning the location of the sample. A 1 pint (500 mL) sample must be obtained from the production plant for every grade of asphalt that is used each day. Procedures used to obtain the samples at the plant are listed in Table C-10. The materials are sampled (Form LB-36) at the plant at the following minimum rates:

- (1) Asphalt Binder: 1 sample / day / grade
- (2) Recycled Asphalt Pavement (RAP): 1 sample per week

C400.04 Handling, Packaging, and Shipping. All shipments of asphalt binder, bituminous materials, or hot-mix asphalt, whether for testing or production purposes, must be accompanied by a sample ticket for future reference.

- (a) *Shipment of Materials for Production.* Shipment of asphalt binder or emulsions and cutbacks to production facilities may be made from any approved unit after testing and acceptance by the DeIDOT. On some occasions, when deemed necessary because of limited tankage or heavy demand, the asphalt binder can be accepted at production plants prior to DeIDOT testing. When this occurs, the asphalt binder will be deemed “certified” by the plant.
- (b) *Shipment of Materials for Testing and Sampling Purposes.* Hot-mix asphalt samples are shipped in a container that is tightly closed to prevent loss or contamination of the sample material. For asphalt binder materials, samples are shipped in a can with a double friction-top or a screw top. Anionic asphalt samples are shipped in only glass or plastic bottles, while cationic emulsified asphalt samples must be shipped in plastic bottles or wide mouth cans.

C400.05 Tests Performed.

- (a) *Bituminous Materials.* Emulsions and cutbacks are tested using a producer-submitted 1 quart (1 Liter) sample, which is accompanied by a complete test report. An example of a complete test report for both emulsified asphalts (Form LB-71) and cutback asphalts (Form LB-72) is provided in Section E. These materials are then tested by the test methods listed in Table B-1.
- (b) *Hot-Mix Asphalt.* Acceptance of hot-mix asphalt is based on tests performed in the field and in the laboratory. The tests and testing frequencies are listed in Table B-1 and must be performed at the rates listed in Section 400.03 and following the test methods listed in Table C-12. SuperPave Gyrotory specimens must be made and tested at either the producer’s plant laboratory or the DeIDOT’s Central Laboratory to determine if the mixture meets the specified volumetric properties. Results of this testing are maintained in the Hotmix Software (2003) and are submitted to the Laboratory for distribution. For drilled cores, Form LB-37 is used to document sample information.

C400.06 Test Report Evaluations and Distributions. Plant inspection personnel are responsible for the maintenance of all records including plant approval, project source approval, and all material test reports. The plant diary should be current, legible, and document all activities in progress or problems that may have been encountered.

Table C-10: Division 400 - Sampling Methods	
Method ID	Method Name
DOH 5	Sampling Stone, Slag, Gravel, Sand, and Sand Block for Use as Highway Materials
AASHTO T2	Sampling of Aggregates
AASHTO T40	Sampling Bituminous Material
AASHTO T168	Sampling Bituminous Paving and Patching Mixtures

Table C-11: Division 400 - Sample Identification Numbering
<p>Plant and Box Samples - The numbering of samples is based on the plant the sample is obtained from, the date it was taken, and whether the sample was a plant run test or a box sample. The format of the sample identification is:</p> <p style="text-align: center;">ZZ-XXX-YY</p> <p>XXXX - Abbreviation of the plant the sample was obtained from MM - Month DD - Day YY - Year # - whether the sample is the first or second test (1,2,3, etc.) Q - Whether the sample was tested at the Plant (P) or is a Box Sample (B)</p>
<p>Samples used for testing - The samples received are given ID numbers that indicate test type (ZZ), order sample was received beginning with January 1 (XXX), and the year the sample was received (YY).</p> <p style="text-align: center;">ZZ-XXX-YY</p> <p>Abbreviations for the tests performed (ZZ in the example) are:</p> <ul style="list-style-type: none"> RA- Refinery Reference Asphalt AB- Abson Extractions A- Hot Mix Asphalt Samples C- Cement, fly ash, slag W- Water T- Miscellaneous Tests, paint, admixtures, etc. CC- Concrete Cores for ASR ASR- Aggregate Reactivity
<p>Rapid Chloride Test specimens are labeled by CL-XXX, where XXX indicates the order that the sample was received from commencement of the system</p>
<p style="text-align: center;">Coarse aggregate samples start with Test # 1 on January 1 and are numbered consecutively until December 31.</p> <p style="text-align: center;">Example: D-1-02 D = Delaware , 1 = test number, 02 = Year 2002</p>
<p>Fine Aggregate Samples - Are numbered consecutively from the start of the fiscal year, July 1, until June 30 the following year</p>
<p>Fine and Coarse Aggregate Specific Gravity Tests - Are computer assigned and are numbered consecutively from initiation of the computer system to the present date.</p>
<p style="text-align: center;">Coarse aggregate samples start with Test # 1 on January 1 and are numbered consecutively until December 31.</p>

Table C-12: Division 400 - Test Methods	
Test ID	Test Name
DOH 13	Guidelines for Acceptance of Bituminous Concrete from Hot Mix Storage Bins
AASHTO PP1-98	Standard Practice for Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV)
AASHTO R18	Establishing and Implementing a Quality System for Construction Materials Testing Laboratories
AASHTO R26	Certifying Suppliers of Performance-Graded Asphalt Binders
AASHTO T27	Sieve Analysis of Fine and Coarse Aggregate
AASHTO T30	Mechanical Analysis of Extracted Aggregate
AASHTO T48	Flash and Fire Points by Cleveland Open Cup
AASHTO T49	Penetration of Bituminous Materials
AASHTO T50	Float Test for Bituminous Materials
AASHTO T59	Testing Emulsified Asphalts
AASHTO T72	Saybolt Viscosity
AASHTO T78	Distillation of Cutback Asphaltic (Bituminous) Products
AASHTO T200	pH of Aqueous Solutions with the Glass Electrode
AASHTO T201	Kinematic Viscosity of Asphalts (Bitumens)
AASHTO T202	Absolute Viscosity of Asphalts
AASHTO T209	Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
AASHTO T224	Correction for Coarse Particles in the Soil Compaction Test
AASHTO T228	Specific Gravity of semi-Solid Bituminous Materials
AASHTO T240	Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test)
AASHTO T272	Family of Curves - One Point Method
AASHTO T308	Determining the Asphalt Binder Content of Hot-Mix Asphalt (HMA) by the Ignition Method
AASHTO T-312	Standard Method for Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor
AASHTO T-313	Method for Determining the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR)
AASHTO TP-314	Method for Determining the Fracture Properties of Asphalt Binder in Direct Tension (DT)
AASHTO T-315	Method for Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)
AASHTO T-316	Method for Viscosity Determination of Asphalt Binder Using Rotational Viscometer
AASHTO TP2-94	Method for the Quantitative Extraction and Recovery of Asphalt Binder from Hot Mix Asphalt (HMA)

Table C-13: Division 400 - Certification Test Procedures / Material Standards	
Test ID	Test Name
ASTM D36	Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
ASTM D70	Standard Test Method for Specific Gravity and Density of Semi-Solid Bituminous Materials (Pycnometer Method)
ASTM D146	Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing
ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers- Tension
ASTM D517	Standard Specification for Asphalt Plank
ASTM D1777	Standard Test Method for Thickness of Textile Materials
ASTM D5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles
ASTM E12	Standard Test Methods for Chemical Analysis of Titanium and Titanium Alloys
AASHTO M17	Mineral Filler for Bituminous Paving Mixtures
AASHTO M81	Cut-Back Asphalt (Rapid-Curing Type)
AASHTO M82	Cut-Back Asphalt (Medium-Curing Type)
AASHTO M140	Emulsified Asphalt
AASHTO M208	Cationic Emulsified Asphalt
AASHTO M231	Weighing Devices Used in the Testing of Materials
AASHTO M226	Viscosity-Graded Asphalt Cement
AASHTO M282	Joint sealants, Hot-Poured, Elastomeric-Type for Portland Cement Concrete Pavements
AASHTO M301	Joint Sealants, Hot-Poured for Concrete and Asphalt Pavements
AASHTO MP1-98	Specification for Performance Graded Asphalt Binder
ISSA TB100	Wet Track Abrasion Loss
ISSA TB102	Mixing, Setting, and Water Resistance
ISSA TB113	Mix Time 25 Degrees Celsius
ISSA TB114	Wet Stripping
ISSA TB139	Wet Cohesion
ISSA TB144	Classification Compatibility
ISSA TB147A	Loaded Wheel Test