QCT LEVEL I

STUDY GUIDE

PREPARED

BY

OFFICE OF MATERIALS

TESTING MANAGEMENT

2021

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Note: The GDT's have been inserted into the study guide but it is strongly recommended that you regularly review the most current versions from "The Source" on the GDOT Website since they are updated from time totime

DOT/QCT CERTIFICATIONPROCESS

The process for the Contractor's Quality Control Technician (QCT) to become certified through the department to perform Acceptance Test for Asphalt Concrete Mix is as follows:

LEVEL 1, QCT – The Level 1 QCT written exam will be administered by the Technical College System of Georgia. Available dates and times for exams can be requested through the Technical Colleges in Georgia. GDOT OMAT/TM Branch will administer the performance exam. The locations for the written exams are located on GDOT website. For more information goto:

http://www.dot.ga.gov/PartnerSmart/Training/technician/Documents/RTT_QCT_Certificationexams.pdf

The respective Testing Management Operations Supervisor (TMOS) will manage the performance exam of the Level 1 QCT. The following is a list of the districts and the respective TMOS and their telephone numbers.

District 1	Gainesville, GA	Kris York	770-531-5871
District 2	Tennille, GA	Robbie Byrd	478-553-3464
District 3	Thomaston, GA	Dustin Wainwright	706-646-6614
District 4	Tifton, GA	Greg Spicer	229-391-5562
District 5	Jesup, GA	Rodney Williams	912-530-4471
District 6	Cartersville, GA	Brian Hammond	678-721-5366
District 7	Forest Park, GA	John Martin	404-608-4812

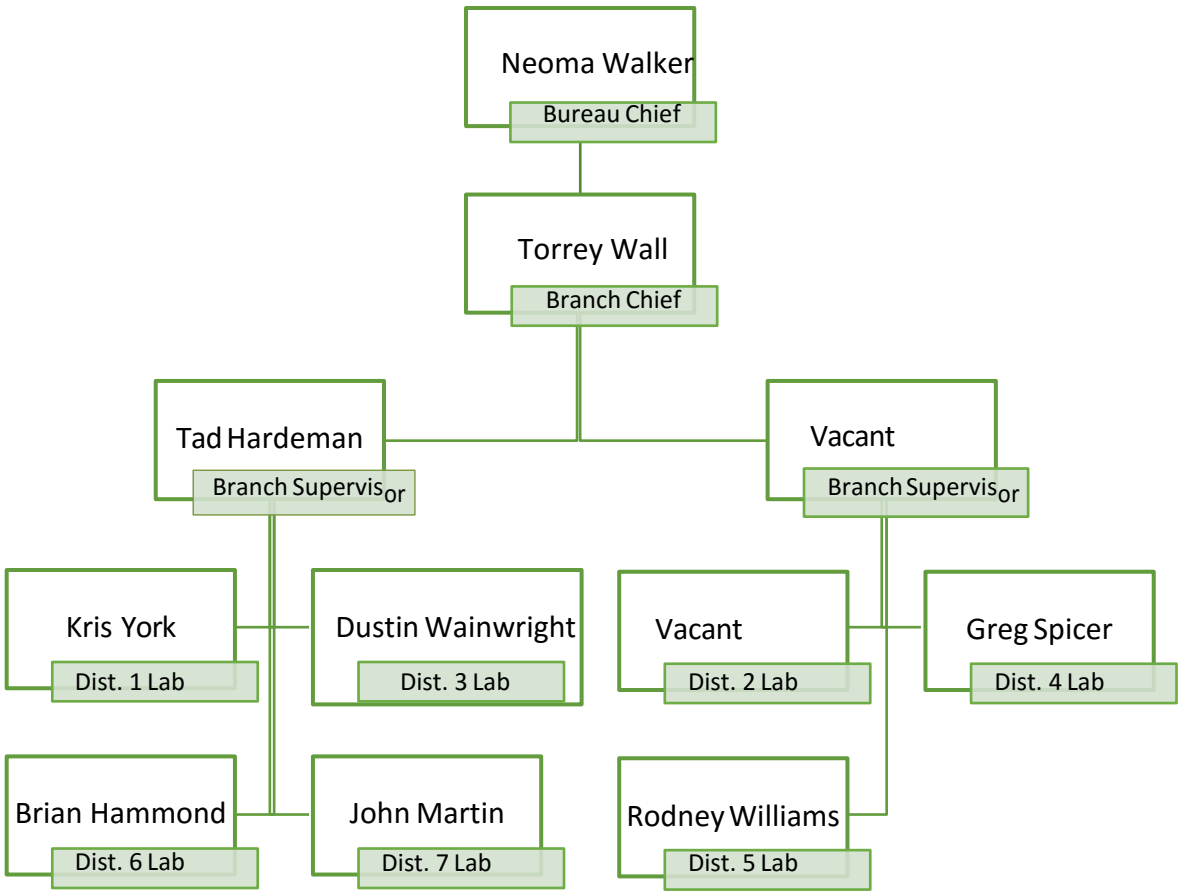
Level II, QCT - The Level II QCT must first satisfy the requirements for the Level 1 QCT; and, in addition, will be required to attend a seminar covering process control of asphalt plants and/or obtain a passing grade on a written examination. The contact persons for Level II QCT certification are:

Jason Oglesby 404-694-6745

Questions in relation to the Level I QCT certification process or re-certification of a technician should be directed to:

Neoma Walker, PE	404-608-4805		
Torrey Wall	706-741-3408	Tad Hardeman	706-646-6614

Testing Management



7 Testing Laboratories

Certification Requirements:
GDOT will grant certification only to those applicants who meet both of the following requirements:

1. A passing grade on the GDOT written examination, and
2. Successful completion of the GDOT performance examination.

Written Examination

The written examination is two hours, open-book, and consists of two sections with a total of

75 multiple-choice questions. To pass the written examination, both of the following

conditions must be met:

1. At least 75% correct for each section
2. A minimum average score of 75%. The final score will be obtained by averaging the two passing section scores and will provide an overall grade for the written examination.

The Technical College System of Georgia will administer the written examination. Examinees will be expected to pay a testing fee when the written portion of the examination is administered.

The campus locations where the written examinations will be administered are as follows.

College	Name	Number	Email
Albany	Matt Trice	229-430-6618	mtrice@albanytech.edu
Athens	John Usry	706-357-0050	jusry@athenstech.edu
Atlanta	Araceli Flores	404-225-4681	aflores1@atlantatech.edu
Augusta	Laura Giddings	706-771-5705	lgiddings@augustatech.edu
Central Ga	Melanie Bradley	478-218-3289	mbradley@centralgatech.edu
Chattahoochee	Tammy Huffstetler	770-975-4041	tammy.hufstetler@chattahoochee.edu
Coastal Pines	Anna McCrea	912-287-5854	amccrea@coastalpines.edu
Columbus	Michelle Shaw	706-649-1558	mshaw@columbustech.edu
GA Northwestern	Patty Hart	706-272-2980	phart@gntc.edu
GA Piedmont	Angela Cooper	404-297-9522, ext.1829	coopera@gptc.edu
Gwinnett	Gwen Moran	678-226-6609	Gmoran@gwinnetttech.edu
Lanier	Joan Lee	770-5336995	jlee2@laniertech.edu
North GA	Leslie Foster	706-754-7715	lfoster@northgatech.edu
Oconee Fall Line	Katrina Veal	478-275-6592	klveal@oflt.edu
Ogeechee	Kristen Waters	912-871-1693	kdwaters@ogeecheetech.edu
Savannah	Lisa Kuyk	912-443-4148	lkuyk@savannahtech.edu
South GA	Tami Blount	229-931-2040	tblount@southgatech.edu
Southeastern	Susan Rustin	912-538-3197	srustin@southeasterntech.edu
Southern Crescent	Steve Hendrix	678-972-9443	shendrix@sctech.edu
Southern Regional *(Moultrie campus)*	Jena Willis	229-217-4257	jmwillis@southernregional.edu
Southern Regional *(Bainbridge campus)*	Susanne Reynolds	229-243-3011	sreynolds@southernregional.edu
Southern Regional *(Thomasville campus)*	Ruby Barron	229-227-2579	rbarron@southernregional.edu
West GA	NO TESTING	n/a	n/a
Wiregrass	Christy Cobb	229-468-2218	Christy.cobb@wiregrass.edu

Performance Examination

The performance examination will be administered by the Georgia Department of Transportation's Office of Materials and Testing staff at the Branch Laboratory associated with each of the Department's Field Districts.

The performance examination is closed-book and requires actual demonstration of the required standards. The examinee is judged on his/her ability to correctly perform or describe all the required procedures. The performance exam must be taken within 90 days of the written exam or the entire test will have to be re-taken.

During the examination the examinee will be judged on their ability to perform or describe all required procedures for each of the GDOT standards based on the criteria in the Performance Examination Checklists.

Re-Examination

It is the examinee's responsibility to request a re-examination.

To protect GDOT's QCT Level 1 Examinations from frivolous trial-and-error attempts and to encourage the examinee to properly prepare for testing, the following allowances are required.

- After first failed examination, the examinee must wait 30 days before re-testing.
- After second failed examination, the examinee must wait 90 days before re-testing.
- After third failed examination, the examinee must wait 12 months before re-testing.

Recertification

Technicians are not required to have any continuous education credit hours to maintain their QCT Level 1 Certification after they have successfully passed the written and practical exams and become certified.

Regardless of re-certification status, for the purpose of fulfilling the requirements of SOP 30 as required by the FHWA, active technicians (those who performed acceptance testing in the last calendar year) are required to have an IA evaluation during each calendar year.

GSP 10

General Description

Use this procedure to sample bituminous materials.

Suppliers of bituminous materials to be used on highway projects are required to comply with the Standard Operating Procedure for Monitoring the Quality of Bituminous Material (SOP 4), and shall be an approved supplier listed on the Qualified Products List (QPL-7).

The Office of Materials and Testing maintains the list of approved sources of bituminous materials, stating the full name of each organization, the types and grades of their approved products, and the locations of their refineries or terminals.

1. Obtain General Information

   a. Confirm that the bituminous material is from an approved supplier listed on QPL-7.

   b. Identify samples by date, source, source code number, grade, tank or distributor number, and type of sample (Log Code).

NOTE: If you see questionable material, regardless of its source, test it first. Do not use thematerial until you receive satisfactory test results from the Office of Materials and Testing.

2. Obtain Bituminous Samples

   - Performance Graded Asphalt Binder – Obtain 2 samples in 1 qt (or 1 L) cans at the terminal, refinery or project distributor.
     - Performance Graded Asphalt Binder (Assurance Testing at Asphalt Plant) – Obtain 2 samples in 1 pint (0.5 L) cans
   - Cutback Asphalt – Obtain 2 samples in 1 qt (or 1 L) cans at the manufacturer's facility or project distributor.
   - Emulsified Asphalt – Obtain 2 samples in plastic 1 gallon (4 L) containers with plastic orplastic lined lids at the manufacturer's facility or project distributor. Electrical tape should be applied around the lid of the plastic gallon containers.

   Visually check for contamination prior to sampling whenever possible.

   a. Bituminous materials may be sampled from theselocations:
      - The sampling valve on tankers, distributors, or storagetanks
      - The railcar, tank or tanker (in absence of a sampling valve)
      - NEVER SAMPLE BITUMINOUS MATERIAL FROM THE DISTRIBUTOR SPRAYBAR OR SPRAY NOZZLE!

      NOTE: Report missing sampling valves at the terminal or refinery to the Bituminous Control Engineer. Missing or nonfunctioning sampling valves at the asphalt plant or on a distributor should be reported to the Bituminous Technical Services Manager.

   b. Observe these and other safety precautions when handling bituminous materials:

1) Wear gloves, face shield or safety glasses, and a long-sleeve shirt or other protective clothing while sampling material and sealing the containers.
2) Do not smoke while sampling.
3) Do not hold the container in your hand while sampling and sealing. Use tongs or some other device to hold the container.
4) Stand above and away from the material being sampled and on the windward side. Never stand in front of the sampling valve.
5) Take the sample slowly to prevent splashing.
6) Let at least one gallon (four liters) of material run from the valve prior to obtaining the sample at the terminal, refinery or point of manufacture. When sampling at the asphalt plant, obtain samples from the AC storage tank sample valve after allowing approximately two (2) quarts to run off. When sampling from distributor sample valve let 2 quarts run off for AC and 1 gallon for emulsion prior to obtaining sample. This helps purge the sample line.

NOTE: Beware of a sudden pressure surge from a partially cloggedvalve.

7) Let the flow stabilize. Fill the container close to the top to minimize air space.
8) Take two samples every time, regardless of the location from which you are sampling.
9) Submit both properly identified samples for testing. (If the first sample fails, the second sample will be tested as a retained sample.)

c. Follow these precautions during sampling to avoid contamination:

1) Ensure sample containers are clean and dry.
   a) Do not wash or rinse the containers before use.
   b) Ensure the top and container fit tightly together.
   c) Obtain emulsion samples in 1 gallon plastic containers. Never place emulsion samplesinto metal containers, or use unlined metal lids.
2) Ensure no contaminants enter the samples from a different type or grade of bituminous material or cleaning agent. Never wipe the outside of the sample container with a solvent saturated cloth.

NOTE: Only a drop or two of any kind of fuel will contaminate theasphalt.

3) Examine the hauler's Bill of Lading to determine the type of material hauled on the previous load. Sample with caution when the previous load was a different type ofmaterial.
4) Examine the Bill or Bills of Lading to determine the supplier's name and the grade ofmaterials sampled. If the last few shipments were from different suppliers (or grades), note the date, supplier name, and grade of the most recent three or four shipments on the sample card.
5) Always sample the material or observe it being sampled. 6) Take samples to the Laboratory as soon as possible.

d. To take a sample from the sampling valve:

1) Circulate the bituminous material to obtain thorough mixing.

2) Open the valve until a steady small flow stabilizes. Allow bituminous material to flow though the sampling valve as detailed in sub-section 2.b.6 prior to obtaining thesample.

3) If needed, use a small funnel to direct the flow into the container and fillit.
4) Tightly seal the sample.
5) Wipe off spilled material from the outside of the container with a clean, dry cloth.

e. To take a sample from a railcar, or storage tank or tanker without a samplevalve:
   1) Vigorously stir the material with a clean paddle or stick to disperse any contaminants on the surface when mechanical agitation is not available.
   2) Attach a clean can, bucket, or other suitable container to a stick, plank, or other type ofhandle.
   3) Rapidly submerge the container into the bituminous material until the container is full. 4) Immediately transfer the material to the sample container and sealit.

f. Identify each control sample on Form 170 or other form ifappropriate.

g. Submit the sample to the Office of Materials and Testing's Central Laboratory or Branch Laboratory designated by the Bituminous Control Section.

h. Test results will be reported on the followingforms:
   - Form 504M—Performance Graded Asphalt Binder
   - Form 503M—Cutback Asphalt
   - Form 325M—Emulsified Asphalt

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A. General Description

Use this procedure to sample hot mix asphalt concrete mixtures from full trucks, roadways, or, occasionally, partially loaded trucks. You may also use this sampling procedure for sand asphalt base or surface courses.

NOTE: When sampling hot mix asphalt concrete mixtures, ensure that the samples accurately represent the materials being produced.

1. Sampling

To take sample from trucks:

a. Prepare a sampling area in the truck by shoveling off the cone of the material until you create a flat area at least 60 percent of the width of the truck and at least 6 in (150 mm)deep.

1) Take samples with a square-nosedshovel.

2) If the truck contains more than one cone, take samples from different cones. For example, take the first sample from the first cone, the second sample from the second cone,etc.

b. Take a sample from the full width of the flattened area so that the sample will weigh 25 to 30 lbs (11.34 to 13.6 kg) (about 3 or 4 shovels-full of material). Take the sample from a uniform depth at approximately a minimum depthof 3 times the nominal particle size for the type mix being sampled, striking off a vertical face for each shovel of material obtained for testing.

c. Place all the material into a bucket lined with a sample bag. Taking care to place the 3 or 4 shovels full ofmaterial in the bucket lined with a sample bag one on top of theother.

d. If you need to take second or third samples, use the same procedures to take them from the areas immediately adjacent to the original samplingarea.

To take samples from the roadway:

e. Divide the roadway spreader width into 3sections.

f. Wait until approximately 1/2 of the load has been dumped from thetruck.

g. Use a square-nosed shovel to take a 25 to 30 lb (11.34 to 13.6kg) sample from each section.

1) Remove material for the total depth of the pavementcourse.

2) Place all the material in a sample bag or bucket lined with a samplebag.

2. Quartering (See description below)

h. **Transport the sample to the quartering table.** In one swift motion, invert the bucket and/or bag on the center of the table. Remove the bag and/or bucket straight up in a manner to leave the composite sample in a symmetrical, cone-shaped pile in the center of thetable.

i. **Sampling stands with the quartering table attached** requires the sample taken to be placedina container/bucket lined with a cloth bag and placed onto the quartering table, ***do not take the sample from the haul vehicle and place it directly onto the quartering table with theshovel.***

j. **Quarter with a quartering device.** With a vertical motion, insert the device straight down into the pile with very slight twisting movement on the vertical axis of the quartering device until the device is firmly resting on the table with no large particles under the device.

k. **First Quarter:** Remove opposite quarters from the table and retain in a suitable container.

l. **Second Quarter:** Quarter again to split the remaining undisturbedquarters.

m. All material removed from the first and second "reducing quarters" should be retained as referee sample material as prescribed in GSP-21.

n. **Third Quarter:** Quarter the remaining undisturbed quarters. Two opposing sections of the pile are combined to serve as the test specimen, while the remaining opposite quarters are labeled and retained asa Comparison Sample in accordance with GSP-21.

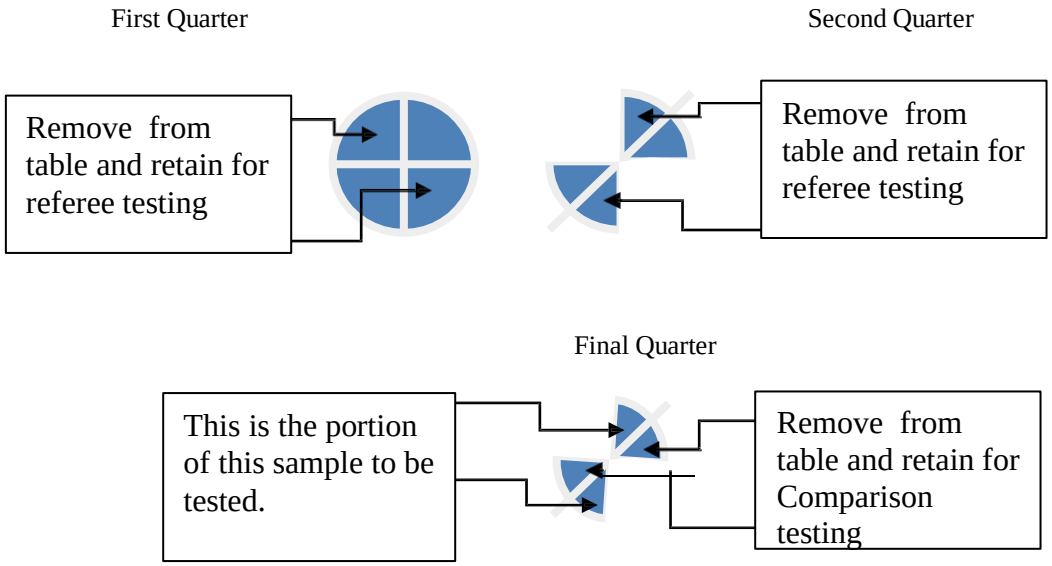
NOTE: Care should be taken each time the sample is "quartered" to ensure that each fraction of the sample is relatively the same size as its counterpart. (Final Results: Sample size should be within the minimum and maximum sample weight of the mix being produced.) The sample should not be mixed once it is placed on the table. If any discrepancies in sampling are noted, notify the TMOS for instruction.

o. Ensure that the mix weight meet the minimum and maximum sample weightrequirement:

Table A

Superpave Mix	Min. Sample Weight lbs (g)	Max. Sample Weight lbs (g)
25 mm Superpave	5.5 (2500)	7.7 (3500)
19 mm Superpave	4.4 (2000)	6.6 (3000)
12.5 mm Superpave	3.3 (1500)	5.5 (2500)
9.5 mm Superpave	2.6 (1200)	4.9 (2200)
4.75 mm Mix	2.2 (1000)	4.4 (2000)
9.5 mm OGFC	2.2 (1000)	4.4 (2000)
12.5 mm OGFC	2.6 (1200)	4.9 (2200)
12.5 mm PEM	2.6 (1200)	4.9 (2200)
19 mm SMA	4.4 (2000)	6.6 (3000)
12.5 mm SMA	3.3 (1500)	5.5 (2500)
9.5 mm SMA	2.6 (1200)	4.9 (2200)

Quartering method



If you cut a core on in-place material for your sample of asphaltic concrete mixtures, ensure the coresmeet the minimum and maximum size requirements In Table A, GDT 125 and GDT 83.

Take all samples of Asphaltic Concrete "OGFC or PEM" mixtures from trucks at the plant as soon after loading as possible, using the following procedure:

p. Take samples with a preheated scoop (place the scoop in the hot mixture topreheat).

q. Prepare a sampling area in the truck by shoveling off the cone of material until you create a flat area at least 60 percent of the width of the truck and at least 6 in (150 mm)deep.

r. Scoop a sample by starting at one side of the prepared area and moving horizontally across the area until you get a sample between 2.2 and 4.4 lbs (1000 - 2000g) for 9.5mm OGFC, 2.6 and 4.9 lbs (1200 - 2200g) for 12.5mm OGFC or PEM.

NOTE: Do not quarter OGFC or PEMsamples.

s. Place the Asphaltic Concrete "OGFC or PEM" sample in a hot melt box (hot or cooled) or in a cloth or plastic bag once material has cooled.

t. Send the sample to the Office of Materials and Research foranalysis.

Revised: December 9, 2020

GSP 21

A. General Description

This procedure governs the sampling procedures for contractor acceptance testing of hot mix asphalticconcrete.

The sampling testing, and inspection duties described herein are to be performed by a Georgia Department of Transportation Certified Contractor QCT. Failure of the QCT to adhereto these requirements may result in the implementation of a formal corrective action plan. Continued failure may result in suspension or revocation of the QCTCertification.

1 Notification

It is the responsibility of the asphaltic concrete mix producer, when they are also the contractor, to notify the Office of Materials and Testing their intent to produce mixture for the Georgia Department of Transportation. Quality Control Testing Technicians shall inform the District Testing Management Laboratory in which the material is being produced, by email, each day of GDOT funded production within 2 hours after shipping the first load of mix. Please include the Plant ID number, Project number, County and mix type(s). In the event the producer is not the contractor, the producer shall submit the Plant ID number, the mix type(s) and the Project number and County provided by the contractor within 2 hours after shipping the first load of mix. Emails for each District Testing Management Laboratory is asfollows:

District Laboratory	Email Address
1	OMATD1Lab@dot.ga.gov
2	OMATD2Lab@dot.ga.gov
3	OMATD3Lab@dot.ga.gov
4	OMATD4Lab@dot.ga.gov
5	OMATD5Lab@dot.ga.gov
6	OMATD6Lab@dot.ga.gov
7	OMATFPLab@dot.ga.gov

In the rare event where internet connection is lost, the asphaltic concrete mix producer shall notify the District TMOS by telephone within the 2-hour deadline and follow up with the required email notification once internet connection is reestablished. Telephone notification is not acceptable under any othercircumstances.

2. Sampling

a. Randomly select samples from within Sublots of 500 tons (or 500 Mg) per mix type. Use the same procedure in situations where more than one mix is produced, or mix is produced for different projects within the same working day.

b. An Acceptance Lot consists of the amount of each type of asphaltic concrete mixture produced and placed in one construction day or at least 500 tons (or 500 Mg). If less than 500 tons (or 500 Mg) is produced per mixture type, it may be incorporated into the next day's production for Lot determination. In this case, use the same mix-sampling schedule as if the mix had been produced all in one operation. For higher production projects with extended paving shifts, Lots may be closed at 2,000 tons at the contractors' request. Prior to mix production, the Contractor may request to separate and maintain Lots of the same mix type when producing and placing mix in separate operations such as one Lotfor mainline and another for shoulder mix under guardrail. Lots will not be separated after theproduction and placement of mix; this request must be submitted prior to mix production. The State Materials Engineer may waive this requirement under extenuatingcircumstances.

c. A Lot containing less than 500 tons may be closed when a pay reduction is imminent due to Quality Acceptance Sample test results when approved by the District Testing Management Operations Supervisor and the Area Bituminous Technical ServicesSpecialist.

d. Sample the mix from the truck or roadway and quarter it according to GSP 15. The appropriate sample size required is prescribed in GDT 83 or GDT 125. When roadway cores are to be obtained or required

for mix acceptance samples, take these cores according to GDT 73. The coring operation will be supervised by a GDOT representative.

a. If the size of both the opposite quarters obtained fails to meet specified size requirements, the next available truck should be sampled, with care taken to obtain a sample that meets the minimum size required for both opposite quarters. It should be documented in the plant diary as to why the random load was not sampled. During the quartering process of Hot Mix samples, the opposite quarters from the acceptance test specimen shall be labeled by the QCT and retained in accordance with Section 400.3.06.A and this GSP. In addition, label the remaining material removed from the total sample and retain for possible Referee testing by the Department. All samples are to be made accessible any time the asphaltic concrete producer is producing material for the Department. In the event the asphaltic concrete producer is not producing material and the plant and laboratory facilities are closed, the Department may request and shall be provided access to these samples at a coordinated time within 48 hours. The samples shall be retained for an additional five (5) days upon request for access to the samples. A worksheet or paper with the SiteManager sample number should be placed with the sample. If SiteManager is not accessible at the time the sample(s) is taken, contact the District TMOS for guidance on how to proceed in documenting the requiredsample(s).

References: GSP 15 (Sampling Procedures For Asphalt ConcreteMixtures)
GDT 73 (Method of Random Selection And Acceptance Testing of Asphaltic Concrete).
DOT 163 (Asphaltic Concrete Plant Sampling Report).
Sampling Report and Random Number SelectionExamples.
Subsection 400.3.06

Note 1: All asphaltic concrete hot mix samples obtained by QCT's for Comparison and Referee testing shall be placed in a hot melt box (hot or cooled), or samples may be placed in a cloth or plastic bag after material has cooled. These sampling methods will help to eliminate the loss of liquid Asphalt Cement. (Do not use metal cans or place hot material in cloth or plastic bags when sampling asphaltic concretemixes.)

Note 2: OGFC and PEM Acceptance Samples are obtained using preheated scoops in accordance with GSP 15. An additional sample shall be obtained and retained as the Opposite Quarter. For PEM, OGFC and thin lift courses < 110 lbs/yd², the retained opposite quarter shall be used for reevaluation when a reevaluation is requested by the Contractor.

Note 3: It will be the responsibility of the QCT Manager or QCT Technician to inform the Testing Management Operations Supervisor and Technical Service Specialist 24 hours prior to starting production if plant operations have been discontinued for more than seven calendardays.

3. Mixture Temperature

a. Take the mix temperature when extractions are obtained and also at other times as necessary to maintain uniform and specification temperatures. If problems exist, take one per load until problem has been corrected. Take the temperature on OGFC and PEM mixes at a frequency of at least one per hour.

b. The QCT shall take the temperature of the mixture and record the results on the load ticket each time a sample is taken. The respective load tickets shall also be signed by the QCT for each load from which a sample or temperature check is taken. In the event this project was let using E-ticketing, these temperature documentations are to be made in the plantdiary.

c. Perform asphalt thermometer calibration at least once per week or at increased intervals as necessary to assure accuracy. Document calibrations in the plant diary.

Temperature Tolerance = ± 20 °F (± 11 °C) of the Job Mix Formula(JMF).

Reference: Subsection 400.2.01.A

4. Stripping Tests

Stripping tests will only be required on Open Graded Friction Course (OGFC) and Porous European Mix (PEM) for every sample obtained.

Reference: GDT 56 (Test Method for Heat Stable Anti-StripAdditive)

5. Extractions

a. Determine the liquid asphalt content either by the extraction or ignition method. Sieve the remaining aggregate to determine gradation.

b. Properly label the extracted aggregate, ensure that it is stored in an approved container and secured in a protected and enclosed environment and retained in accordance with Section 400.3.06.A and this GSP. All samples are to be made accessible any time the asphaltic concrete producer is producing material for the Department. In the event the asphaltic concrete producer is not producing material and the plant and laboratory facilities are closed, the Department may request and shall be provided access to these samples at a coordinated time within 48 hours. The samples shall be retained for an additional five (5) days upon request for access to the samples. If samples meet a 1.00 pay factor and are not procured by the Department within three state funded production days, they may be discarded. If there is less than a 1.00 pay factor, the sample must be saved for seven state funded production days before beingdiscarded.

b. Perform these procedures at the prescribed frequency in accordance with GDT 83 or GDT 125, GDT 38 and Subsection 400.3.06 of the Contract. Complete acceptance test results on the same day samples are obtained and entered into SiteManager. In the event the DOT data collection system is unavailable, or error messages are given, email a printout of the results to the appropriate District Mailbox given in Section 1 within one working day. If SiteManager is not accessible at the time the sample(s) is taken, contact the District TMOS for guidance on how to proceed in documenting the required sample(s).

Note 4: Any test out of Section 828 must be reported to TMOS and Bituminous TSS immediately and properly documented.

Note 5: When determining the AC content by ignition (GDT 125) the long burn ticket shall be saved in the asphalt plant's filing system by projectbasis.

Note 6: Perform Lift Test in accordance with Ignition Oven's Manufacturer's recommendations or at a minimum frequency of once a month (30 days) and maintain test results for a minimum of 12 months.

References: GDT 38 (Method of Test for Mechanical Analysis of Extracted Aggregate)

GDT 83 (Method of Test for Extraction of Bitumen from Paving Mixtures using the Vacuum Extractor)

GDT 125 (Method of Test for Determining AC Content by Ignition)

Subsection 400.3.06.A.3.b.3

OMR-TM-140 (Extraction Analysis Worksheet)

DOT 159-5 (Asphaltic Concrete Lot Report)

Extraction Worksheet Example

Extraction Analysis Sieve Sizes for Each Mix
Asphalt Extraction Handout

6. Lot Tonnage

Enter all information requested on the Daily Production Status Sheet on a daily basis. Give the completed sheet to the TMOS no later than two working days after the end of the respective month.

Reference: Daily Production StatusSheet.

7. Haul Vehicle Inspection

Inspect haul vehicles prior to loading for proper tarps, strapping, insulation, and holes for taking temperature. Inspect vehicle beds for evidence of diesel fuel, or un-approved releasing agent, loose, foreign material and asphalt build-up. When any of these items are found to be in noncompliance with the specifications, make corrections before haul vehicle is allowed to transportmaterial.

References: Subsection 400.2.01.A.

8. Lime Checks

a. Make lime checks daily, during mixture production regardless of tonnage, according to lime check procedures posted at each plant for type of system. Record the calculations and test results of these in the Plant Diary. Place the percent lime on DOT159-5.

   Tolerance: Daily plus or minus 10% of JMF requirement.

   Semi-weekly (Volumetric System)- plus or minus 10% of weighed volume of lime comparedto target weight of lime.

   Semi-weekly (Weigh Pod System)- plus or minus 2% ofweights.

b. Check weight systems by utilizing test weights at least twice per week (7 calendar days) or at increased intervals as needed to maintain accurate calibration. Record the results of these checks and the calculations in the plant diary.

c. Check volumetric systems by weight and record in diary at least twice perweek.

d. Check lime interlock systems according to the posted procedure or once per month to insure plant operations will interrupt mixture production if hydrated lime introduction fails. Record the actual time it takes for systems to interrupt mixture production in the plantdiary.

References: Subsection 400.3.02.6.c

9. Rap Requirements

Prior to mixture production for each lot of asphaltic concrete mixture, the QCT shall verify themaximum % RAP approved for the Job Mix Formula and RAP stockpile. During mixture production the QCT shall verify that the asphaltic concrete mixture being produced complies with approved Job Mix Formula requirements. RAP verification readings, obtained from the material feed data on the asphalt plant's computer, are to be documented in the asphalt plant diary and to be recorded in the remarks section of SiteManager ™ or AASHTOWare Project & Construction Materials online software, for each lot produced.

For asphaltic concrete mix designs incorporating ≤ 35 % RAP which were approved with Hamburg Wheel Tracking Device (HWD) testing, Abson Recovery testing is not required. For asphaltic concrete mix designs not approved with HWD testing, Abson Recovery testing is required for all asphaltic concrete mixtures that contain ≥ 20% RAP. For asphaltic concrete mixtures incorporating any percentage of Recycled Asphalt Shingles (RAS), Abson Recovery testing is required. Take an Abson Recovery sample at the beginning of construction for each affected mix type. Thereafter, use a sampling frequency of one sample per seven (7) lots for verification testing by DSR for viscosity of recovered AC. When incorporating GTR to obtain a PG76-22 ARB, a minimum sample frequency is one per week or seven (7)

lots. The Department may take Abson Recovery Samples on asphaltic concrete mixtures forquality assurance purposes.

a. Samples may be taken at the same time extraction samples are taken from trucks. Take samples with a clean scoop, trowel, or spoon and deposit into a minimum 5 pound/maximum 10 pound (minimum 2.3 kg/maximum 4.6 kg) hot melt box. Properly close the box. Enter the sample in SiteManager and properly identify the samples and submit them along with the accompanying completed report to the appropriate DOT Lab. If SiteManager is not accessible at the time the sample(s) is taken, contact the District TMOS for guidance on how to proceed in documenting the requiredsample(s).

References: Section 402

10. A.C. Samples

a. Take liquid asphalt samples and submit them to the Central or Branch Lab fortesting.

b. Obtain samples from the AC storage tank sample valve after allowing approximately two (2) quarts to run off. Obtain samples in two (2) 1-pint (.5 liter), tin cans. If liquid overruns can, discard and obtain another sample.

c. Frequency

- **Start-up Samples** = When plant has been down for more than seven (7) calendar days, obtain results prior to plant operation beginning.
- **Quality Assurance AC Samples Interstate projects** = Two (2) per week (seven calendar days).
- **Quality Assurance AC Samples Non-Interstate projects** = One (1) per week (seven calendar days).

d. Abson Recovery Samples for GTR modified Mixtures

In accordance with Section 820.2.01.A.2.d, PG 64-22 or PG 67-22 modified to meet PG 76-22 ARB using GTR, via the dry method, will be evaluated using complete analysis for compliance with PG 76-22 ARB requirements prior to mixture production using laboratory blended materials. PG 64-22 or PG 67-22 modified to meet PG 76-22 ARB using GTR, via the dry method, will be evaluated for compliance with original DSR testing requirements for PG 76-22 ARB during mixture production using abson recovery testing accordance with GDT 119 in compliance with AC sampling frequencies established in GSP 21 sub-section A.9.a.

References: GSP 10 **(Sampling Procedure for Bituminous Material)**
GDT 119

Note 7: Obtain Quality Assurance AC samples with a GDOT Representative present. All samples shall be entered into SiteManager before being dropped off at the Central or Branch labs and must be accompanied by the SiteManager sample ID number. If SiteManager is not available at the time the sample(s) is taken, contact the District TMOS for guidance on how to proceed in documenting the required sample(s).

Notes 8: All contractors will be required to submit start-up samples to the Central or Branch Labs 24 hours prior to starting production. When production is scheduled to begin on a weekend, state Holiday or the day after a state holiday, submit samples 3 to 4 days prior to start of production. Producers will not be allowed to start until test results are complete and meet the specified Requirements for asphalt cement.

The start-up requirement can be waived by the State Bituminous Construction Engineer In extenuating circumstances on all grades of asphalt cement except PG 76-22, if asphaltic concrete mix has been produced for private work during this time and it can be verified with asphalt cement bill of ladings (3 minimum) that the asphalt cement has been replenished with fresh material meeting the Performance Grade requirements for a state project.

If any failing asphalt cement sample is obtained, ensure that a representative of the Department is present when the follow-up sample is obtained.

11. Other Sampling Requirements

a. Provide all sample containers, extractants, forms, diaries and other supplies. These items are subject to the approval of the Engineer.

b. The following are materials that the Contractor's QCT will be required to sample and submit to the appropriate DOT laboratory, as directed. Samples should be submitted no later than seven (7) days from sample date should Department Technicians not assist withdelivery:

1) Sampling mix for HWDtesting.
2) Sampling mix for field verification of mixdesign.
3) Sampling of miscellaneous materials used in themix.

12. Warm Mix Asphaltic Concrete (WMAC) Projects Only

a. Sampling and fabrication requirements for WMAC for field verification of mixdesigns:

In addition to all standard sampling , testing and inspection requirements established in Section 410, Section 400, Section 402, Section 828 and other sections within this document, the additional following requirements are established:

1) Fabricate samples for testing in accordance with GDT 66 , during the first day of WMAC production and then once every 5 days or 5 Lots thereafter unless otherwise instructed by the Office of Materials and Testing as required in accordance with Section 828 guidelines when stripping is visually indicated. These samples are to be fabricated during mixture production and not from reheated material. The fabricated samples are to be submitted to the District laboratory for testing along with completed sample cards.
2) Within the first three (3) lots of production, submit Fifteen (15) filled ten pound (4.6 kg), minimum, hot melt boxes of mix ***(with each box having at a minimum, the mix ID and sample number of the test recorded with a marker on the box)*** to the Branch Laboratory for HWD, T-209 and when required, GDT 66 Testing from the same portion of mix as taken for asphalt cement content and gradation accompanied with the SiteManager sample id for thissample
3) Obtain aggregate stockpile samples for all aggregate types used in the production of the WMAC and determine moisture content.
4) The Department may obtain cores samples on warm asphaltic concrete mixtures from the roadway for quality assurance purposes.

b. Documentation Requirements for WMACProjects

1) Record aggregate moisture contents obtained for all sampled aggregate stockpiles in the plant diary
2) Record, under Remarks on the 159-5, that WMAC is beingproduced.

13. Interstate Projects Only*

a. Sampling and fabrication of HMA specimens for field verification of mix designs for mixtures placed on interstates mainlines including leveling and patching meeting the specified lot frequency: Field verification of new mix designs will be required on interstate projects regardless of area of placement. The contractor will be required to fabricate and submit one set (two specimens) of mix design volumetric pills for mainline placement only.

1) Submit Fifteen (15) filled ten pound (4.6 kg), minimum, hot melt boxes of mix ***(with each box having at a minimum, the mix ID and sample number of the test recorded with a marker onthe box)*** to the Branch Laboratory for HWD, T-209, Abrasion Loss (TP 108) for required mix types and when required, GDT 66 Testing from the same portion of mix as taken for asphalt cement content and gradation accompanied with the SiteManager sample id for this sample. Provide one set of samples for each mix type per Lot within the first two lots of production and one set per seven (7) lots, thereafter. The Office of Materials and Testing may reduce the field verification frequency, at the discretion of the State Bituminous Construction Engineer, based on prior field verification results.

2) Fabricate and submit one set (two specimens) of mix design volumetric pills for Gap-graded and Dense-graded mixtures with each field mix design verification. Prepare the specimens using the gyratory compactor at the N Design Level Specified for the mixtures. Compact the mixtures at the Job Mix Formula temperature.

3. Conduct testing for AASHTO T-209 to determine the maximum specific gravity of the mixture by testing one sample for each specimen taken for gyratory compactor described above. Determine the mix density and percent air voids of each gyratory compactor specimen described above by using the average result of the two AASHTO T-209 samples as the theoretical maximum specific gravity.

4) Submit the opposite quarter of the acceptance sample used for asphalt cement content and gradation for Ignition Oven Calibrationverification.

b. When mix problems constitute a Job Mix Formula adjustment, obtain approval for the changes from the Technical Services Specialist. Upon approval, fabricate one set (two specimens) for gyration at N design and two samples of mix for AASSHTO T-209, and submit an additional Fifteen (15) filled ten pound (4.6 kg) minimum hot melt boxes (or other approved container) of mix to the Branch Laboratory for other required testing with the set of gyrated samples. Submit these samples to the Branch Laboratory.

Note 9: Supply a gyratory compactor, including a calibration kit, electronic balance with a weighing capacity of 12,000 grams, asphalt ignition oven and all T-209 test equipment in the field laboratory as specified in Section 152 of the contract on all Interstate projects mainline pavingonly.

14. Non-Interstate Projects Only (No Gyratory Compactor Required)

a. Sampling and fabrication of HMA specimens for field verification of mixdesigns:

1) Sampling and fabrication of HMA specimens for field verification will only be required when a new Mix design is submitted, or a Job Mix Formula change isrequested.

2) Within the first three (3) days of production or after a JMF change, submit material to the lab for verification of mix design.

3) Submit Fifteen (15) filled ten pound (4.6 kg), minimum, hot melt boxes of mix ***(with each box having at a minimum, the mix ID and sample number of the test recorded with a marker on the box)*** to the Branch Laboratory for fabrication of one set (two specimens) for gyration at N design, six specimens for HWD, one complete set of pills (six specimens) for GDT-66, as required in accordance with Section 828 guidelines when stripping is visually indicated and two samples for AASHTO T-209.

4) Submit the opposite quarter of the acceptance sample used for asphalt cement content and gradation accompanied with the SiteManager ID for this sample for Ignition Oven Calibration verification.

Note 10: A complete field mix design verification is required for a change of PG grade (PG 67-22 and PG 64-22) of asphalt cement. A new approved mix design is required for any change in mineral filler type or source.

Note 11: For all plant produced mix design verifications obtain the mix from the same load as the acceptance sample. Record the sample tests results, mix ID number and JMF requirements on the back of the sample card. Samples must be within tolerance established in Section 828.

15. Plant Inspection Duties

Perform the inspection duties listed below at the designated frequency, document on the OMR-TM-143 form, and submit to the respective TMOS.

a) Visually observe cold feed bins and mechanical condition of each.
b) Visually inspect stockpiles for proper construction, segregation, and contamination.
c) Visually observe dryer, dust collection system, and baghouse.
d) Visually observe asphalt storage system (unloading of tanker).
e) Visually inspect mixer on batch type plants and discharge gate on all type plants.
f) Visually inspect mix for segregation.
g) Visually inspect haul vehicles for proper covers, beds, and approved releasing agents.
h) Visually inspect lime systems.
i) Check A.C. and aggregate scales for accuracy and enter results in plant diary.

Reference: OMR-TM-143 (Asphalt Plant Check List)

16. Plant Diary

a. The plant diary is a legal document. Ensure that it remains at each plant and is properly filled out, daily. All entries are to be neat and legible.
b. Use preprinted Plant Diaries and include, as a minimum, the following information, to be entered on a daily basis.

   Entries shall include, but are not limited to:

   1) Project number or numbers
   2) Date and weather conditions
   3) Contractor's Representative (specify Q.C.)
   4) Type of mix
   5) Tons
   6) Lot number
   7) Mix I.D. number (from JMF)
   8) CPW checks (Furnished by DOT personnel)
   9) AC sample, Releasing Agent and Lime Samples including any samples taken for Lab testing
   10) Thermometer calibration
   11) Daily and Semi-weekly lime check calculations
   12) Moisture content of aggregate stockpiles (when producing WMAC)

13) Any instructions given or received
14) Any DOT visitors
15) Any activities pertaining to Statework.
16) Signature and title

c. For any lot of asphaltic concrete, the Asphaltic Concrete Producer shall thoroughly document any occurrence where greater than two loads of asphaltic concrete mixture are returned to the asphaltplant for any reason related to quality, either by direction of the Department or the contractor, and immediately notify the Technical Services Specialist. The Asphaltic Concrete Producer shall include date, project number, lot, mix type, load numbers and reason for the returned mixture. Also, to be detailed in the diary are the measures taken at the asphalt plant in response to the returned mixture.

17. Computer

Note 12: In the event the Contractor's computer system is inoperable, operations may be allowed to continue for a maximum of three working days by providing hand written test reports to the TMOS on a daily basis.

a. Enter all test data into SiteManager daily with the SiteManager sample id for all samples placed in the plant diary and made accessible to GDOT representatives. At each plant provide an internet service provider connection and an e-mail address for exchanging electronic correspondence with GDOT.

b. In accordance with SOP 27, provide an individual PC or laptop computer at each plant. Ensure that this computer remains at the plant at all times.

c. Ensure that each plant has a computer and accessories meeting the following requirements and as specified in Section 152 of thecontract.

1) Minimum Requirements:

- At a minimum, each plant shall have hardware, software, and network connection that allows for installation and operation of AASHTOWARE Project SiteManager using Citrix Receiver and email capabilities.
- Printer: Windows-compatible laser or ink jetprinter

18. Control of Asphaltic ConcreteMixtures

a. Designate a Level II QCT Manager to be responsible for the daily quality control operations within his/her organization and held accountable for the action of all assigned QCTs as specified in contract. The Quality Control Manager will be responsible of ensuring that Quality Control Technicians do not simultaneously perform QCT and Plant OperatorDuties.

b. The designated Level II - QCT manager will be responsible to control the Asphaltic Concrete mixtures produced for GDOT Projects. The mixture control tolerances from an approved Job Mix Formula are written in Section 828 and mixture acceptance tolerances are as written in Section 400, Section 410 and Section 415 of the governing GDOT Specifications for the respectiveProject.

References: GSP 21 (Sampling Procedures forContractors)
GDTs (Sampling and Testing Manual or Study Guide)
Section 828 (Hot Mix Asphaltic Concrete Mixtures)
Section 400 (Hot Mix Asphaltic ConcreteConstruction)

GDT 38

A. Scope

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

Use this test method to determine the particle size distribution of fine and coarse aggregates extracted from bituminous mixtures.

B. Apparatus

The apparatus consists of the following:

1. Balance: The balance or scale shall be capable of weighing the sample without additional splitting or distribution and have a resolution of 0.1 gram.
2. Mechanical Sieve Shaker: The Mechanical sieving device shall create a lateral, vertical, and jarring motion to keep the sample particles moving continuously over the surface of thesieve.
3. Sieves: Use woven-wire cloth sieves that conform to the "Standard Specification for Sieves for Testing Purposes," AASHTO M 92. Mount sieves with square openings on substantial frames constructed to prevent material loss during sifting. Select sieve sizes to furnish the information required by the Standard Specifications for the material to betested.
4. Oven or Stove: An oven or stove of suitable size capable of maintaining a standardized temperature for the purpose of drying the aggregate, excluding Ignition Oven typefurnaces.

C. Sample Size and Preparation

Use the entire sample of aggregate from which the bituminous material has been extracted (see GDT 83 or GDT 125).

NOTE: If utilizing GDT-125 for determining asphalt content, the extracted aggregate containing at least the aggregate passing the #8, (2.36mm) sieve and finer material must be subjected to washingover a No. 200 sieve in accordance with AASHTO T-11.

D. Procedures

1. Dry the aggregate utilizing a vented oven or stove with a vented hood to a constant weight and allowed to cool to room temperature.

2. Weigh the sample.

3. Nest the sieves in order of decreasing size of opening from top to bottom and place the sample in the top sieve. The sample shall be classified by particle sizes utilizing the required sieves outlined in the specifications for the material type being tested. Care should be taken to insure that sieve diameter is adequate. Limit the quantity of material on a given sieve by adding additional sieves as necessary so as all particles have the opportunity to reach the sieve openings a number of times during the sieving operation. a. Do not turn or manipulate fragments in the sample through the sieve by hand.

4. Agitate the sieves by hand or mechanical shaker for about 10 minutes or until less than 1 percent by weight of the total sample passes any sieve during 1 minute.

Note: When using a mechanical sieve shaker, periodically test the sieve's shakers accuracy against the results of sifting by hand. Make necessary adjustments in sifting time and/or repairs as required by manufacturer. This shall be included as part of the equipment review process for annual plant inspection.

Note: When sieving by hand hold individual sieves in a slightly inclined position in one hand. Strike the side of the sieve sharply and with an upward motion against the heel of the other hand at a rate of about 150 times per minute, turning the sieve about one-sixth of a revolution at intervals of about 25 strokes.

5. Record the accumulative weight of the material retained on each sieve.

E. Calculations

Calculate the percent passing each sieve as follows:

$$P = 100 - \frac{R}{T} \times 100$$

where:

P = Accumulative percent passing sieve by weight of total aggregate

R = Accumulative weight of mineral aggregate retained on sieve

T = Total weight of extracted mineral aggregate

F. Report

Report the results of the sieve analysis as accumulated percentages passing each sieve. Report percentages to the nearest 0.1 percent on the (TM-140, Site Manager appropriate Form(s).

GDT 39

March 31, 2011

A. Scope

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

Use this test method to determine bulk specific gravity of specimens of compacted bituminous mixtures. These procedures are described:

Uncoated Specimens, Dense Graded Mixtures Only

Paraffin Coated Specimens

AASHTO T 331 is an approved alternative method to Paraffin Coating method.

B. Apparatus

The apparatus consists of the following:

1. **Balance:** Use a balance having a capacity of 10 lb (4.5 kg) or more and sensitive to 0.0002 lbs (0.1 g) or less.
2. **Apparatus:** The suspension apparatus shall be constructed to enable the unit (wire basket or container) and the specimen to be immersed in water suspended by wire from the center of a weighing device to a depth sufficient to cover it and the test specimen during weighing.
3. **Water bath or Container:** for immersing specimens in water while suspended under a weighing device. The water bath or container shall be equipped with an overflow outlet to maintaining a constant water level.

C. Sample Size and Preparation

Make test specimens from either laboratory-molded bituminous mixtures or cut or cored compacted pavements. Do not distort, bend, or crack specimens during and after removal from pavement or mold.

Store specimens in a safe, cool place.

Ensure specimens are free from foreign materials such as seal coat, tack coat, foundation material, soil, or paper. Separate specimens from other pavement layers by sawing.

D. Procedures

Uncoated Specimens

Note: When roadway cores are saturated with water, conduct the following steps in this order: 4, 5, 1, 2, 3, and 6.

1. Dry the specimen to a constant weight. Constant weight is attained when further drying at 110 °, ± 9 °F (43.5 °, ± 5 °C) will not alter the weight 0.0002 lbs (0.1 g).
2. Cool the specimen to room temperature.
3. **Weigh the uncoated specimen**.
   1) Determine the dry weight of the specimen to the nearest 0.0002 lbs (0.1 g).
   2) Designate this weight as "A".
4. **Weigh the specimen in water.**
   a) Place the specimen on an immersed ~~in~~ suspension device, in water, at room temperature for 1 to 4 minutes or until a constant weight is obtained.
   b) Leave the specimen in the water and weigh to the nearest 0.0002 lbs (0.1 g).
   3) Designate this weight as "C".
5. **Weigh the surface-dry specimen.**
   a) Remove the specimen from the water.
   b) Dry the surface by blotting with a damp cloth (*damp is when no water can be wrung out*).
   c) Weigh the specimen to determine the surface-dry weight.

d) Designate this weight as "B".

6. **Calculate the bulk specific gravity of the uncoated test specimen as follows:**

$$\text{Bulk Specific Gravity} = \frac{A}{B - C} \text{ where}$$

A = weight of dry sample in air in grams

B = weight of surface-dry sample in air in grams

C = weight of sample in water in grams

7. **Calculate the percent of water absorbed by the specimen (on a volume basis) as follows:**

$$\text{Percent of Water Absorbed by Volume} = \left[\frac{(B - A)}{(B - C)}\right] * 100$$

If the percent of water absorbed by the specimen as calculated exceeds 2.0 percent, use the Paraffin Coating Method to determine Bulk Specific Gravity. AASHTO T 331 is the recommended alternative to the Paraffin Coating Method for specimens with water absorbed results that exceeds 2.0 percent of water by volume.

Paraffin Coating

1. Dry the specimen to a constant weight. Constant weight is attained when further drying at 110°, ± 9° F (43.5 °, ±5 °C) will not alter the weight 0.0002 (0.1 g).
2. Cool the specimen to room temperature.
3. Weigh the uncoated specimen.
   1) Determine the dry weight of the specimen to the nearest 0.0002 (0.1 g).
   2) Designate this weight as "A".
4. Weigh the coated specimen.
   1) Preheat the paraffin to 130 ° to 150 °F (54 ° to 66°C).
   2) Coat the test specimen on all surfaces with paraffin thick enough to seal all surface voids. Apply the coat in one of two ways: either use a paint brush to apply the hot paraffin or dip the specimen in the heated paraffin and brush more on to seal all pin-point holes.
   3) Determine the dry weight of the test specimen at room temperature. Weigh to the nearest 0.0002 lbs (0.1 g).
   4) Designate this weight as "D".

Note: If you want to use the specimen for further tests that require removing the paraffin coating, dust the specimen with talc before applying the paraffin.

5. Weigh the coated specimen in water.
   1) Place the paraffin-coated specimen in the wire basket.
   2) Immerse the basket in water at room temperature.
   3) Weigh to the nearest 0.0002 (0.1 g).
   4) Designate this weight as "C".

6. Calculate the bulk specific gravity of the test specimen asfollows:

$$\text{Bulk Specific Gravity} = \frac{A}{\left|(D-C)-\left[\frac{(D-A)}{0.90}\right]\right|}$$

A = Weight in grams of the specimen before paraffin coating inair

D = Weight in grams of the paraffin-coated specimen inair

C = Weight in grams of the paraffin-coated specimen inwater

0.90 = Bulk specific gravity of the paraffin

E. Calculations

Determine the density of a specimen taken from compacted mixture asfollows:

Roadway Core Density = Bulk Specific Gravity of Specimen * Specific Gravity of Water (62.4)

Determine the in-place air voids of a specimen taken from compacted mixture as follows:

{(100) – [(Density of Specimen ÷ Theoretical density) *(100)]}

NOTE: Target Specific Gravity is the Actual Specific Gravity as shown on the job mix formula or the Specific Gravity obtained on the project control strip.

F. Report

1. Calculate the specific gravity to the nearest 0.001.
2. Report density to the nearest 0.1 on form OMR-TM-150 and 159-5

Report voids to the nearest 0.1 on Form OMR-TM-150 and159-5.

GDT 56

July 2010
January 2012

A. Scope

For a complete list of GDTs, see the Table of Contents.
Use this test method to determine the heat stability of a liquid anti-strip additive in bituminous mixtures. Use this method to evaluate an anti-strip additive before placing it on the Qualified Products List or to evaluate the effectiveness of the additive in the mix manufactured at a hot mix plant.

B. Apparatus

The apparatus consists of the following:
1. Balances: Use balances that are accurate to the nearest 0.0002 lb (0.1 g).

2. Hot-Plate, Gas Burner, or Stove

3. Watch or Timer

4. Metal Container: Use a non-corrosive metal beaker with a volume of approximately 0.5 gal (2000 ml) for boiling the asphaltic concrete mixture. The container is equipped with a shelf made of No. 10 (2.00 mm) wire mesh elevated 1 in (25 mm) off the bottom.

5. Pans: Use shallow, 12 in (305 mm) diameter pans, or equivalent.

6. Spatula: Use a spatula with a stiff blade.

7. Quart Can: Use a quart can or similar container for treating the asphalt cement with anti-strip additive.

8. Other Equipment: Use equipment necessary to perform AASHTO T 49 and T 202.

9. Scoop: Standard Metal Scoop that holds 8-10 ounces

C. Sample Size and Preparation

The two alternatives presented differ with the intended use of the test.
1. Alternate 1: Approving Anti-Strip Additives for the Qualified Products List

a. Heat the asphalt cement to 325 °F (163 °C).

b. Thoroughly mix in 0.5 percent of the additive by weight of the asphalt cement.

c. Maintain the treated asphalt cement at 325 °F (163 °C) for 96 hours.

d. Ensure that mixing temperatures conform to AASHTO T 245.

e. Prepare two 250g batches of a laboratory standard aggregate with the gradation shown below for the stripping test.

NOTE: The laboratory-standard aggregate has a known history of stripping problems, and the laboratory-standard asphalt is an PG-67-22 normally used in the laboratory for mix design purposes.
f. Ensure that the mix from the stripping test meets the following gradation requirements:

Size	Percent Passing
1/2 in (12.5 mm)	100
3/8 in (9.5 mm)	95-100
No.4 (4.75 mm)	60-70
No. 8 (2.36 mm)	44-46
No. 50 (300 µm)	18-22
No. 200 (75 µm)	5.6-6.5
%AC	5.25-7.0

g. Use the optimum asphalt content to mix the two specimens using the laboratory-standard asphalt cement treated with the additive in question.

h. Perform the stripping test in Procedures, step 2 after the 96-hour curing period and before the mix temperature falls below 250 °F (121 °C).

i. The additive is considered heat-stable if no more than 5 percent of the particles become totally or partially uncoated.

j. After approving a liquid anti-strip additive with this test, subject it to GDT 66 to determine diametral tensile strength. The materials must meet test requirements as outlined in Section 828 of the Standard Specifications.

2. Alternate 2: Evaluating Anti-strip Additives at Hot Mix Plants

NOTE: Carefully handle the sample and maintain an adequate mix temperature, according to the type of mix you are sampling.

a. Start the water boiling at the test site. It should be boiling by the time you arrive with the test sample.

b. Prior to taking sample from haul vehicle place scoop inside an oven to preheat. Keep the scoop preheated. When the scoop is preheated, it will not cool down the mix.

c. As soon as the mix has been loaded onto the haul vehicle, take one representative large shovel full.

NOTE: Perform the next steps within 10 minutes after the mix comes out of the plant.

d. Place the sample gently into a bag or container so that the mass remains intact.

e. Immediately take the bag or container to the testing area where the container of water is already boilingslowly.

f. Break open the mass of material sampled, use approximately [0.44 to 0.66 lbs (200 to 300 g)] and perform the appropriate tests.

D. Procedures

1. Asphalt Cement

a. Test the thermoplastic asphalt cement with and without the heat-stableanti-stripadditive.

b. When you add the anti-strip additive, it shall not change the asphalt cement penetration at 77 °F (25 °C) by more than 3 mm nor viscosity at140 °F (60 °C) by more than 1.68 lbs/in (300 poises) persecond.

c. Approve additives based on tests performed with the laboratory standard asphalt cement. However, the specific asphalt to be used on the project must comply with Section 820 of the Standard Specifications.

2. Stripping Test (Boil Test) for Asphaltic Concrete Mixture

a. Use a preheated scoop to transfer 8 to 10 ounces of the mix from the material sampled [approximate 0.44 to .66 lbs (200 to 300 g)] into the boiling water for 10 minutes

b. Drain off the water and dump the mix onto an absorptive paperproduct.

c. Let the mix cool at room temperature until dry.

d. Do not move or disturb the mix until you visually inspect the material. A stripped particle is one that visually appears to have the asphalt cement totally or partiallyremoved.

E. Calculations

No calculations are necessary for thesetests.

F. Report

Report the visual inspection of the stripping test result to the nearest 5 percent for the 96-hour test or field test, whichever applies, on Form FDCS 159.

Updated 10-13-2020
Larry Warren, TM Branch Chief

GDT 73
Method A
Random Selection of Asphalt Plant Samples

A. Scope

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

Use this test method to randomly select and test asphaltic concrete mixes for mixture acceptance on a lot basis.

B. Sample Size and Preparation

1. Lot Boundaries

   An Acceptance Lot normally consists of the amount of asphaltic concrete produced and placed in one construction day, or at least 500 tons (500 Mg).
2. Evaluate each Lot with the sampling procedures and the specified acceptance criteria for mixture composition.
3. When evaluating this feature, always use the same Lot boundaries. If the Job Mix Formula changes significantly, the Contractor QCT may end one Lot and begin a new Lot with the permission from the TMOS and TSS.

C. Procedures

1. Selecting Loads to be Sampled
   a. Randomly sample the designated Lot based on the loadnumber.
   b. Randomly sample the mix for the Lot from sub lots consisting of approximately 500 tons (500 Mg).

2. Testing for Asphalt Cement Content and Gradation
   a. Use GDT 83 or GDT 125 to test for asphalt cementcontent.
      1) When the plant that produces the mix is operating and the mix is tested according to GDT 125, use the asphalt cement content calculated from the ticket. Calculate the content from the appropriate ticket that corresponds to the load from which the sample was taken. The ticket and gradation worksheet should be attached to the TM159-5 report and retained in the project files. In all cases, test the mixture gradation with GDT 38.
   b. Project personnel may submit to the Central Laboratory forapproval any other method for random sampling when existing conditions make load samplingimpractical.

Note: Test according to GDT 83 or GDT 125 and GDT 38. Accept according to Specification Section 400.

Updated 10-13-2020
Larry Warren, TM Branch Chief

GDT 73 Table 1

1		2		3		4		5		6		7	
.576	.730	.430	.754	.271	.870	.732	.721	.998	.239	.053	.899	.554	.627
.892	.948	.858	.025	.935	.114	.153	.508	.749	.291	.810	.159	.225	.163
.669	.726	.501	.402	.231	.505	.009	.420	.517	.858	.081	.277	.035	.039
.609	.482	.809	.140	.396	.025	.937	.310	.253	.761	.982	.468	.334	.921
.971	.824	.902	.470	.997	.392	.892	.957	.640	.463	.095	.801	.576	.417
8		**9**		**10**		**11**		**12**		**13**		**14**	
.427	.760	.470	.040	.904	.993	.509	.025	.794	.850	.917	.887	.751	.608
.549	.405	.285	.542	.231	.919	.371	.059	.164	.838	.289	.169	.569	.977
.860	.507	.081	.538	.986	.501	.165	.996	.356	.375	.654	.979	.815	.592
.690	.806	.879	.414	.106	.031	.477	.535	.137	.155	.767	.187	.579	.787
.251	.884	.522	.235	.398	.222	.788	.101	.434	.638	.021	.894	.324	.871
15		**16**		**17**		**18**		**19**		**20**		**21**	
.698	.683	.566	.815	.622	.548	.947	.169	.817	.472	.864	.466	.897	.877
.796	.996	.901	.342	.873	.964	.942	.985	.123	.086	.335	.212	.875	.969
.348	.743	.470	.682	.412	.064	.150	.962	.925	.355	.909	.019	.190	.696
.358	.595	.068	.242	.667	.356	.195	.313	.396	.460	.740	.247	.341	.688
.698	.539	.874	.420	.127	.284	.448	.215	.833	.652	.601	.326	.846	.355
22		**23**		**24**		**25**		**26**		**27**		**28**	
.209	.862	.428	.117	.100	.259	.425	.284	.882	.227	.552	.077	.454	.731
.109	.843	.759	.239	.890	.317	.428	.802	.464	.658	.629	.269	.069	.998
.757	.283	.666	.491	.523	.665	.919	.146	.123	.791	.503	.447	.659	.463
.587	.908	.865	.333	.928	.404	.892	.696	.116	.120	.721	.137	.263	.176
.831	.218	.945	.364	.673	.305	.195	.887	.836	.206	.914	.574	.870	.390
29		**30**		**31**		**32**		**33**		**34**		**35**	
.716	.265	.058	.075	.636	.195	.614	.486	.629	.663	.619	.007	.296	.456
.917	.217	.220	.659	.630	.673	.665	.666	.399	.592	.441	.649	.270	.612
.994	.307	.631	.422	.804	.112	.331	.606	.551	.928	.830	.841	.602	.183
.798	.879	.432	.391	.360	.193	.181	.399	.564	.772	.890	.062	.919	.875
.104	.755	.082	.939	.183	.651	.157	.150	.800	.875	.205	.446	.648	.685

D. Calculations

1. Method A
   a. Method A Calculations

   This example uses Table 1 to calculate the sub lot tests. You are given the following:

   Expected plant production: 1,600 to 1,800 tons (1,600 to 1,800 Mg) (3 to 4 samples)

   Average load of haul vehicles: 20 tons (20 Mg)

   1) Therefore, use 25 loads [(500 tons (500 Mg) sublot size) / ((20 tons (20 Mg)/load) per truck load) = 25 loads per lot] for the sub lots.
   2) By an unbiased method, select the table and random number to start with. (For this example, we selected table 18 and number 10) Therefore use the last random number in Block 18 of Table 1 in the right column and the four successive numbers (.215, .284, .802, .146 and.696).
   3) Calculate the loads to sample asfollows:

Sample	Calculation	Load
1	25 loads x .215 = 5.4 therefore 5+0	= 5th Load
2	25 loads x .284 = 7.1 therefore 7 +25	= 32nd Load
3	25 loads x .802 = 20.1 therefore 20 +50	= 70th Load
4	25 loads x .146 = 3.7 therefore 4 +75	= 79th Load

   4) If the plant produced 92 loads for that day, take samples of the mix from loads 5, 32, 70, and 79 to represent that Lot.

   b. This example uses pill can and tokens to calculate the sub lot tests. Given the following:

   Plant production: 2,600 to 3,000 tons (2,600 to 3,000 Mg) (4 to 5 samples)

   Average load of haul vehicles: 18 tons (18 Mg)

   1) Therefore, use 27 loads [(500 tons (500Mg) sublot size) / (18 tons (18 Mg)/ per truck load) = 27 loadsper sublot] for the sub lots.
   2) Place 27 tokens numbered 1 through 27 in a container.
   3) Draw a token from the container.
   4) Record the number and return it to the container.
   5) Calculate the sub lots to be tested asfollows:

Sample	Calculation	Load
1	Token #1 drawn = 1	= 1st Load
2	Token #16 drawn = 16 + 27	= 43rd Load
3	Token #25 drawn = 25 + 27+27	= 79th Load
4	Token #16 drawn = 16 + 27+27+27	= 97th Load
5	Token #11 drawn = 11 +27+27+27+27	= 119th Load

   6) If the plant produced 130 loads for that day, take samples of the mix from loads 1, 43, 79, 97, and 119 to represent that Lot

2. Method B (Computer Generated Method)
   a. This example uses GDOT approved computer program to calculate the sub lot tests.
      1) Using a computer-based program, enter the requested pertinent data about expected production and the haul load sizes. The program will randomly select the loads per sub lot for the entire Lot.
      2) Maintain computer generated random sampling data as part of the project records.

E. Re-Evaluation

The contractor shall submit a request for re-evaluation to the Area Manager for approval. The request for re-evaluation shall be made within 5 working days of notification of the lot results. Re-evaluation of lots and acceptance will be based on evaluations performed by the Department.

1) Mixture acceptance

For all mix types other than PEM, OGFC, and Mixture paid as patching and thin lift courses < 110 lbs. /yd^2, the Department will take the same number of new tests using cores taken at randomly selected locations and will only use these cores for acceptance. The pill can, total length of lot, and table 18 above shall be used to determine locations to be cored for each sublot. For PEM, OGFC and Mixture paid as patching and thin lift courses < 110 lbs. /yd^2, the retained opposite quarter shall be used for revaluation when a re-evaluation is requested by the Contractor as described above.

Note: Traffic control will be the responsibility of the contractor. The TMOS, ATMOS, or TSS must be present during re-evaluation.

a. **Determine Coring Locations**

This example uses Table 1 to calculate the sub lot tests. You are given the following:

Total number of acceptance test: 2

Total length of lot: 8,000 ft.

Total length of a sublot: Total Length of lot divided by number of QCT Tests to be re-evaluated = Total length of sublot. Example, 8000 ft. lot / 2 samples = 4,000 ft. sublots

1) Therefore, use sublot length to determine random sample location.
2) By an unbiased method, select the table and random number to start with. (For this example, we selected table 18 and number 10) Therefore use the last random number in Block 18 of Table 1 in the right column and the successive numbers (.215, .284, .802, .146 and .696).
3) Calculate the sample location as follows:

Station Within Each Sub lot	
Sub lot 1	4000 feet x 0.215= 860 feet from start of sub lot
Sub lot 2	4000t x 0.284= 1136 feet from start of sub lot

4) To determine transverse coordinates, divide the lane into equal transverse zones.
5) If the width of lane is 12 feet you will use 1 foot per zone (12 ft./12 zones = 1 ft. per zone
6) For this example, place 12 tokens, numbered 1 through 12, in a container.
7) By an unbiased method, you select 2 numbers from the pill can to determine the transverse locations of the test sites. The numbers are 2, and 9.
8) Since the left edge of the lane looking ahead is the axis, take the readings at the following transverse locations:

Sublot	Calculation	Location	Distance from Left Edge (Longitudinal Joint)
1	Pill 2	2 ft.	#2 (pill drawn) = 2 ft. from left edge
2	Pill 9	9 ft.	#9 (pill drawn) = 9 ft. from left edge

Note: Avoid testing sites that fall on the edge of a paving lane. Testing location must be a minimum of 1 foot off pavement edge.

9) Take the core for sub lot # 1 starting at 860 ft. from the beginning of the sub lot at 2 ft. from the left edge of the lane.
10) Determine the test locations for the remaining sub lots using the same process.

F. Report

Report all results on the 159.5 report.

GDT 83

JULY 2010

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 filterring.
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 testingcores.
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 washbottles
10. Spatula
11. Glass Stirring Rod—Use for stirring (*GDOT LaboratoryOnly)*
12. Drying Pans—Use two 18 in or 16 in (450 mm or 400 mm) diameter drying pans forfilter,
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 QPLlist.

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

15. Filtering Aid—Use a diatomaceous silica filteringaid.
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 iscentered)
4. Place the funnel ring over the filter and tighten the wingnuts.
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 notBelow)***
6. For mixes with a high percentage of minus No. 200 (75 µm) material or for mixes made with local material, theamount of diatomaceous earth may be increased to improve the filtering process.
7. Stir until the filtering aid is completely insuspension.
8. Immediately pour the solution onto the filter and start the vacuumpump.
9. Leave the vacuum on until the pad formed by the filtering aidis 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 funnelring.

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 thesieve.

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 thecrust.
    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 turnmilky-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 filterpad.

3) Pour the water over the entire surface of thesieve.

4) Repeat the water washing from 3 to 5 times until the water isclear.

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 berequired.

14. Use a wash bottle with water and thoroughly rinse all aggregate particles from the sample container and spoon ontothe sieve(s).
15. Remove the 12 in (300 mm) sieve(s) containing the plus No. 200 (75 µm) material and put them aside todry.
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 funnelring.
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 theweights.
22. If you need the aggregate gradation, use GDT 38 and always use "T" for total weight of extractedaggregate.

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 vacuumextractor

   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 nearest0.01.

4. Calculate the Retention Factor **(Only ifapplicable)**

   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 themixture.

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 andweigh.

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 thoroughlycoated. 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 tomix

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.

GDT 125 – DETERMINING ASPHALT CONTENT BY IGNITION

A. Scope

This test measures the asphalt cement content of asphaltic concrete mixtures, Reclaimed Asphalt Pavement (RAP), and Reclaimed Asphalt Shingles (RAS) by burning away the asphalt binder in a high-temperature furnace. The aggregate remaining may be used for sieve analysis using AASHTO T-30 or GDT 38. The method includes the procedure for determining the calibration factor and notes on calibrating mixtures containing hydrated lime and fiberadditives.

For a complete list of GDTs, see the Table of Contents (GDT Table of Contents in The Source, online).

B. Apparatus

1. Ignition furnace

The test requires an ignition furnace designed for determining asphalt cement content. The furnace may heat the sample by convection or radiant heating. It must be equipped with an internal balance thermally isolated from the furnace chamber. The internal balance must be capable of weighing a 3500 gram sample in addition to the sample baskets, and it must be calibrated and certified as meeting the requirements of AASHTO T-308. Calibration and certification must be performed every twelve months using certified NIST-traceable weights or by an independentcalibrationservice. Additional calibrations may be required when error is suspected. Maintain records of all calibrationsandcertifications, including those for certified NIST-traceable weights, ifused.

The furnace must incorporate an internal data collection system which automatically prints and displays ignition chamber temperature, weight loss, and per cent weight loss each minute during the test. The data system shall provide for the input of the Calibration Factor and shall issue a printed record of each test, listing the initial sample weight in grams, the Calibration Factor (%), calibrated asphalt content (%), elapsed time, and chamber temperature (°C). The furnace shall be equipped with an audible alarm and indicator light which signals when the weight loss does not exceed 0.1% of the sample weight for three consecutive minutes. The sample door must be equipped with an automatic lock to prevent its being opened during the ignition test. The furnace must heat the sample sufficiently to ignite and completely vaporize the liquid asphalt, and it must be equipped with an exhaust filtration system to vaporize or remove airborne particles. The furnace must be vented to the outside via an exhaust system capable of maintaining sufficient draft to prevent the escape of smoke and strong odors into the laboratory. The exhaust must not be vented near flammable materials.

3. Sample basket assembly

A complete sample basket assembly designed for the furnace is required, consisting of two baskets with covers, a catch pan, and a retaining bracket, all made of a high-temperature alloy. The basket must enclose the sample completely with perforated sheet metal to allow air and combustion gases to flow through and around the sample with no measurable removal of dust particles. The baskets and catch pan must fit together in a stack, so that the catch pan will receive all particles that may fall from the baskets. In addition, a special lifting fork designed by the manufacturer for lifting the basket assembly must be provided.

4. Laboratory oven

Provide a laboratory oven to loosen and dry samples. It must maintain a temperature of 260° F (125°C).

5. Laboratory balance

Provide a laboratory balance with a capacity of at least 6,500 grams meeting the requirements of AASHTO M-231, Class G-2 (i.e., readability and sensitivity to 0.1 g and accuracy of 0.2 g or 0.1 percent). The balance must be calibrated and certified to meet these requirements every twelve months using certified NIST-traceable weights, if owned, or by an independent calibration service. Maintain records of all calibrations and certifications, including those for certified NIST-traceable weights, if used.

6. Safety equipment

The operator must wear high-temperature protective apparel including forearm covers, apron, gloves, and safetyglasses or face shield. Provide a heat resistant surface capable of withstanding 1200 °F (650 °C), and a protective cage to surround the sample baskets.

7. Miscellaneous equipment for gradation analysis

Provide a metal pan larger than the sample baskets for transferring samples after ignition. Provide a plastic wash bottle, trowel, spoon, spatula, bowl, quartering device, 2-inch paint brush, and a wire sievebrush.

C. Procedure

Prerequisites.

u. Use the Calibration Factor (CF) established for the mixture to be tested. (Here *mixture* means a formulation of ingredients from specific sources according to an approved mix design.) *Use the mix designer's CF when available, or as provided in E.1 below.* See E.1 for the requirements for calibrating mixtures.

v. The technician-operator must be thoroughly familiar with the operating manual provided by the manufacturer of the furnace, especially with the safety information. A copy of the manual shall be available forreference.

w. Inspect the ignition furnace for cleanliness, safety, and correct alignment of the internal balance. The ceramic tubes which support the sample platform must be centered in the holes in the bottom of the chamber. Refer to the manufacturer's instructions for cleaning and maintenance. Clean the flue filter as recommended by the manufacturer or if the lift test reading is below the limit established bythemanufacturer.

x. Ensure that the furnace is set to print out all data points; **do not use the abbreviated print-out.** Ensure that the paper tape supply is sufficient to complete thetest.

2. Preparation of samples

Obtain samples according to GSP-15. Samples may consist of loose material or cores heated and broken down. Ensure that samples are dried to a constant weight, as necessary. Take normal precautions in handling to avoid segregating the mix. Refer to the table below to determine the correct sample weight for the type of mix to be tested. Samples of loose mix must be reduced by splitting or quartering to fall within the specified range. When sampling loose mix, ensure that the weight collected will obtain a weight within the specified range after it is split or quartered. Note that the quartered or split sample must not exceed the specified size. If a sample cannot be separated with a trowel or quartering device, heat it in a laboratory oven at not more than 260 °F (125 °C) until it becomes workable. Avoid heating longer than necessary. Heat and separate roadway core samples in the same manner. Obtain core samples in sufficient numbers for the tested layer to fall within the weight range specified in the table below.

Sample Weights for Ignition Tests, ingrams

Mix Type	Minimum weight	Maximum weight
25 mm Superpave	2500	3500*
19 mm Superpave	2000	3000*
12.5 mm Superpave	1500	2500*
9.5mm Superpave	1200	2200*
4.75 mm Mix	1000	2000*
9.5 mm OGFC	1000	2000*
12.5 mm OGFC	1200	2200*
12.5 mm PEM	1200	2200*
19 mm SMA	2000	3000*
12.5 mm SMA	1500	2500*
9.5 mm SMA	1200	2200*

*Check for signs of incomplete burning when sample size approaches maximum weight.

NOTE: Steps 3 through 12 below describe how to operate a typical furnace. Ignition furnaces from different manufacturers vary in the arrangement and functions of manual controls, although the test method is essentially the same. The following instructions are written primarily for convection furnaces, which are the most common models. For models programmed to display menus and instructions, follow the programmed prompts. Refer to the manufacturer's handbook for instructions on the particular type and model to be used.

3. Temperature

   If the furnace is of the convection type, pre-heat it to the "set point" temperature of 1000 °F (538°C). (When testing an aggregate which fractures in high heat, it may be necessary to select a lower set point or temperature profile according to the manufacturer's instructions. Refer to E.4 below for requirements for the Aggregate Gradation Correction Factor.) To set, press "Temp" and enter the target temperature ("set point") of 1000 °F (538 °C). Press "Enter" and note the temperature displayed before starting the test.

4. Settings

   Ensure that the "Test Stability Threshold" setting is set to 0.1g.

   If the device features more than one automatic cutoff mode ("burn mode"), select a mode which stops the test when the incremental weight loss falls below the cutoff limit for three minutes. Do not set burn time manually for routine tests.

5. Enter Calibration Factor (CF)

   For convection furnaces, enter the CF ("% Correction"), by pressing "% Correction". The display will read "0.00". Enter the Calibration Factor for the specific mix to be tested, as determined by the procedure in section E below, and press "Enter". *To enter a negative calibration factor, press "% Correction" twice, then enter the numerals.* The Calibration Factor will be displayed with a negative sign in the window.

   Alternatively, the CF may be set to zero; this is recommended where multiple mix designs will be tested, to reduce the possibility of incorrect entries. Either value may be used for step D.2 below.

6. Weigh the basket assembly

   Weigh the empty sample baskets and catch pan on the laboratory balance with covers and retaining bracket in place and record the total weight of the assembly (tare weight) on the worksheet provided below. Note: Record all weights on the worksheet to 0.1 gram.

7. Load the sample

   Fit the lower sample basket onto the catch pan. Using a spatula or trowel, spread about half of the sample into the lower basket in an even layer, taking care to keep the material away from the sides. Fit the upper basket in place over the lower one. Spread the remainder of the sample into the upper basket in an even layer, and install the basket cover and guard.

8. Record combined and net weights

   Using the laboratory balance, measure and record the initial combined weight of the assembly and sample, to 0.1 gram. Subtract the empty weight of the assembly determined in step 6 above and record the initial net weight of the sample, **W.**

9. Enter initial sample weight in furnace

   a. Press "Weight" and key in the *net weight* **W** of the sample. (The furnace accepts only a four-digit whole number.) The "Percent Loss" window will briefly display the sample weight. Immediately press "Enter."

   b. Press "Weight" again and **verify the sample weight**. The results printed on the ticket will be calculated from this initial sample weight and the loss measured by the internal balance.

   c. Tare the internal balance by pressing the zero key.

10. Install baskets

    Using the special lifting fork, place the sample basket assembly into the ignition chamber. Important: The assembly must be placed gently on the sample platform to avoid dislodging the ceramic tubes which support the platform. Ensure that the basket assembly does not contact the sides and that the door latch is secure. The convection furnace will display the total weight of the assembly in the window marked "Balance Indicator." As a check before proceeding, confirm that this weight does not differ from the total weight recorded in step 8 by more than 5.0 grams. Failure of these weights to agree within 5.0 grams indicates a malfunction or an error in weighing, recording, or entering. In this event, re-weigh the sample on the external scale and, wearing the prescribed protective apparel, *confirm visually that the sample platform and ceramic tubes in the furnace are properly positioned and not bound by loose particles and that the assembly is not touching the walls of the chamber.*

11. Start test

Press the “Start/Stop” button. This will lock the ignition chamber door, actuate the combustion blower, and start the test. The test will continue until the weight of the sample has stabilized, during which time the apparatus will record the progressive loss of weight from the sample and the changes in chamber temperature. (Note: It is normal for the temperature to decrease below the set temperature initially and to rise well above it as the sample fully ignites.)

12. End of Test

    When the weight of the sample has stabilized, this will be indicated by a light and audible signal. Press the “Start/Stop” button again to unlock the chamber and cause the printer to print the test results. Wearing the prescribed protective apparel, use the special lifting fork to gently move the assembly to a safe location for cooling. Place the protective cage over the basket assembly during cooling.

13. Record final weight of burned sample and basketassembly

    When the sample and basket assembly have cooled to a safe temperature for handling, return them to thelaboratory balance. Record the final combined weight on the worksheet whereindicated.

14. Gradation.

    Empty all contents of the sample basket assembly into a flat pan, using a brush to dislodge any fines remaining on the baskets and catch pan. Re-weigh the sample. As a check, compare with weight obtained in step13 above, minus weight of basket assembly obtained in step 6. (Do not re-weigh the empty basket assembly.) Perform a gradation analysis according to AASHTO T-30 or GDT 38, as required. A washed gradation must be performed for every test; however, the 2.36 mm sieve and above may be omitted unless otherwise required. Record results on the worksheet below.

D. Calculation and report.

Use the worksheet below for recording and calculating all data. For acceptance and project record purposes, report resultson Form DOT 159-5 and store the worksheet and the complete print-out with the project records. The steps indicated in the worksheet follow the instructions below. Note: Users may obtain the electronic version of the worksheet from the State Asphalt Design Engineer. Alternatively, a contractor may use a modified version of the worksheet which has been approved by the State Asphalt Design Engineer. The modified version shall include all information required in the original worksheet and may include additional information useful to thecontractor.

1. Calculate the asphalt content of the sample as follows: Subtract the combined weight of sample and basket assembly after burning from the initial combined weight from step C.8. Record as "Loss, **W–W'**." Divide this by the initial net weight **W**, multiply by 100 per cent, and record as the Percent Loss. Subtract the approved CF for the mix design. Record this result on the worksheet as Calculated Asphalt Content.

   For acceptance testing: Use Calibrated Asphalt Content from printed ticket for the acceptance result. Follow Part D.2 below to compare "Calibrated Asphalt Content" from printed ticket with "Calculated Asphalt Content" from calculation above. (If no CF was entered in furnace, first apply the CF to the result on ticket.) Add completed worksheet form below and printed ticket to project records. *Worksheet must show both results.*

2. Compare Calculated Asphalt Content to result from printed ticket: In the spaces provided on the worksheet, re-enter Calculated Asphalt Content (from line 8) and the "Calibrated Asphalt Content" from the furnace's print-out. (If the CF entered in the furnace is zero, re-enter Percent Loss from line 7 step D.1.) If the difference between the two exceeds **0.15%**, a malfunction or weighing error may have occurred. Re-check the furnace and calculations and re-weigh the sample. If difference is not resolved, notify the State Asphalt Design Engineer, District TMOS and area Technical Service Engineer and record the date and time, project number, lot number, both results, and the name of the technician performing the test in the Plant Diary. The District TMOS and area Technical Service Engineer may be contacted to request assistance in resolving the discrepancy. These parties shall always be contacted for their concurrence prior to burning the opposite quarters.

3. Always attach the original printout to theworksheet.

4. Adjustment for un-calibrated mixtures containing lime: In some cases (e.g., for testing RAP) it is necessary todetermine the asphalt content of a mixture for which no CF can be determined. It has been established through field studies that mixtures containing 1% hydrated lime required an average adjustment of -0.28%. Where permitted, use this value in place of the calibration factor for mixtures known to contain 1% lime.

E. Calibration procedure

1. Requirements

   An approved CF is required for each new mix design; it shall remain in effect for the design unless, upon verification, it is found to be inaccurate by the State Bituminous Construction Engineer. A new approvedcalibration is required when

the mix design CF is found to be inaccurate or when the dosage rate of hydrated lime, cellulose fiber, or other combustible ingredient is changed. For mix designs approved prior to this requirement, an approved CF must be obtained for use in acceptance testing. Calibrations, verifications, and re-calibrations must be performed according to the procedure below, either by or under the supervision of a certified Superpave Mix Design Technician. Submit printouts and the calibration worksheet, bearing the name and certification number of the technician who performed or directly supervised the work, to the State Bituminous Construction Engineerforapproval.

A new calibration is not warranted for an adjustment in the Job Mix Formula except upon adjustment ofthe dosage rate of hydrated lime, cellulose fiber, or other combustible ingredient. However, verification of a CF may be requested if inaccuracy is suspected.

2. Preparation of samples

   Prepare three samples at the gradation and asphalt content of the mix design, using the ingredients from the sources and stockpiles from which the mix will be produced. Ensure that aggregate ingredients have been dried to a constant weight. Batch size should exceed the minimum weight in the table of Section III by not less than 300g. Mix and discard one of the three samples as a "butter mix" to prepare the mixingvessel.

   The following special requirements shall apply when calibrating mixtures containing Recycled Asphalt Pavement (RAP): Do not use the average asphalt content of the RAP stockpile for batching. Prior to batching, split a sufficient quantity of RAP using a sample splitter or quartering device, as described in AASHTO T-328. Determine the actual asphalt cement content of one portion by ignition or solvent extraction and use this value in the batching calculations. (Refer to D.4 above.) Avoid segregating the RAP in handling. If RAP constitutes more than 15 % of the mix, break it down in a screen shaker (e.g., Gilson shaker) and re-combine the sizes in the same manner as thevirginaggregate.

   The coating of asphalt cement and fines on the tools and mixing vessel should not be allowed to accumulate from sample to sample. Perform the following check after mixing the samples: Average the two net weights (**W** on line 3 of the calibration worksheet) of the calibration samples, divide by their batch weight, and subtract the result from 1. Do not use the samples if the difference exceeds0.005.

   Note: Loss of sample weight in mixing may be excessive in mixes with high film thickness, such as open-graded mixes and SMA. If this loss cannot be controlled, the calibration samples may be batched at an asphalt content 0.5% below optimum.

3. Test and calculation

   Test the mixture specimens in the ignition furnace, following the test procedure above, steps C.3 through C.13. In Step C.5 enter a calibration value of zero. Using the Calibration Worksheet below, calculate the percent weight loss of each sample based on the initial and final weighings. Record results in the columns for samples A and B. If the two samples differ in percent loss by more than 0.15 %, prepare and test two additional samples. Calculate the percent loss for each of these samples and enter results in the columns for samples C and D. Omitting the highest and lowest percent loss, subtract the as-mixed asphalt content from the two remaining. Calculate and record the algebraic average of the two results as the CF for the mix design.

4. Aggregate Gradation Correction Factor.

   When testing materials with a history of excessive breakdown during heating, determine and apply the Aggregate Gradation Correction Factor according to Sections A.2.1 through A.2.9 of AASHTO T-308. The calibration worksheet and printed tickets should be submitted with the mix design to the State Bituminous Construction Engineerforapproval.

F. Verification of CF

For quality control and acceptance testing, the accuracy of the CF must be verified at certain intervals for each mix design to be produced. Requirements for verifications are setforth in SOP2.

WORKSHEET FOR GDT-125 - ASPHALT CONTENT BYIGNITION

Test date_____ Technician preparing report:_____

Mix identification no. & source of mixture_____ Source code_____

Project no./contract id:_____ Comparison with (IA samples only) _____

A. CALCULATED ASPHALT CONTENT

Initial weight: (See C.9b)	(1) basket assembly	_____.__g
	(2) sample + basket assembly	_____.__g
	(3) initial weight of sample, (2) – (1)	_____.__g (**W**)
Weight after burn:	(4) sample + basket assembly	_____.__g
	(5)final weight of sample, (4) – (1)	_____.__g (**W'**)
Weight Loss:	(6) **W — W'** =	_____.__g
Percent Loss:	(7) **(W — W')** X 100%	_____.__%
	W	
Subtract calibration factor.		**—** .___%
(8) ASPHALT CONTENT		.___%

B. CHECK RESULTS

Record "Calibrated Asphalt Content" fromprinted ticket. _____%

Subtract Asphalt Content (8) or Percent Loss (7) if furnace CF is setto zero.. _____%

Difference _____%

If difference exceeds 0.15%, check furnace, re-weigh sample, and review test for errors. If difference is not resolved, see step D.2 of procedure. **Attach print-out to this worksheet. *Use Calibrated Asphalt Content from printed ticket for Acceptance***

C. GRADATION BY GDT 38 AND AASHTO T-11:

Sieve size, in. (mm)	Wt. retained	Cumulative wt. retained, R	Percent passing P=100%[1-R/T]	Job Mix Formula	deviation
1½ (37.5)					
1 (25)					
¾ (19)					
½ (12.5)					
3/8 (9.5)					
#4 (4.75)					
#8 (2.36)					
#16 (1.18)					
#30 (0.600 mm)					
#50 (0.300 mm)					
#100(0.150 mm)					
#200(0.075 mm)					
Pan					

Check: Percent passing #200 versus weight from pan + amount removed bywashing:

pan +loss by washing	**g**	**----------**	**%**

Notes: _____

WORKSHEET FOR GDT-125 – Determining Calibration Factor(CF)

For Mix design No._____ Optimum AC __.__% Batch weight_____.__g

Attach batch sheet from mix design. List here the percentages of lime, cellulose fiber, rubber, andother special ingredients, asapplicable: _____

	Sample A	Sample B	Sample C*	Sample D*
(1) Wt. of basket assembly				
(2) Initial wt. of basket assembly & sample				
(3) **W** = Initial net wt of sample, (2) – (1)				
(4) Wt. of sample & basket assembly after ignition				
W' = Wt of sample after ignition (4) – (1)				
Enter loss, **W – W'**, (2) – (4)				
P', Per cent loss: **P'**=[**[W – W']÷W] x 100%**				
Minus **P,** the % AC as mixed				
Difference **Δ = P' – P** (record negative sign if **P** is greater.)				

***** Samples C and D will be needed only if **P'** of A and **P'** of B differ more than 0.15%. If so, prepare and test Samples C and D. Ignore highest and lowest of the four Δ's.

Calibration factor. Average the two Δ's: _.__% **This is the CF.** (Be sure to take the *algebraic* average. For example, the algebraic average of 0.06 and - 0.10 is - 0.02.) Round to two decimal places.

Check: Compare CF to value from printed tickets.

Average "Calibrated Asphalt Content" from the twoprinted tickets. _____%

Average the two Percent Losses from table aboveand subtract. –_____%

Difference _____%

If these values differ more than 0.15%, check furnace, re-weigh sample, and review test for errors. If difference is not resolved, repeat the calibration procedure. **Attach all print-outs to thisworksheet.**

Notes

1. In mixtures containing lime, the CF for a lime mix is normally negative. Other ingredients, such as cellulose fibers and rubber, have an opposite but lesser effect.

2. The CF normally will fall between 0.10% (without lime) and – 0.38% (with lime). A CF which is outside this range or differs substantially from CF's for mixes with the same ingredient sources should be suspect. Check weights and calculations for error. If not corrected, the CF should be verified by repeating the calibration.

Date _____

Certified Mix Design Technician who performed or supervised thecalibration _____

Section 400—Hot Mix Asphaltic Concrete Construction

400.1 General Description

This work includes constructing one or more courses of bituminous plant mixture on the prepared foundation or existing roadway surface. Ensure the mixture conforms with lines, grades, thicknesses, and typical cross sections shown on the plans or established by the Engineer.

This section includes the requirements for all bituminous plant mixtures regardless of the gradation of the aggregates, type and amount of bituminous material, or pavement use.

Acceptance of work is on a lot-to-lot basis according to the requirements of this Section and Section 106.

400.1.1 Definitions

Segregated Mixture: Mixture lacking homogeneity in HMA constituents of such magnitude there is a reasonable expectation of accelerated pavement distress or performance problems. May be quantified by measurable changes in temperature, gradation, asphalt content, air voids, or surface texture.

Wearing Course: The upper course of asphaltic concrete placed on a roadway, airport or other asphalt pavement.

Surface Course: The upper course of asphaltic concrete placed on a roadway, airport or other asphalt pavement and also includes the dense-graded asphaltic concrete mixture beneath Open Graded Friction Course (OGFC) or Porous European Mixture (PEM).

Intermediate (Binder) Course: The lift(s) of asphaltic concrete above the base course and below the wearing course.

Asphaltic Concrete Base Course: The lower lift(s) of asphaltic concrete generally placed on graded aggregate base (GAB), soil cement or other stabilized base material.

New Construction: A roadway section more than 0.5 mile (800 m) long that is not longitudinally adjacent to the existing roadway. If one or more lanes are added longitudinally adjacent to the existing lane, the lane(s) shall be tested under the criteria for a resurfacing project. If work is performed on the existing roadway including leveling, grade changes, widening and/or resurfacing then that lane shall be tested under the criteria for a resurfacing project.

Trench Widening: Widening no more than 4 ft. (1.2 m) in width.

Comparison Sample: Opposite quarters of material sampled by the Contractor.

Independent Sample (Quality Assurance Sample): A sample taken by the Department to verify an acceptance decision without regard to any other sample that may also have been taken to represent the material in question.

Referee sample: A sample of the material retained during the quartering process which is used for evaluation if a comparison of Contractor and Departmental split sample test results is outside allowable tolerances.

400.1.2 Related References

A. Standard Specifications

Section 106—Control of Materials

Section 109—Measurement and Payment

Section 152—Field Laboratory Building

Section 413—Bituminous Tack Coat

Section 424—Bituminous Surface Treatment

Section 802—Aggregate for Asphaltic Concrete

Section 828—Hot Mix Asphaltic Concrete Mixtures

B. Referenced Documents

AASHTO T 324

AASHTO T 315

AASHTO T 209

AASHTO T 202

AASHTO T 49

Department of Transportation Standard Operating Procedure (SOP) 15

Department of Transportation Standard Operating Procedure (SOP) 27

Department of Transportation Standard Operating Procedure (SOP) 40

Department of Transportation Standard Operating Procedure (SOP) 46

GDT 38

GDT 39

GDT 42

GDT 59

GDT 73

GDT 78

GDT 83

GDT 119

GDT 125

GDT 126

GDT 134

GSP 15

GSP 21

QPL 1

QPL 2

QPL 7

QPL 26

QPL 30

QPL 39

QPL 41

QPL 45

QPL 65

QPL 67

QPL 70

QPL 77

QPL 88

QPL 91

QPL 92 (A, B, C)

QPL 97

400.1.3 Submittals

A. Invoices

Furnish formal written invoices from a supplier for all materials used in production of HMA when requested by the Department. Show the following on the Bill of Lading:

- Date shipped
- Quantity in tons (megagrams)
- Included with or without additives (for asphalt cement)

Purchase asphaltic cement directly from a supplier listed on Qualified Products List 7 and provide copies of Bill of Lading at the Department's request.

B. Paving Plan

Before starting asphaltic concrete construction, submit a written paving plan to the Engineer for approval. Include the following on the paving plan:

- Proposed starting date
- Location of plant(s)
- Rate of production
- Average haul distance(s)
- Number of haul trucks
- Paver speed feet (meter)/minute for each placement operation
- Mat width for each placement operation
- Number and type of rollers for each placement operation
- Sketch of the typical section showing the paving sequence for each placement operation
- Electronic controls used for each placement operation
- Temporary pavement marking plan

If staged construction is designated in the plans or contract, provide a paving plan for each construction stage.

If segregation is detected, submit a written plan of measures and actions to prevent segregation. Work will not continue until the plan is submitted to and approved by the Department.

C. Job Mix Formula

Submit to the Engineer a written job mix formula proposed for each mixture type to be used based on an approved mix design. Furnish the following information for each mix:

- Specific project for which the mixture will be used
- Source and description of the materials to be used
- Mixture I.D. Number
- Proportions of the raw materials to be combined in the paving mixture
- Single percentage of the combined mineral aggregates passing each specified sieve
- Single percentage of asphalt by weight of the total mix to be incorporated in the completed mixture
- Single temperature at which to discharge the mixture from the plant
- Theoretical specific gravity of the mixture at the designated asphalt content
- Name of the person or agency responsible for quality control of the mixture during production

Do the following to have the Job Mix Formulas approved in accordance with SOP 40 *Approval of Contractor Job Mix Formulas* and to ensure their quality:

1. Submit proposed job Mix Formulas for review at least two weeks before beginning the mixing operations.
2. Do not start hot mix asphaltic concrete work until the Engineer has approved a job mix formula for the mixture to be used. No mixture will be accepted until the Engineer has given approval.
3. Provide mix designs for all SMA, Superpave and 4.75 mm mixes to be used. The Department will provide mix design results for other mixes to be used.
4. After a job mix formula has been approved, assume responsibility for the quality control of the mixtures supplied to the Department according to Subsection 106.01, *Source of Supply and Quantity of Materials*.

D. Quality Control Program

Submit a Quality Control Plan to the Office of Materials and Testing for approval. The Quality Control Program will be included as part of the certification in the annual plant inspection report.

400.2 Materials

Ensure materials comply with the specifications listed in Table 1.

TABLE 1 — MATERIALS SPECIFICATIONS

Material	Subsection
Asphalt Cement, Grade Specified	820.2
Coarse Aggregates for Asphaltic Concrete	802.2.02
Fine Aggregates for Asphaltic Concrete	802.2.01
Mineral Filler	883.1
Heat Stable Anti-Stripping Additive	831.2.04
Hydrated Lime	882.2.03
Silicone Fluid (When approved by the Office of Materials and Testing)	831.2.05
Bituminous Tack Coat: PG 58-22, PG 64-22, PG67-22	820.2
Hot Mix Asphaltic Concrete Mixtures	828
Fiber Stabilizing Additives	819

When approved by the Office of Materials and Testing and required in the Contract, provide Uintaite material, hereafter referred to by the common trade name Gilsonite, as a reinforcing agent for bituminous mixtures. Supply a manufacturer's certification that the Gilsonite is a granular solid which meets the following requirements:

Softening Point (AASHTO: T-53)	300-350 °F (150-175 °C)
Specific Gravity, 77 °F (25 °C) (AASHTO: T-228)	1.04 ± 0.02
Flash Point, COC (AASHTO: T-48)	550 °F (290 °C) Min.
Ash Content (AASHTO: T-111)	1.0% Max.
Penetration, 77 °F (25 °C), 100 gm., 5 sec. (AASHTO: T-49)	0

400.2.01 Delivery, Storage, and Handling

Storage of material is allowed in a properly sealed and insulated system for up to 24 hours. Ensure Stone Matrix Asphalt (SMA), Open-Graded Friction Course (OGFC), or Porous European Mix (PEM) mixtures are not stored more than 12 hours. Mixtures other than SMA, OGFC, or PEM may be stored up to 72 hours in a sealed and insulated system, equipped with an auxiliary inert gas system, with the Engineer's approval. Segregation, lumpiness, drain-down, or stiffness of stored mixture is cause for rejection of the mixture. The Engineer will not approve using a storage or surge bin if the mixture segregates, loses excessive heat, or oxidizes during storage.

The Engineer may obtain mixture samples or recover asphalt cement according to GDT 119 or AASHTO T 324. AASHTO T 315, AASHTO T 202, or AASHTO T 49 will be used to perform viscosity and penetration tests to determine how much asphalt hardening has occurred. AASHTO T-324 will be used to perform Hamburg Wheel Tracking Device testing to determine rutting and moisture damage susceptibility.

A. Vehicles for Transporting and Delivering Mixtures

Ensure trucks used for hauling bituminous mixtures have tight, clean, smooth beds.

Follow these guidelines when preparing vehicles to transport bituminous mixtures:

1. Use an approved releasing agent from QPL 39 in the transporting vehicle beds, if necessary, to prevent the mixture from sticking to the bed. Ensure the releasing agent is not detrimental to the mixture. When applying the agent, drain the excess agent from the bed before loading. Remove from the project any transporting vehicles determined to contain unapproved releasing agents.
2. Protect the mixture with a waterproof cover large enough to extend over the sides and ends of the bed. Securely fasten the waterproof cover before the vehicle begins moving.
3. Insulate the front end and sides of each bed with an insulating material with the following specifications:
    - Consists of builders insulating board or equivalent;
    - Has a minimum "R" value of 4.0; and
    - Can withstand approximately 400 °F (200 °C) temperatures

    Install the insulating material so it is protected from loss and contamination. A "Heat Dump Body" may be used in lieu of insulation of the bed. "Heat Dump Body" refers to any approved transport vehicle capable of diverting engine exhaust and transmitting heat evenly throughout the dump body to keep asphalt at required temperature. Mark the "Heat Dump Body" clearly with "OPEN" and "CLOSE" position at the exhaust diverter. Install a padlock and lock it in the "OPEN" position when the "Heat Dump Body" is used to transport bituminous mixtures.
4. Mark each transporting vehicle with a clearly visible identification number.
5. Create a hole in each side of the bed so the temperature of the loaded mixture can be checked. Ensure the placement of these holes are located to assure the thermometer is being placed in the hot mix asphaltic concrete mixtures.

    Ensure the mixture is delivered to the roadway at a temperature within ± 20 °F (± 11 °C) of the temperature on the job mix formula.

    If the Engineer determines a truck may be hazardous to the project or adversely affect the quality of the work, remove the truck from the project.

B. Containers for Transporting, Conveying, and Storing Bituminous Material

To transport, convey, and store bituminous material, use containers free of foreign material and equipped with sample valves. Bituminous material will not be accepted from conveying vehicles if material has leaked or spilled from the containers.

400.3 Construction Requirements

400.3. 01 Personnel

General Provisions 101 through 150.

400.3.2 400.3.02 Equipment

Hot mix asphaltic concrete plants producing mix for Department use are governed by Quality Assurance for Hot Mix Asphaltic Concrete Plants in Georgia, Laboratory Standard Operating Procedure No. 27.

The Engineer will approve the equipment used to transport and construct hot mix asphaltic concrete. Ensure the equipment is in satisfactory mechanical condition and can function properly during production and placement operations. Place the following equipment at the plant or project site:

A. Field Laboratory

Provide a field laboratory according to Section 152.

B. Plant Equipment

1. Scales

   Provide scales as follows:

   a. Furnish (at the Contractor's expense) scales to weigh bituminous plant mixtures, regardless of the measurement method for payment.

   b. Ensure the weight measuring devices provide documentation complying with Subsection 109.01, *Measurement and Quantities*.

   c. Provide weight devices recording the mixture net weights delivered to the truck when not using platform scales. A net weight system will include, but is not limited to:

      - Hopper or batcher-type weight systems delivering asphaltic mixture directly to the truck
      - Fully automatic batching equipment with a digital recording device

   d. Use a net weight printing system only with automatic batching and mixing systems approved by the Engineer.

   e. Ensure the net weight scale mechanism or device manufacturer, installation, performance, and operation meets the requirements in Subsection 109.01, *Measurement and Quantities*

   f. Provide information on the Project tickets according to Department of Transportation SOP-15.

2. Time-Locking Devices

   Furnish batch type asphalt plants with automatic time-locking devices controlling the mixing time automatically. Construct these devices to ensure the operator cannot shorten or eliminate any portion of the mixing cycle.

3. Surge- and Storage-Systems

   Provide surge and storage bins as follows:

   a. Ensure bins for mixture storage are insulated and have a working seal, top and bottom, to prevent outside air infiltration and to maintain an inert atmosphere during storage. Bins not intended as storage bins may be used as surge bins to hold hot mixtures for part of the working day. However, empty these surge bins completely at the end of the working day.

   b. Ensure surge and storage bins can retain a predetermined minimum level of mixture in the bin when the trucks are loaded.

   c. Ensure surge and storage systems do not contribute to mix segregation, lumpiness, drain-down, or stiffness.

   d. Ensure the scale mechanism or device manufacture, installation, performance, and operation meets the requirements in Subsection 109.01 *Measurement and Quantities*.

4. Controls for Dust Collector Fines

   Control dust collection as follows:

   a. When collecting airborne aggregate particles and returning them to the mixture, have the return system meter all or part of the collected dust uniformly into the aggregate mixture and waste the excess. The collected dust percentage returned to the mixture is subject to the Engineer's approval.

   b. When the collected dust is returned directly to the hot aggregate flow, interlock the dust feeder with the hot aggregate flow, and meter the flow to maintain a constant, proportioned and uniform flow.

5. Mineral Filler Supply System

   When mineral filler is required as a mixture ingredient:

   a. Use a separate bin and feed system to store and proportion the required quantity into the mixture with uniform distribution.

   b. Control the feeder system with a proportioning device meeting these specifications:

      - Is accurate to within ± 10 percent of the filler required
      - Has a convenient and accurate means of calibration
      - Interlocks with the aggregate feed or weigh system to maintain the correct proportions for all rates of production and batch sizes

   c. Provide flow indicators or sensing devices for the mineral filler system and interlock them with the plant controls to interrupt the mixture production if mineral filler introduction fails to meet the required target value after no longer than 60 seconds.

   d. Add mineral filler to the mixture as follows, according to the plant type:

      - Batch Type Asphalt Plant: add mineral filler to the mixture in the weigh hopper.
      - Continuous Plant Using Pugmill Mixers: feed the mineral filler into the hot aggregate before it is introduced into the mixer to ensure dry mixing is accomplished before the bituminous material is added.
      - Continuous Plants Using the Drier-Drum Mixers: add the mineral filler to ensure dry mixing is accomplished before the bituminous material is added and ensure the filler does not become entrained into the air stream of the drier.

6. Hydrated Lime Treatment System

   When hydrated lime is required as a mixture ingredient:

   a. Use a separate bin and feed system to store and proportion the required quantity into the mixture.

   b. Ensure the aggregate is uniformly coated with hydrated lime aggregate before adding the bituminous material to the mixture. Ensure the addition of hydrated lime will not become entrained in the exhaust system of the drier or plant.

   c. Control the feeder system with a proportioning device meeting these specifications:

      - Is accurate to within ± 10 percent of the amount required
      - Has a convenient and accurate means of calibration
      - Interlocks with the aggregate feed or weigh system to maintain the correct proportions for all rates of production and batch sizes and to ensure mixture produced is properly treated with lime

   d. Provide flow indicators or sensing devices for the hydrated lime system and interlock them with the plant controls to interrupt mixture production if hydrated lime introduction fails to meet the required target value after no longer than 60 seconds.

7. Net Weight Weighing Mechanisms

   Certify the accuracy of the net weight weighing mechanisms by an approved registered scale serviceperson at least once every 6 months. Check the accuracy of net weight weighing mechanisms at the beginning of Project production and thereafter as directed by the Engineer. Check mechanism accuracy asfollows:

   a. Weigh a load on a set of certified commercial truck scales. Ensure the difference between the printed total net weight and weight obtained from the commercial scales is no greater than 4 lbs./1,000 lbs. (4 kg/Mg) of load.

      Check the accuracy of the bitumen scales asfollows:

      - Use standard test weights.
      - If the checks indicate printed weights are out of tolerance, have a registered scale serviceperson check the batch scales and certify the accuracy of theprinter.
      - While the printer system is out of tolerance and before its adjustment, continue production only if using a set of certified truck scales to determine the truck weights.

   b. Ensure plants using batch scales maintain ten 50 lb. (25 kg) standard test weights at the plant site to check batching scale accuracy.

   c. Ensure plant scales are used only to proportion mixture ingredients, and not to determine that pay quantities, are within two percent throughout the range.

8. Fiber Supply System

   When stabilizing fiber is required as a mixture ingredient:

   a. Use a separate feed system to store and proportion by weight the required quantity into the mixture with uniform distribution.

   b. Control the feeder system with a proportioning device meeting these specifications:

      - Is accurate to within ± 10 percent of the amount required. Automatically adjusts the feed rate to maintain the material within this tolerance at alltimes.
      - Has a convenient and accurate means ofcalibration.
      - Provide in-process monitoring, consisting of either a digital display of output or a printout of feed rate, in pounds (kg) per minute, to verify feedrate.
      - Interlocks with the aggregate feed or weigh system to maintain the correct proportions forall rates of production and batch sizes.

   c. Provide flow indicators or sensing devices for the fiber system and interlock them with the plant controls to interrupt the mixture production if fiber introduction fails or if the output rate is not within thetolerances given above.

   d. Introduce the fiber as follows:

      - When a batch type plant is used, add the fiber to the aggregate in the weigh hopper. Increasethe batch dry mixing time by 8 to 12 seconds from the time the aggregate is completely emptied into the mixer to ensure the fibers are uniformly distributed prior to the injection of asphalt cement into the mixer.
      - When a continuous or drier-drum type plant is used, add the fiber to the aggregate and uniformly disperse prior to the injection of asphalt cement. Ensure the fibers will not become entrained in the exhaust system of the drier or plant.

9. Crumb Rubber Modifier Supply System

When specified, crumb rubber modifier may be substituted at the Contractor's discretion to produce a PG 76-22 asphaltic cement at the production facility in accordance with Section 820:

a. Use a separate feed system to store and proportion by weight of the total asphaltic cement, the required percentage of crumb rubber into the mixture.

b. Control the feeder system with a proportioning device meeting these specifications:

- Is accurate to within ± 6 percent of the amount required. Automatically adjusts the feed rate to maintain the material within this tolerance at all times.
- Has a convenient and accurate means of calibration.
- Provide in-process monitoring, consisting of either a digital display of output or a printout of feed rate, in pounds per minute, to verify feed rate. Ensure the supply system reports the feed in 1 lb. (454 gr.) increments using load cells enabling the user to monitor the depletion of the modifier. Monitoring the system volumetrically will not be allowed.
- Interlocks with the aggregate weigh system and asphaltic cement pump to maintain the correct proportions for all rates of production and batch sizes.

c. Provide flow indicators or sensing devices for the system and interlock them with the plant controls to interrupt the mixture production if the crumb rubber introduction output rate is not within the ± 6 percent tolerance given above. This interlock will immediately notify the operator if the targeted rate exceeds introduction tolerances. All plant production will cease if the introduction rate is not brought back within tolerance after 30 seconds. When the interlock system interrupts production and the plant has to be restarted, upon restarting operations; ensure the modifier system runs until a uniform feed can be observed on the output display. Ensure all mix produced prior to obtaining a uniform feed is rejected.

d. Introduce the crumb rubber modifier as follows:

- When a batch type plant is used, add the rubber to the aggregate in the weigh hopper. Increase the batch dry mixing time by 15 to 20 seconds from the time the aggregate is completely emptied into the mixer to ensure the modifiers are uniformly distributed prior to the injection of asphalt cement into the mixer. Increase the batch wet mix time by 15 to 20 seconds to ensure the crumb rubber modifier is uniformly blended with the asphaltic cement.
- When a continuous or drier-drum type plant is used, add the rubber to the aggregate and uniformly disperse prior to the injection of asphalt cement. The point of introduction in the drum mixer will be approved by the Engineer prior to production. Ensure the crumb rubber modifier will not become entrained in the exhaust system of the drier or plant and will not be exposed to the drier flame at any point after induction.

e. No separate measurement and payment will be made if Contractor elects to utilize crumb rubber.

10. Fiber-Reinforcement Supply System

When reinforcement fiber is specified in the contract as a mixture ingredient:

Ensure, that the reinforcement fiber is an approved material and listed on QPL 97" Georgia's List of Approved Reinforcement Fiber". Use a separate Fiber Meetering Device feed system to proportion by weight of the total asphaltic cement, the required percentage of fiber-reinforcement into themixture.

a. Control the meetering system with a proportioning device meeting these specifications:
   - Is accurate to within ± 6 percent of the amount required. Automatically adjusts the feed rate to maintain the material within this tolerance at alltimes.
   - Has a convenient and accurate means ofcalibration.
   - Provides in-process monitoring, consisting of either a digital display of output or a printout of feed rate, in pounds, or (kg) per minute, to verify feedrate
   - Interlocks with the aggregate feed or weigh system to maintain the correct proportions forall rates of production and batch sizes.

b. Provide flow indicators or sensing devices for the fiber system and interlock them with the plant controls to interrupt the mixture production if fiber introduction fails or if the output rate is not within the tolerances given above.

c. Introduce the fiber as follows:
   - When a batch type plant is used, add the fiber dossage to the aggregate in the weigh hopper. This may be done with loose fibers and a Fiber Meetering Device or may be done by using pre-measured packages that are specifically designed to disintegrate within the mixing cycle. Increase the batch dry mixing time by 8 to 12 seconds from the time the aggregate iscompletely emptied into the mixer to ensure the fibers are uniformly distributed prior to the injection of asphalt cement into the mixer.
   - When a continuous or drier-drum type plant is used, add the fiber to the aggregate or RAP material at the beginning of the mixing cycle and uniformly disperse prior to the injection of asphalt cement. The final configuration of the fibers at the point when mixing begins, should closely resemble the fibers as they are packaged. Pre-distributing the fibers into their individual form should be avoided. Ensure the fibers will not become entrained in the exhaust system of the drier or plant. The producer should inspect their plant for any protrusions that may accumulate fibers and create the potential for fiberclumps.
   - When a continuous or drier-drum type plant is used for limited production volumes, the addition of the fibers may be done by using pre-measured packages that are specifically designed to disintegrate within the mixing cycle and adding them directly into the RAP port of the plant. Because this is not an automated process, a written protocol must be supplied by the producer to demonstrate how they will attain the dossage requirement, and documentation must be supplied by the material manufacturer assuring this method will produce the desired random fiber distribution.

C. Equipment at Project Site

1. Cleaning Equipment

   Provide sufficient hand tools and power equipment to clean the roadway surface before placing the bituminous tack coat. Use power equipment complying with Subsection 424.3.02.F, *Power Broom and Power Blower*.

2. Pressure Distributor

   To apply the bituminous tack coat, use a pressure distributor complying with Subsection 424.3.02.B, *Pressure Distributor*.

3. Bituminous Pavers

   To place hot mix asphaltic concrete, use bituminous pavers that can spread and finish courses that are:

   - As wide and deep as indicated on the plans
   - True to line, grade, and cross section
   - Smooth
   - Uniform in density and texture

   a. Continuous Line and Grade Reference Control. Furnish, place, and maintain the supports, wires, devices, and materials required to provide continuous line and grade reference control to the automatic paver control system.

   b. Automatic Screed Control System. Equip the bituminous pavers with an automatic screed control system actuated from sensor-directed mechanisms or devices that will maintain the paver screed at a pre-determined transverse slope and elevation to obtain the required surface.

   c. Transverse Slope Controller. Use a transverse slope controller capable of maintaining the screed at the desired slope within ± 0.1 percent. Do not use continuous paving set-ups resulting in unbalanced screed widths or off-center breaks in the main screed cross section unless approved by the Engineer.

   d. Screed Control. Equip the paver to permit the following four modes of screed control. Ensure the method used is approved by the Engineer.

      - Automatic grade sensing and slope control
      - Automatic dual grade sensing
      - Combination automatic and manual control
      - Total manual control

      Ensure the controls are referenced with a taut string or wire set to grade, or with a ski-type device or mobile reference at least 30 ft. (9 m) long when using a conventional ski. Approved non-contacting laser or sonar-type skis listed on QPL 91 “Georgia’s List of Approved Non-contacting Laser and Sonar-type Electronic Grade and Slope Controls” may be used in lieu of conventional 30 ft. (9 m) skis. Under limited conditions, a short ski or shoe may be substituted for a long ski on the second paver operating in tandem, or when the reference plane is a newly placed adjacent lane.

      Automatic screed control is required on all projects; however, when the Engineer determines that project conditions prohibit the use of such controls, the Engineer may waive the grade control, or slope control requirements, or both.

   e. Paver Screed Extension. When the laydown width requires a paver screed extension, use bolt-on screed extensions to extend the screeds, or use an approved mechanical screed extension device. When the screed is extended, add auger extensions to assure a length of no more than 18 in. (0.5 m) from the auger to the end gate of the paver. Auger extensions may be omitted when paving variable widths. Ensure the paver is equipped with tunnel extensions when the screed and augers are extended.

NOTE: Do not use extendible strike-off devices instead of approved screed extensions. Only use a strike-off device in areas that would normally be luted in by handlabor.

4. Compaction Equipment

   Ensure that the compaction equipment is in good mechanical condition and can compact the mixture tothe required density. The compaction equipment number, type, size, operation, and condition is subject to the Engineer's approval

5. Materials Transfer Vehicle (MTV)

   a. Use a Materials Transfer Vehicle (MTV) when placing asphaltic concrete mixtures on projects on the state route system with the following conditions. If a project fails to meet any one of the following conditions, the MTV's use is not required other than during the placement of SMA, PEM and OGFC mixtures. MTVs are required during the placement of SMA, PEM and OGFC mixtures regardless of ADT, project length and mixture tonnage unless waived at the discretion of the Office of Materials and Testing.

      1) When to use:

         - The two-way ADT is equal to or greater than 6000
         - The project length is equal to or greater than 3000 linear feet (915 linear meters)
         - The total tonnage (megagrams) of all asphaltic concrete mixtures is greater than 2000tons (1815 Mg)

      2) Where to use:

         - Mainline of the traveled way
         - Collector/distributor (C/D) lanes on Interstates and limited access roadways
         - Leveling courses at the Engineer's discretion

      3) Do not use the MTV for the following conditions:

         - A resurfacing project that only 9.5 mm mix isrequired.
         - A project with lane width that is equal or less than 11 ft. (3.4m).
         - A passing lane only project.
         - When noted on the plans.

   b. Ensure the MTV and conventional paving equipment meet the followingrequirements:

      1) MTV

         - Has a truck unloading system which receives mixture from the hauling equipment and independently deliver mixtures from the hauling equipment to the paving equipment.
         - Has mixture remixing capability approved by the Office of Materials and Testing and is listed on QPL 88 "Georgia's List of Approved Materials TransferVehicles".
         - Provides to the paver a homogeneous, non-segregated mixture of uniform temperature with no more than 20 °F (11 °C) difference between the highest and lowest temperatures when measured transversely across the width of the mat in a straight line at a distance of one foot to twenty-five feet (0.3 m to 7.6 m) from the screed while the paver is operating. Ensure that the MTV is capable of providing the paver a consistent material flow that is sufficient to prevent the paver from stopping between truck exchanges.

      2) Conventional Paving Equipment

         - Has a paver hopper insert with a minimum capacity of 14 tons (13 Mg) installed in the hopper of conventional paving equipment when an MTV is used.

c. If the MTV malfunctions during spreading operations, discontinue placement of hot mix asphaltic concrete after there is sufficient mix placed to maintain traffic in a safe manner. However, placement of hot mix asphaltic concrete in a lift not exceeding 2 in. (50 mm) may continue until any additional hot mix in transit at the time of the malfunction has been placed. Cease spreading operations thereafter until the MTV is operational.

d. Ensure the MTV is empty when crossing a bridge and is moved across without any other Contractor vehicles or equipment on the bridge. Move the MTV across a bridge in a travel lane and not on the shoulder. Ensure the speed of the MTV is no greater than 5 mph (8 kph) without any acceleration or deceleration while crossing a bridge.

400.3.3 Preparation

A. Prepare Existing Surface

Prepare the existing surface as follows:

1. Clean the Existing Surface. Before applying hot mix asphaltic concrete pavement, clean the existing surface to the Engineer's satisfaction.
2. Patch and Repair Minor Defects

   Before placing leveling course:

   a. Correct potholes and broken areas requiring patching in the existing surface and base as directed by the Engineer.

   b. Cut out, trim to vertical sides, and remove loose material from the areas to be patched.

   c. Prime or tack coat the area after being cleaned. Compact patches to the Engineer's satisfaction. Material for patches does not require a job mix formula but must meet the gradation range shown in Section 828. The Engineer must approve the asphalt content to be used.
3. Apply Bituminous Tack Coat

   Apply the tack coat according to Section 413. The Engineer will determine the application rate, which must be within the limitations in Tables 2A and 2B.

TABLE 2A—APPLICATION RATES FOR BITUMINOUS TACK, GAL/YD²(L/M²)

Tack Uses	Minimum	Maximum
Under OGFC and PEM Mixes	0.06 (0.27)	0.08 (0.36)
All Other Mixes	0.04 (0.18)	0.06 (0.27)
Non-tracking Hot Applied Polymer Modified Tack (NTHAPT) (Note 2)	0.06 (0.27)	0.18 (0.81)
Note 1: On thin leveling courses and freshly placed asphaltic concrete mixes, reduce the application rate to 0.02 to 0.04 gal/yd² (0.09 to 0.18 L/m²). **Note 2: Use higher application rate (0.12 to 0.18) within the minimum and maximum range under OGFC and PEM Mixes**		

TABLE 2B – APPLICATION RATES FOR ANIONIC EMULSIFIED ASPHALT OR CATIONIC EMULSIFIED ASPHALT BITUMINUS TACK, GAL/YD²(L/M²)

Tack Uses	Minimum	Maximum
New Asphaltic Concrete Pavement to New Asphaltic Concrete Pavement or Thin Lift Leveling	0.05 (0.23)	0.08 (0.36)
New Asphaltic Concrete Pavement (≤ 25% RAP) to Aged Existing Pavement or Milled Surface	0.06 (0.27)	0.10 (0.45)
New Asphaltic Concrete Pavement (> 25% RAP) to Aged Existing Pavement or Milled Surface	0.08 (0.36)	0.12 (0.54)
Non-tracking Emulsified Asphalt	0.07 (0.32)	0.12 (0.54)
CQS-Special Modified Asphalt Emulsion (Note 1)	0.12 (0.54)	0.28 (1.27)

- Allow standard anionic emulsified asphalt or cationic emulsified asphalt to break per emulsion manufacturer's recommendation. Proceed with paving only after the anionic emulsified asphalt or cationic emulsified asphalt has cured to the satisfaction of the Engineer.
- Do not use anionic emulsified asphalt or cationic emulsified asphalt, other than CQS-Special Modified Asphalt Emulsion in conjunction with a spray paver, under OGFC or PEM on interstates or limited access state routes.

Note 1: Use higher application rate (0.22 to 0.28) within the minimum and maximum under OGFC and PEM Mixes

B. Place Patching and Leveling Course

1. When the existing surface is irregular, bring the surface area to the proper cross section and grade with a leveling course of hot mix asphaltic concrete materials.
2. Place leveling at the locations and in the amounts directed by the Engineer.
3. Use leveling course mixtures meeting the requirements of the job mix formulas defined in:
   - Subsection 400.3.05.A, *Observe Composition of Mixtures*
   - Section 828
   - Leveling acceptance schedules in Subsection 400.3.06.A, *Acceptance Plans for Gradation and Asphalt Cement Content*
4. If the leveling and patching mix type is undesignated, determine the mix type by the thickness or spread rate according to Table 3, but do not use 4.75 mm mix on interstate projects.
5. If patching is required to correct mat deficiencies in the final surface layer, ensure patches extend full lane width and no less than the length of the affected area as determined by the Engineer.

TABLE 3—LEVELING AND PATCHING MIX TYPES

Thickness	Rate of Spread	Type of Mix
Up to 0.75 in. (19 mm)	Up to 85 lbs./yd² (46 kg/m²)	4.75 mm Mix or 9.5 mm Superpave Type 1
0.75 to 1.5 in. (19 to 38 mm)	85 to 165 lbs./yd²(46 to 90 kg/m²)	9.5 mm Superpave Type 2
1.5 to 2 in. (38 to 50 mm)	165 to 220 lbs./yd² (90 to 120 kg/m²)	12.5 mm Superpave *
2 to 3 in. (50 to 75 mm)	220 to 330 lbs./yd² (120 to 180 kg/m²)	19 mm Superpave **
Over 2.5 in. (64 mm)	Over 275 lbs./yd² (180 kg/m²)	25 mm Superpave

* This mixture may be used for isolated patches no more than 6 in. (150 mm) deep and no more than 4 ft. (1.2 m) in diameter or length.

** This mixture may be used for patching no more than 4 in. (100 mm) deep in limited confined deep mill and patching locations.

400.3.4 tion

General Provisions 101 through 150.

400.3.5 Construction

Provide the Engineer at least one day's notice prior to beginning construction, or prior to resuming productionif operations have been temporarily suspended.

A. Observe Composition of Mixtures

1. Calibration of plant equipment

   If the material changes, or if a component affecting the ingredient proportions hasbeen repaired, replaced, or adjusted, check and recalibrate the proportions.

   Calibrate as follows:

   a. Before producing mixture for the Project, calibrate by scale weight the electronic sensors or settings for proportioning mixture ingredients.

   b. Calibrate ingredient proportioning for all rates ofproduction.

2. Mixture control

   Compose hot mix asphaltic concrete from a uniform mixture of aggregates, bituminous material, and if required, hydrated lime, mineral filler, or other approved additive.

   Ensure the constituents proportional to produce mixtures meeting the requirements in Section 828. The general composition limits prescribed are extreme ranges within which the job mix formula must be established. Base mixtures on a design analysis that meets the requirements of Section 828.

   Ensure the field performance of the in-place mixtures meet the requirements of Subsection 828.2B for Permeability, Moisture Susceptibility, Rutting Susceptibility and Fatigue. In-place mix may be evaluated for compliance with Subsection 828.2.B at the discretion of the State Bituminous Construction Engineer under the following conditions:

   - Deviates greater than 10 percent on gradation for mixture control sieves from the approved Job Mix Formula based on Acceptance or Independent Samples.
   - Deviates greater than 0.7 percent in asphalt cement content from the approved Job Mix Formula based on Acceptance or Independent Samples.
   - The calculated mean pavement air voids result in an adjusted pay factor less than 0.80 or any single sub lot result in mean pavement air voids exceeding 10.5 percent.
   - Mix produced not using an approved mix design and/or job mix formula.

   Remove and replace any material determined to not meet the requirements established in Section 828.2.B at the Contractor's expense.

   If control test results show the characteristic tested does not conform to the job mix formula control tolerances given in Section 828, take immediate action to ensure that the quality control methods are effective.

   Control the materials to ensure extreme variations do not occur. Maintain the gradation within the composition limits in Section 828.

B. Prepare Bituminous Material

Uniformly heat the bituminous material to the temperature specified in the job mix formula with a tolerance of ± 20 °F (± 11 °C).

C. Prepare the Aggregate

Prepare the aggregate as follows:

1. Heat the aggregate for the mixture and ensure a mix temperature within the limits of the job mix formula.
2. Do not contaminate the aggregate with fuel during heating.
3. Reduce the absorbed moisture in the aggregate until the asphalt does not separate from the aggregate in the prepared mixture. If this problem occurs, the Engineer will establish a maximum limit for moisture content in the aggregates. When this limit is established, maintain the moisture content below this limit.

D. Prepare the Mixture

Proportion the mixture ingredients as necessary to meet the required job mix formula. Mix until a homogenous mixture is produced.

1. Add Mineral Filler

   When mineral filler is used, introduce it in the proper proportions and as specified in Subsection 400.3.02.B.5, *Mineral Filler Supply System*.

2. Add Hydrated Lime

   When hydrated lime is included in the mixture, add it at a rate specified in Section 828 and the job mix formula. Use methods and equipment for adding hydrated lime according to Subsection 400.3.02.B.6, *Hydrated Lime Treatment System*.

   Add hydrated lime to the aggregate by using Method A or B as follows:

   Method A—Dry Form—Add hydrated lime in its dry form to the mixture as follows, according to the type of plant:

   a. Batch Type Asphalt Plant: Add hydrated lime to the mixture in the weigh hopper or as approved and directed by the Engineer.

   b. Continuous Plant Using Pugmill Mixer: Feed hydrated lime into the hot aggregate before it is introduced into the mixer to ensure dry mixing is complete before the bituminous material isadded.

   Method B—Lime/Water Slurry—Add the required quantity of hydrated lime (based on dry weight) in lime/water slurry form to the aggregate. This solution consists of lime and water in concentrations as directed by the Engineer.

   Equip the plant to blend and maintain the hydrated lime in suspension and to mix the hydrated lime with the aggregates uniformly in the proportionsspecified.

   c. Continuous Plant Using Drier-Drum Mixer: Add hydrated lime so to ensure the lime will not become entrained into the air stream of the drier and to ensure thorough dry mixing will be complete before the bituminous material is added.

3. Add Stabilizing Fiber

   When stabilizing fiber is included in the mixture, add stabilizing fiber at a rate specified in Section 819 and the Job Mix Formula. Introduce it as specified in Subsection 400.3.02.B.8, *Fiber Supply System*.

4. Add Gilsonite Modifier

   When approved by the Office of Materials and Testing and required by the Contract, add the Gilsonite modifier to the mixture at a rate to ensure eight percent by weight of the asphalt cement is replaced by Gilsonite. Use either PG 64-22 or PG 67-22 asphalt cement as specified in Subsection 820.2.01. Provide suitable means to calibrate and check the rate of Gilsonite being added. Introduce Gilsonite modifier by either of the following methods.

   a. For batch type plants, incorporate Gilsonite into the pugmill at the beginning of the dry mixing cycle. Increase the dry mix cycle by a minimum of 10 seconds after the Gilsonite is added and prior to introduction of the asphalt cement. For this method, supply Gilsonite in plastic bags to protect the material during shipment and handling and store the modifier in a waterproof environment. Ensure the bags are capable of being completely melted and uniformly blended into the combined mixture.

      Gilsonite may also be added through a mineral filler supply system as described in Subsection 400.3.02.B.5, *Mineral Filler Supply System*. Ensure the system iscapable of injecting the modifier into the weigh hopper near the center of the aggregate batching cycle so the material can be accurately weighed.

   b. For drier-drum plants, add Gilsonite through the recycle ring or through an acceptable means which will introduce the Gilsonite prior to the asphalt cement injection point. The modifier must proportionately feed into the drum mixer at the required rate by a proportioning device which shall be accurate within $\pm$ 10 percent of the amount required. Ensure the entry point is away from flames and the Gilsonite will not be caught up in the air stream and exhaust system.

5. Materials from Different Sources

   Do not use mixtures prepared from aggregates from different sources intermittently. This will cause thecolor of the finished pavement to vary.

E. Observe Weather Limitations

Do not mix and place asphaltic concrete if the existing surface is wet or frozen. Do not lay asphaltic concrete OGFC mix or PEM at air temperatures below 60 °F (16 °C). When using a MTV, OGFC mix or PEM may beplaced at 55 °F (13 °C) when approved by the Engineer. For other courses, follow the temperature guidelines in the following table:

TABLE 4—LIFT THICKNESS TABLE

Lift Thickness	Minimum Temperature
1 in. (25 mm) or less	55 °F (13 °C)
1.1 to 2 in. (26 mm to 50 mm)	45 °F (8 °C)
2.1 to 3 in. (51 mm to 75 mm)	40 °F (4 °C)
3.1 to 4 in. (76 mm to 100 mm)	35 °F (2 °C)
4.1 to 8 in. (101 mm to 200 mm)	32 °F (0 °C) and rising. Base material must not be frozen.

F. Perform Spreading and Finishing

Spread and finish the course as follows:
Determine the maximum compacted layer thickness by the type mix being used according to Table5.

TABLE 5—MIX TYPE MINIMUM, MAXIMUM LAYER AND TOTALTHICKNESS

Mix Type	Minimum Layer Thickness	Maximum Layer Thickness	Maximum Total Thickness
25 mm Superpave	2 1/2 in. (64 mm)	5 in. (125 mm) *	—
19 mm Superpave	1 3/4 in. (44 mm)	3 in. (75 mm) *	—
12.5 mm Superpave	1 3/8 in. (35 mm)	2 1/2 in. (64 mm)**/***	8 in. (200 mm)
9.5 mm Superpave Type 2	1 1/8 in. (29 mm)	1 1/2 in. (38 mm)***	4 in. (100 mm)
9.5 mm Superpave Type 1	7/8 in. (22 mm)	1 1/4 in. (32 mm)	4 in. (100 mm)
4.75 mm Mix	3/4 in. (19 mm)	1 1/8 in. (29 mm)	2 in. (50 mm)
9.5 mm OGFC	75 lbs./yd² (41 kg/m²)	95 lbs./yd² (51 kg/m²)	—
12.5 mm OGFC	85 lbs./yd² (46 kg/m²)	110 lbs./yd² (60 kg/m²)	—
12.5 mm PEM	110 lbs./yd² (60 kg/m²)	165 lbs./yd² (90 kg/m²)	—
9.5 mm SMA	1 1/8 in. (29 mm)	1 1/2 in. (38 mm)	4 in. (100 mm)
12.5 mm SMA	1 3/8 in. (35 mm)	3 in. (75 mm)	6 in. (150 mm)
19 mm SMA	1 3/4 in. (44 mm)	3 in. (75 mm)	—
* Allow up to 6 in. (150 mm) per lift on trench widening. **Allow up to 4 in. (100 mm) per lift on trench widening of ≤ 2 ft. when no overlay is required. ***Place 9.5 mm Superpave and 12.5 mm Superpave up to 4 in. (100 mm) thick for driveway and side road transition.			

1. Unload the mixture into the paver hopper or into a device designed to receive the mixture from delivery vehicles.
2. Except for leveling courses, spread the mixture to the loose depth for the compacted thickness or the spread rate. Use a mechanical spreader true to the line, grade, and cross section specified.
3. For leveling courses, use a motor grader equipped with a spreader box and smooth tires to spread the material or use a mechanical spreader meeting the requirements in Subsection 400.3.02.C, *Equipment at Project Site*.
4. Obtain the Engineer's approval for the sequence of paving operations, including paving the adjoining lanes. Minimize tracking tack onto surrounding surfaces.
5. Ensure the outside edges of the pavement being laid are aligned and parallel to the roadway centerline.
6. For New Construction or Resurfacing Contracts containing multiple lifts or courses, arrange the width of the individual lifts so the longitudinal joints of each successive lift are offset from the previous lift at least 1 ft. (300 mm). This requirement does not apply to the lift immediately over thin lift leveling courses.
7. Ensure the longitudinal joint(s) in the surface course and the mix immediately underneath asphaltic concrete OGFC or PEM are at the lane line(s).

NOTE: Perform night work with artificial light provided by the Contractor and approved by the Engineer.

8. Where mechanical equipment cannot be used, spread and rake the mixture by hand. Obtain the Engineer's approval of the operation sequence, including compactive methods, in these areas.
9. Keep small hand raking tools clean and free from asphalt build up. Do not use fuel oil or other harmful solvents to clean tools during the work.
10. Do not use mixture with any of these characteristics:
    - Segregated
    - Nonconforming temperature
    - Deficient or excessive asphalt cement content
    - Otherwise unsuitable to place on the roadway in the work
11. Remove and replace mixture placed on the roadway that the Engineer determines has unacceptable blemish levels from segregation, raveling, streaking, pulling and tearing, or other deficient characteristics. Replace with acceptable mixture at the Contractor's expense. Do not continually place mixtures with deficiencies.

    Do not place subsequent course lifts over another lift or course while the temperature of the previously placed mix is 140 °F (60 °C) or greater.
12. Obtain the Engineer's approval of the material compaction equipment. Perform the rolling as follows:
    a. Begin the rolling as close behind the spreader as possible without causing excessive distortion of the asphaltic concrete surface.
    b. Continue rolling until roller marks are no longer visible.
    c. Use pneumatic-tired rollers with breakdown rollers on all courses except asphaltic concrete OGFC, PEM and SMA or other mixes designated by the Engineer.
13. If applicable, taper or "feather" asphaltic concrete from full depth to a depth no greater than 0.5 in. (13 mm) along curbs, gutters, raised pavement edges, and areas where drainage characteristics of the road must be retained. The Engineer will determine the location and extent of tapering.

G. Maintain Continuity of Operations

Coordinate plant production, transportation, and paving operations to maintain a continuous operation. If the spreading operations are interrupted, construct a transverse joint if the mixture immediately behind the paver screed cools to less than 250 ºF (120 ºC).

H. Construct the Joints

1. Construct Transverse Joints

   a. Construct transverse joints to facilitate full depth exposure of the course before resuming placement of the affected course.

   b. Properly clean and tack the vertical face of the transverse joint before placing additional material.

NOTE: Never burn or heat the joint by applying fuel oil or other volatile materials.

   c. Straightedge transverse joints immediately after forming the joint.

   d. Immediately correct any irregularity that exceeds 3/16 in. in 10 ft. (5 mm in 3 m).

2. Construct Longitudinal Joints

   Clean and tack the vertical face of the longitudinal joint before placing adjoining material.Construct longitudinal joints so that the joint is smooth, well-sealed, and bonded.

3. Construction Joint Detail for OGFC and PEM Mixtures

   In addition to meeting joint requirements described above, construct joints and transition areas for 12.5 mm OGFC and 12.5 mm PEM mixtures as follows:

   a. For projects which do not have milling included as a pay item:

      1) Place OGFC mixture meeting gradation requirements of 9.5 mm OGFC as specified in Section 828 on entrance and exit ramp gore areas and end of project construction joints.

         - Taper mixture from 3/8 in. (10 mm) at end of project to full plan depth within maximum distance of spread for one load of mixture.
         - Taper mixture placed on gore areas from thickness of the edge of the mainline to 3/8 in. (10 mm) at the point of the ramp transverse joint.

      2) Construct the ramp transverse joint at the point specified in the plans or as directed by the Engineer.

      3) Mixture placed in the transition and gore areas will be paid for at the contract unit price for 12.5 mm OGFC or 12.5 mm PEM, as applicable.

   b. For projects which have milling included as a pay item:

      1) Taper milling for a distance of no less than 50 ft. (15 m) to a depth of 2 1/4 in. (59 mm) at the point of the transverse joint.

      2) Taper thickness, if needed, of the dense-graded surface mix within the 50 ft. (15 m) distance to 1 1/2 in. (40 mm) at the point of the transverse joint.

      3) Taper thickness of the 12.5 mm OGFC or 12.5 mm PEM to 3/4 in. (19 mm) to ensure the materialties in at grade level with the existing surface at the point of the transverse joint

I. Protect the Pavement

Protect sections of the newly finished pavement from traffic until the traffic will not mar the surface or alter the surface texture. If directed by the Engineer, use artificial methods to cool the newly finished pavement to open the pavement to traffic more quickly.

J. Modify the Job Mix Formula

If the Engineer determines that undesirable mixture or mat characteristics are being obtained, the job mix formula may require immediate adjustment.

400.3.6 Quality Acceptance

A. Acceptance Plans for Gradation and Asphalt Cement Content

The Contractor will randomly sample and test mixtures for acceptance on a lot basis. The Department will monitor the Contractor testing program and perform comparison and quality assurance testing. The Contractor's Quality Control Technicians shall participate in the Department's Independent Assurance Systems Basis Program.

1. Determine Lot Amount

   A lot consists of the tons (megagrams) of asphaltic concrete produced and placed each production day. If this production is less than 500 tons (500 Mg), or its square yard (meter) equivalent, production may be incorporated into the next working day. The Engineer may terminate a lot when a pay adjustment is imminent if a plant or materials adjustment resulting in a probable correction has been made. Terminate all open lots at the end of the month, except for materials produced and placed during the adjustment period. The lot will be terminated as described in Subsection 400.5.01,*Adjustments*.

   If the final day's production does not constitute a lot, the production may be included in the lot for the previous day's run; or, the Engineer may treat the production as a separate lot with a corresponding lower number of tests.

2. Determine Lot Acceptance

   Determine lot acceptance as found in Subsection 400.5.01, *Adjustments*.

   The Department will perform the following task:

   Determine the pay factor by using the mean of the deviations from the job mix formula of the tests in each lot and apply it to Table 10 Mixture Acceptance Schedule for Surface Mixes or Table 11 Mixture Acceptance Schedule for Subsurface Mixes, whichever is appropriate. This mean will be determined by averaging the actual numeric value of the individual deviations from the job mix formula, disregarding whether the deviations are positive or negative amounts. Do not calculate lot acceptance using test results for materials not used in the Work. Determine the pay factor for each lot by multiplying the contract unit price by the appropriate pay factor from the Mixture Acceptance Schedule - Table 10 or Table 11. When two or more pay factors for a specific lot are less than 1.0, determine the adjusted payment by multiplying the contract unit price by the lowest pay factor.

   If the mean of the deviations from the job mix formula of the lot acceptance tests for a control sieve or for asphalt cement content exceeds the tolerances established in the appropriate Mixture Acceptance Schedule, and if the Engineer determines that the material need not be removed and replaced, the lot may be accepted at an adjusted unit price as determined by the Engineer. If the Engineer determines that the material is not acceptable to leave in place, the materials shall be removed and replaced at the Contractor's expense.

3. Provide Quality Control Program

   Provide a Quality Control Program as established in SOP 27 which includes:

   - Assignment of quality control responsibilities to specifically named individuals who have been certified by the Office of Materials and Testing
   - Provisions for prompt implementation of control and corrective measures
   - Provisions for communication with Project Manager, Bituminous Technical Services Engineer, and Testing Management Operations Supervisor at all times
   - Provisions for reporting all test results daily through the Office of Materials and Testing computerized Field Data Collection System, AASHTO Trns*port SiteManager, or approved computerized application; other checks, calibrations and records will be reported on a form developed by the Contractor and will be included as part of the project records
   - Notification in writing of any change in quality control personnel

a. Certification Requirements:

- Use laboratory and testing equipment certified by the Department. (Laboratories which participate in and maintain AASHTO accreditation for testing asphaltic concrete mixtures will be acceptable in lieu of Departmental certification.)
- Provide certified quality control personnel to perform the sampling and testing. A Quality Control Technician (QCT) may be certified at three levels:

1) Temporary Certification – must be a technician trainee who shall be given direct oversight by a certified Level 1 or Level 2 QCT while performing acceptance testing duties during the first 5 days of training. The trainee must complete qualification requirements within 30 Georgia Department of Transportation funded production days after being granted temporary certification. A trainee who does not become qualified within 30 Georgia Department of Transportation funded production days will not be re-eligible for temporary certification. A certified Level 1 or Level 2 QCT shall be at the plant at all times during production and shipment of mixture to monitor work of the temporarily certified technician.

2) Level 1 – must demonstrate they are competent in performing the process control and acceptance tests and procedures related to hot mix asphalt production and successfully pass a written exam.

3) Level 2 – must meet Level 1 requirements and must be capable of and responsible for making process control adjustments, and successfully pass a written exam.

- Technician certification is valid for 3 years from the date on the technician's certificate unless revoked or suspended. Eligible technicians may become certified through special training and testing approved by the Office of Materials and Testing. Technicians who lose their certification due to falsification of test data will not be eligible for recertification in the future unless approved by the State Materials and Testing Engineer.

b. Quality Control Management

1) Designate at least one Level 2 QCT as manager of the quality control operation. Ensure the Quality Control Manager meets the following requirements:

- Be accountable for actions of other QCT personnel.
- Ensure all applicable sampling requirements and frequencies, test procedures, and Standard Operating Procedures are followed.
- Ensure all reports, charts, and other documentation are completed as required

2) Provide QCT personnel at the plant as follows:

- If daily production for all mix types is to be greater than 250 tons (megagrams), have a QCT person at the plant at all times during production and shipment of mixture until all required acceptance tests have been completed.
- If daily production for all mix types will not be greater than 250 tons (megagrams), a QCT may be responsible for conducting tests at up to two plants, subject to random number sample selection.
- Have available at the plant, or within immediate contact by phone or radio, a Level 2 QCT responsible for making prompt process control adjustments as necessary to correct the mix.

3) Sampling, Testing, and Inspection Requirements.

a. Provide all sample containers, extractants, forms, diaries, and other supplies subject to approval of the Engineer.

b. Perform daily sampling, testing, and inspection of mixture production that meetthe following requirements:

1) Randomly sample mixtures according to GSP 15 and GDT 73 (Method C) and test on a lot basis. In the event less than the specified number of samples are taken, obtain representative 6 in. (150 mm) cores from the roadway at a location where the load not sampled was placed. Take enough cores to ensure minimum sample size requirements are met for each sample needed.

2) Maintain a printed copy of the computer-generated random sampling data as a part of the project records.

3) Perform sampling, testing, and inspection duties of GSP 21.

4) Perform extraction or ignition test (GDT 83 or GDT 125) and extraction analysis (GDT 38). If the ignition oven is used, a printout of sample data including weights becomes a part of the project records. For asphalt cement content only, digital printouts of liquid asphalt cement weights maybe substituted in lieu of an extraction test for plants with digital recorders. Calculate the asphalt content from the ticket representing the mixture tested forgradation.

5) Save extracted aggregate, opposite quarters, and remaining material (for possible referee testing) of each sample as follows:

- Store in properly labeled, suitable containers.
- Secure in a protected environment.
- Store for three working days. If not obtained by the Department within three days, they may be discarded in accordance with GSP 21.

6) Add the following information on load tickets from which a sample or temperature check istaken:

- Mixture temperature
- Signature of the QCT person performing thetesting

7) Calibrate the lime system when hydrated lime is included in the mixture:

- Perform a minimum of twice weekly during production
- Post results at the plant for review.
- Provide records of materials invoices upon request (including asphalt cement, aggregate, hydrated lime, etc.).

8) Take action if acceptance test results are outside Mixture Control Tolerances of Section 828.

- One sample out of tolerance
  a. Contact Level 2 - QCT to determine if a plant adjustment is needed.
  b. Immediately run a process control sample. Make immediate plant adjustments if this sample is also out of tolerance.
  c. Test additional process control samples as needed to ensure corrective action taken appropriately controls the mixture.
- Two consecutive acceptance samples of the same mix type out of tolerance regardless of Lot or mix design level, or three consecutive acceptance samples out of tolerance regardless of mix type.
  a. Stop plant production immediately.
  b. Reject any mixture in storage:
     - Deviating more than 10 percent in gradation from the job mix formula based on the acceptance sample.
     - Deviating more than 0.7 percent in asphalt content from the job mix formula based on the acceptance sample.
  c. Make a plant correction to any mix type out of tolerance prior to resuming production.
     - Do not send any mixture to the project before test results of a process control sample meets Mixture Control Tolerances.
     - Reject any mixture produced at initial restarting that does not meet Mixture Control Tolerances.

NOTE: Determine mixture temperature at least once per hour of production for OGFC and PEM mixes.

4) Comparison Testing and Quality Assurance Program

a. Periodic comparison testing by the Department will be required of each QCT to monitor consistency of equipment and test procedures. The Department will take independent samples to monitor the Contractor's quality control program.

1) Comparison Sampling and Testing

Retain samples for comparison testing and referee testing if needed as described in Subsection 400.3.06.A.3.b.3. Discard these samples only if the Contractor's acceptance test results meet a 1.00 pay factor and the Department does not procure the samples within three working days.

The Department will test comparison samples on a random basis. Results will be compared to the respective contractor acceptance tests, and the maximum difference is as follows:

TABLE 6—ALLOWABLE PERCENT DIFFERENCE BETWEEN DEPARTMENT AND CONTRACTOR ACCEPTANCE TESTS

Sieve Size	Surface	Sub-surface
1/2 in. (12.5 mm)		4.0%
3/8 in. (9.5 mm)	3.5%	4.0%
No. 4 (4.75 mm)	3.5%	3.5%
No. 8 (2.36 mm)	2.5%	3.0%
No. 200 (75 μm)	2.0%	2.0%
A.C.	0.4%	0.5%

1) If test comparisons are within these tolerances:
   - Continue production
   - Use the Contractor's tests for acceptance of the lot
2) If test comparisons are not within these tolerances:
   - Another Departmental technician will test the corresponding referee sample.
   - Results of the referee sample will be compared to the respective contractor and Departmental tests using the tolerance for comparison samples given above.
     a. If referee test results are within the above tolerances when compared to the Contractor acceptance test, use the Contractor's test for acceptance of the effected lot.
     b. If referee test results are not within the above tolerances when compared to the Contractor acceptance test, the Department will review the Contractor's quality control methods and determine if a thorough investigation is needed.

b. Independent Verification Sampling and Testing

1) Randomly take a minimum of two independent samples from the lesser of five days or five lots of production regardless of mix type or number of projects.

2) Compare test deviation from job mix formula to Mixture Control Tolerances in Section 828. If results are outside these tolerances, another sample from the respective mix may be taken.

If test results of the additional sample are not within Mixture Control Tolerances, the Department will take the following action:

- Take random samples from throughout the subject lot(s) as established in Subsection 400.3.06.A.3.b.3 and use these test results for acceptance and in calculations for the monthly plant rating. Applicable pay factors will apply and the contractor QCT test results will not be included in pay factor calculations nor in the monthly plant rating.
- Determine if the Contractor's quality control program is satisfactory and require prompt corrective action by the Contractor if specification requirements are not being met.
- Determine if the QCT has not followed Departmental procedures or has provided erroneous information.
- Take samples of any in-place mixture represented by unacceptable QCT tests and use the additional sample results for acceptance and in calculations for the monthly plant rating and apply applicable pay factors. The Contractor QCT tests will not be included in the pay factor calculations nor in the monthly plant rating.

NOTE: For leveling or dense graded surface courses less than 110 lb./yd² (60 kg/m²) having quality assurance test results outside the Mixture Control Tolerances of Section 828, use the Department's test results only and applicable pay factors will apply.

B. Compaction

Determine the mixture compaction using either GDT 39, GDT 59, or AASHTO T 331. The method of GDT 39 for "Uncoated Specimens, Dense Graded Mixtures Only" shall not apply when the water absorption of a sample exceeds 2.0 percent, as measured according to AASHTO T 166. In this case, either AASHTO T 331 or the paraffin method of GDT 39 shall apply. The compaction is accepted in lots defined in Subsection 400.3.06. A, *Acceptance Plans for Gradation and Asphalt Cement Content* and is within the same lot boundaries as the mixture acceptance.

1. Calculate Pavement Mean Air Voids

The Department is responsible for pavement mean air void acceptance testing. The Contractor is responsible for establishing all roller patterns and any quality control testing. Upon written request by the Contractor, the Office of Materials and Testing will provide nuclear gauge testing assistance for compaction related issues.

The Department will calculate the pavement air voids placed within each lot as follows:

a. One test per sub-lot.

- Lots > 400 ton (400 Mg) of mix are divided into 5 sub-lots of equal distance.
- Lots ≤ 400 tons (400 Mg) of mix are divided into a sub-lot or sub-lots of equal distance at a rate of one per 100 tons (100 Mg) mix each (Example: 299 tons of mix require 3 sublots and 301 tons of mix require 4 sublots). There will be less than 5 sub-lots.

b. Average the results of all tests run on randomly selected sites in that lot.

c. Select representative sites randomly using GDT 73.

Density tests are not required for asphaltic concrete placed at 90 lbs./yd2 (50 kg/m2) or less, 4.75 mm mix, asphaltic concrete OGFC, PEM, and mixes placed as variable depth or width leveling. Compact these courses to the Engineer's satisfaction. Density tests will not be performed on turn-outs and driveways.

The targeted maximum Pavement Mean Air Void content for all Superpave and Stone Matrix Asphalt mixtures is 5.0 percent. Ensure that the maximum Pavement Mean Air Voids for all Superpave and Stone Matrix Asphalt mixtures does not exceed 7.0 percent. The maximum Pavement Mean Air Voids for 2 ft. shoulder widening is 9.0 percent. The adjustment period for density is four lots or four production days, whichever is less, in order for the contractor to ensure maximum compactive effort has been achieved, which will yield no more than the specified maximum allowed Mean Air Voids. One additional lot or production day of adjustment may be given for a reduction in asphalt cement content on the JMF made by the Office of Materials and Testing for mix designs incorporating the Corrected Optimum Asphalt Content COAC.

If the contractor needs to adjust the mixture to improve density results, a change in the job mix formula may be requested for approval during the adjustment period so long as the following values are not exceeded:

- Coarse pay sieve ± 4%
- No. 8 (2.36 mm) sieve ± 2%
- No. 200 (75 μm) sieve ± 1%
- Asphalt Content ± 0.2%
- All value changes must still be within specification limits.

If the Office of Materials and Testing is satisfied that the contractor has exerted the maximum compactive effort and is not able to maintain Pavement Mean Air Voids at no more than 7.0%, the Engineer may establish a maximum target for Pavement Mean Air Voids.

Ensure mixture placed during the adjustment period for density meets the requirements for a 0.90 pay factor in Table 13 of Subsection 400.5.01.C, *Calculate Mean Pavement Air Voids*. Mixture not meeting these density requirements is paid for using the applicable pay factor.

If the mean air voids of the pavement placed within a lot exceeds 100% of the maximum target air voids, if established, and the Engineer determines that the material need not be removed and replaced, the lot may be accepted at an adjusted unit price as determined by the Engineer.

2. Obtain Uniform Compaction

For a lot to receive a pay factor of 1.00 for compaction acceptance, the air void range cannot exceed 5 percent for new construction or resurfacing projects. The range is the difference between the highest and lowest acceptance test results within the affected lot. If the air void range exceeds these tolerances, apply a Pay Factor of 95%.

The 5% reduced pay factor for the compaction range does not apply in these instances:

- The mixture is placed during the adjustment period as defined in Subsection 400.5.01.A, *Materials Produced and Placed During the Adjustment Period*.
- All air void results within a given lot are less than 7.0%.
- A lot containing two sublot or less.
- On two foot trench widening.
- For sub-surfaces mixes including 19 mm and 25 mm Superpave mixes if all air void results within a given lot are >2.5 % <8 %.

When lots are reevaluated for range penalty, as shown in Subsection 106.03, *Samples, Tests, Cited Specifications*, sampling and testing is according to GDT 73. Request for reevaluation must be made within 5 working days of notification of the lot results. The following procedures apply:

The Department will reevaluate the lot through additional testing by obtaining and testing three additional cores acquired in representative sites selected randomly throughout each sub-lot representing the high and low in-place air voids as detailed in GDT 73. The additional six cores (three cores from each sub-lot will be averaged) will replace the original five core results for range specified requirements only. The original five cores' results will be reported for Pavement Mean Air Voids for the lot. This will be the final evaluation for compaction range for the lot. Lots will not be re-evaluated for range when the Pavement Mean Air Voids result in a lower than 95% pay factor. Ensure requests for reevaluation are made within 5 working days of notification of the lot results.

The Department will determine the payment for each lot by multiplying the Contract Unit Price by the adjusted pay factor shown in the Table 7 Average Air Voids Range Acceptance Schedule:

TABLE 7—AVERAGE AIR VOIDS RANGE FOR ACCEPTANCE SCHEDULE

Pay Factor	Range between High and Low Air Void Original 5 cores	Re-evaluated Range between High and Low Air Void Cores 6 New Cores obtained from High (3 cores) and Low location (3 cores)
100	≤ 5 %	≤ 4.50 %
0.95	> 5 %	> 4.50 %

C. Surface Tolerance

In this specification, pavement courses to be overlaid with an OGFC or PEM are considered surface courses. All OGFC or PEM are to be evaluated after the roadway has been opened to traffic for a minimum of 5 days and a maximum of 15 days. Asphaltic Concrete paving is subject to straightedge and visual inspection and irregularity correction as shown below:

1. Visual and Straightedge Inspection

   Paving is subject to visual and straightedge inspection during and after construction operations until Final Acceptance. Locate surface irregularities as follows:

   a. Keep a 10 ft. (3 m) straightedge near the paving operation to measure surface irregularities on courses. Provide the straightedge and the labor for its use.

   b. Inspect the base, intermediate, and surface course surfaces with the straightedge to detect irregularities.

   c. Correct irregularities that exceed 3/16 in. in 10 ft. (5 mm in 3 m) for base and intermediate courses and surface courses.

   Mixture or operating techniques will be stopped if irregularities such as rippling, tearing, or pulling occur and the Engineer suspects a continuing equipment problem. Stop the paving operation and correct the problem. Correct surface course evaluations on individual Laser Road Profiler test sections, normally 1 mile (1 km) long.

2. Target Surface Profile Smoothness

   The Department will use the Laser Road Profiler method to conduct acceptance testing for surface course tolerance according to GDT 126. This testing will be performed only on:

   - Surface courses on Projects with mainline traveled way measuring a minimum distance of 1 mile (1600 m)
   - Ramps more than 0.5 mile (800 m) long

   Combine partial sections measuring less than 0.5 mile (800 m) with the previous full mile for acceptance.

Achieve the smoothest possible ride during construction. Do not exceed the target Laser RoadProfiler smoothness index as shown below:

TABLE 8—PAVEMENT SMOOTHNESS TARGETREQUIREMENTS

Construction Description	Smoothness Index
All Asphaltic Concrete OGFC and PEM on interstate including resurfacing and new construction. Asphaltic Concrete OGFC and PEM placed on state routes as new construction.	750
Asphaltic Concrete SMA or dense-graded surface mixtures placed directly beneath the Asphaltic Concrete OGFC or PEM on interstates. Asphaltic Concrete OGFC and PEM placed on state routes as resurfacing. All new construction on state routes with exception of OGFC and PEM as stated above.	825
All other resurfacing on state routes (excluding LARP, PR, airports, etc.)	900
All Urban new construction and resurfacing on state routes within curb andgutter sections located in posted 40 miles per hour (MPH) or less speedzones.	1175

If the target values are not achieved, immediately adjust the operations to meet the target values. Placement operations may be suspended until a remedial plan to comply with target smoothness requirements is submitted and approved by the Engineer if adjustments do not satisfy target smoothness values.

TABLE 9—PAVEMENT SMOOTHNESS CORRECTIVE WORKREQUIREMENT

Construction Description	Smoothness Index
All Asphaltic Concrete OGFC and PEM placed on interstate including resurfacing and new construction. Asphaltic Concrete OGFC and PEM placed on state routes as new construction.	825
Asphaltic Concrete SMA or dense-graded surface mixtures placed directly beneath the Asphaltic Concrete OGFC or PEM on interstates. Asphaltic Concrete OGFC and PEM placed on state routes as resurfacing. All new construction on state routes with exception of OGFC and PEM as stated above.	900
All other resurfacing on state routes (excluding LARP, PR, airports, etc.)	1025
All Urban new construction and resurfacing on state routes within curb andgutter sections located in posted 40 miles per hour (MPH) or less speedzones.	1250

If surface tolerance deficiencies need correction, obtain the Engineer's approval of the methods and type mix used.

3. Bridge Approach Profile Smoothness Quality

The following are subject to a ride quality test of roadway approaching each end of a bridge using the Laser Road Profiler, Rainhart Profiler or Lightweight Profiler:

- A state route with 4 lanes or more
- A 2-lane state route with a current traffic count two-way ADT 2,000 vpd or more
- Locations designated on the plans

All other bridge approaches not meeting the above criteria shall meet the 3/16 in. in 10 ft. (5 mm in 3 m) straightedge requirement. When the distance between the ends of two bridges, the end of a bridge and an intersection, or the end of a bridge and a vertical or horizontal curve is less than 540 ft. (165 m) and locations where the testing vehicle cannot maintain minimum testing speed while taking profile measurements will not be tested and will be subject to straightedge requirements.

The bridge approaches will meet the straightedge requirements.

Test ride quality as follows:

For Resurfacing Projects:

a. The Department will determine a profile smoothness index value using the laser road profiler in accordance with test method GDT 126.

b. The Department will determine the Half Car Simulation (HCS) IRI for each HMA asphalt 1/10th of mile (0.16 km) segments adjacent to each approach slab joint for each lane. The HCS IRI will be reported in 1/20th of mile (0.08 km) segment readings that will be averaged to calculate the final 1/10-mile section, in accordance with GDT 126.

   - Correct individual bumps or depression exceeding 3/16 in. in 10 ft. (3 mm in 3 m) straightedge requirement as directed by the Engineer.
   - Ensure the profile smoothness index shows an improvement over pre-construction profile smoothness or meets a profile smoothness index of ≤ 1025 mm/km (66 inches/mile) for the average 1/10 mile (0.16 km).

c. Ensure Resurfacing projects meet the profile smoothnessindex improvement requirement for the specified 1/10th mile (0.16 km) segment of roadway up to the bridge approach/exit slab joint.

   In accordance with Section 106.3.A.3, the Contractor may request reevaluation(s) for Laser Road Profiler Test results on Resurfacing Bridge Projects and straightedge measurement(s) on either that fail to meet specified requirements. Request for reevaluation shall be made to the Engineer within 5 working days of notification of failing results. At the Engineer's approval, reevaluation of failing results using the Lightweight Profiler Test, Laser Road Profiler Test and straightedge measurement(s) shall be conducted in conjunction with representatives from the Office of Materials and Testing in accordance with GDT 126 or GDT 134, whichever is applicable. The Department will perform ride quality testing up to two times on the bridge approaches/exits at no cost to the Contractor. For these reevaluations, evaluation of the bridge exit end may be taken testing towards the bridge against traffic if the contractor provides traffic control, at the contractors' expense, upon request.

For All New Construction Projects:

a. The Department will determine a profile index value according to test method GDT 78 or GDT 134.

b. The Department will average the profile index value from the right and left wheelpath for each 100 ft. (30 m) section for each lane.

   - Keep the profile index value under 30 in/mile (475 mm/km), correct individual bumps or depressions exceeding 0.2 in. (5 mm) from blanking band on the profilograph trace.

c. Ensure New Construction projects meet the profile index value for the specified 100 ft. (30 m) section of roadway up to the bridge joint.

d. Schedule the ride quality testing on All New Construction projects 5 days before needed by contacting the Office of Materials and Testing. Clean and clear obstructions from the test area.

Correct the sections that do not meet the ride quality criteria of this specification. After correction, these sections are subject to retesting with the Lightweight Profiler. The Engineer direct the type of correction method, which may include:

- Milling
- Grinding
- Removing and replacing the roadway

No additional compensation will be made.

In accordance with Section 106.3.A.3, the Contractor may request reevaluation(s) for Lightweight Profiler Test results on newly construction bridge projects, Laser Road Profiler Test results on resurfacing bridge projects and straightedge measurement(s) on either that fail to meet specified requirements. Request for reevaluation shall be made to the Engineer within 5 working days of notification of failing results. At the Engineer's approval, reevaluation of failing results using the Lightweight Profiler Test, Laser Road Profiler Test and straightedge measurement(s) shall be conducted by representatives from the Office of Materials and Testing in accordance with GDT 134.

The Department will perform ride quality testing up to two times on the bridge approaches at no cost to the Contractor. Additional testing will be charged to the Contractor in accordance with Section 500.5.01.B.

4. Surface Smoothness Acceptance

When recommended by the Office of Materials and Testing, a pay reduction may be accepted in lieu of correction for roadways and bridge approaches that fail to achieve specified smoothness indexes in accordance with SOP 46 "Procedure for Calculating Pay Reduction for Failing Roadway and Bridge Approach Smoothness" Roadway and Bridge Approach Smoothness. The Office of Materials and Testing may recommend a waiver of profile smoothness requirements when improvement over pre-construction smoothness profile exceeds 25 percent for urban roadways, as defined in Table 9.

D. Reevaluation of Lots

When lots are reevaluated as shown in Subsection 106.03, *Samples, Tests, Cited Specifications*, sampling and testing is according to GDT 73. Ensure request for reevaluation are made within 5 working days of notification of the lot results. The following proceduresapply:

1. For asphaltic concrete mixtures other than OGFC and PEM mix types, thin lift courses < 110 lbs./yd^2 and mixture paid for as patching, the Department will take the same number of new tests using cores taken at randomly selected locations in accordance GDT 73. The Department will use only these test results for gradation and AC content obtained using these cores for acceptance. For OGFC and PEM mix types, thin lift courses < 110 lbs./yd^2 and mixture paid for as patching, the retained opposite quarter shall be used for mixture acceptance reevaluation when requested by the Contractor. The Department will use the absolute average deviations from the job mix formula for these tests to determine acceptance based on the appropriate column in the Asphalt Cement Content and Aggregate Gradation of Asphalt Concrete Mixture Acceptance Schedule—Table 10 or 11.
2. Compaction Acceptance

The Department will reevaluate the lot through additional testing by cutting the same number of cores originally obtained and averaging these results with the results from the original density tests. The Department will use the average to determine acceptance according to the Compaction Acceptance Schedule in Subsection 400.5.01.C, *Calculate Pavement Mean Air Voids*.

TABLE 10—MIXTURE ACCEPTANCE SCHEDULE—SURFACE MIXES

Mixture Characteristics	Pay Factor	Mean of the Deviations from the Job Mix Formula							
		1 Test	2 Tests	3 Tests	4 Tests	5 Tests	6 Tests	7 Tests	8 Tests
Asphalt Cement Content (Extraction, Ignition)	1.00	0.00 - 0.70	0.00 - 0.54	0.00 - 0.46	0.00 - 0.41	0.00 - 0.38	0.00 - 0.35	0.00 - 0.32	0.00 - 0.30
	0.95	0.71 - 0.80	0.55 - 0.61	0.47 - 0.52	0.42 - 0.46	0.39 - 0.43	0.36 - 0.39	0.33 - 0.36	0.31 - 0.34
	0.90	0.81 - 0.90	0.62 - 0.68	0.53 - 0.58	0.47 - 0.51	0.44 - 0.47	0.40 - 0.45	0.37 - 0.40	0.35 - 0.37
	0.80	0.91 - 1.00	0.69 - 0.75	0.59 - 0.64	0.52 - 0.56	0.48 - 0.52	0.44 - 0.47	0.41 - 0.44	0.38 - 0.41
	0.70	1.01 - 1.19	0.76 - 0.82	0.65 - 0.69	0.57 - 0.61	0.53 - 0.56	0.48 - 0.51	0.45 - 0.47	0.42 - 0.44
	0.50	1.20 - 1.40	0.83 - 0.85	0.70 - 0.72	0.62 - 0.64	0.57 - 0.59	0.52 - 0.55	0.48 - 0.51	0.45 - 0.48
3/8 in. (9.5 mm) Sieve (12.5 mm OGFC, 12.5 mm PEM, 12.5 mm Superpave)	1.00	0.00 – 9.0	0.00 - 6.6	0.00 - 5.6	0.00 - 5.0	0.00 - 4.6	0.00 - 4.2	0.00 - 3.9	0.00 - 3.6
	0.98	9.1 - 10.0	6.7 - 7.5	5.7 - 6.3	5.1 - 5.6	4.7 - 5.2	4.3 - 4.7	4.0 - 4.4	3.7 - 4.1
	0.95	10.1 - 11.9	7.6 - 8.4	6.4 - 7.0	5.7 - 6.3	5.3 - 5.8	4.8 - 5.3	4.5 - 5.0	4.2 - 4.6
	0.90	12.0 - 13.0	8.5 - 9.3	7.1 - 7.7	6.4 - 6.9	5.9 - 6.3	5.4 - 5.8	5.1 - 5.4	4.7 - 5.0
	0.85	13.1 - 14.0	9.4 - 10.2	7.8 - 8.6	7.0 - 7.6	6.4 - 6.9	5.9 - 6.3	5.5 - 5.9	5.1 - 5.5
	0.80	14.1 - 14.5	10.3 - 10.5	8.7 - 8.9	7.7 - 8.0	7.0 - 7.5	6.4 - 6.8	6.0 - 6.4	5.6 - 6.0
3/8 in. (9.5 mm) Sieve (12.5 mm SMA)	1.00	0.0 - 6.8	0.00 - 5.0	0.00 - 4.2	0.00 - 3.8	0.00 - 3.4	0.00 - 3.2	0.00 - 2.9	0.00 - 2.7
	0.98	6.9 - 7.5	5.1 - 5.6	4.3 - 4.7	3.9 - 4.2	3.5 - 3.9	3.3 - 3.5	3.0 - 3.3	2.8 - 3.1
	0.95	7.6 - 8.9	5.7 - 6.3	4.8 - 5.2	4.3 - 4.7	4.0 - 4.4	3.6 - 4.0	3.4 - 3.8	3.2 - 3.4
	0.90	9.0 - 9.8	6.4 - 7.0	5.3 - 5.8	4.8 - 5.2	4.5 - 4.8	4.1 - 4.4	3.9 - 4.1	3.5 - 3.8
	0.85	9.9 - 10.5	7.1 - 7.6	5.9 - 6.4	5.3 - 5.7	4.9 - 5.2	4.5 - 4.7	4.2 - 4.4	3.9 - 4.1
	0.80	10.6 - 10.9	7.7 - 7.9	6.5 - 6.7	5.8 - 6.0	5.3 - 5.6	4.8 - 5.1	4.5 - 4.8	4.2 - 4.5
No. 4 (4.75 mm) Sieve (9.5 mm OGFC, 9.5 mm Superpave)	1.00	0.00 - 9.0	0.00 - 6.7	0.00 - 5.7	0.00 - 5.2	0.00 - 4.8	0.00 - 4.4	0.00 - 4.1	0.00 - 3.8
	0.98	9.1 - 10.0	6.8 - 7.6	5.8 - 6.3	5.3 - 5.8	4.9 - 5.4	4.5 - 4.9	4.2 - 4.6	3.9 - 4.3
	0.95	10.1 - 11.9	7.7 - 8.5	6.4 - 6.9	5.9 - 6.4	5.5 - 5.9	5.0 - 5.4	4.7 - 5.0	4.4 - 4.7
	0.90	12.0 - 13.0	8.6 - 9.4	7.0 - 7.5	6.5 - 7.0	6.0 - 6.5	5.5 - 5.9	5.1 - 5.5	4.8 - 5.1

Mixture Characteristics	Pay Factor	Mean of the Deviations from the Job Mix Formula							
		1 Test	2 Tests	3 Tests	4 Tests	5 Tests	6 Tests	7 Tests	8 Tests
	0.85	13.1 - 14.0	9.5 - 10.2	7.6 - 8.0	7.1 - 7.6	6.6 - 7.0	6.0 - 6.4	5.6 - 5.9	5.2 - 5.5
	0.80	14.1 - 14.5	10.3 - 10.5	8.1 - 8.3	7.7 - 8.0	7.1 - 7.5	6.5 - 6.9	6.0 - 6.4	5.6 - 5.9
No. 4 (4.75 mm) Sieve (9.5 mm SMA)	1.00	0.00 - 6.8	0.00 - 5.0	0.00 - 4.3	0.00 - 3.9	0.00 - 3.6	0.00 - 3.3	0.00 - 3.1	0.00 - 2.8
	0.98	6.9 - 7.5	5.1 - 5.7	4.4 - 4.7	4.0 - 4.4	3.7 - 4.0	3.4 - 3.7	3.2 - 3.4	2.9 - 3.2
	0.95	7.6 - 8.9	5.8 - 6.4	4.8 - 5.2	4.5 - 4.8	4.1 - 4.4	3.8 - 4.0	3.5 - 3.8	3.3 - 3.5
	0.90	9.0 - 9.8	6.5 - 7.0	5.3 - 5.6	4.9 - 5.2	4.5 - 4.9	4.1 - 4.4	3.9 - 4.1	3.6 - 3.8
	0.85	9.9 - 10.5	7.1 - 7.7	5.7 - 6.0	5.3 - 5.7	5.0 - 5.2	4.3 - 4.8	4.2 - 4.4	3.9 - 4.1
	0.80	10.6 - 10.9	7.8 - 7.9	6.1 - 6.2	5.8 - 6.0	5.3 - 5.6	4.9 - 5.2	4.5 - 4.8	4.2 - 4.4
No. 8 (2.36 mm) Sieve (OGFC, PEM, Superpave and 4.75 mm mixes)	1.00	0.00 - 7.0	0.00 - 5.6	0.00 - 4.8	0.00 - 4.3	0.00 - 4.0	0.00 - 3.6	0.00 - 3.4	0.00 - 3.2
	0.98	7.1 - 8.0	5.7 - 6.3	4.9 - 5.4	4.4 - 4.8	4.1 - 4.5	3.7 - 4.1	3.5 - 3.8	3.3 - 3.6
	0.95	8.1 - 9.0	6.4 - 7.0	5.5 - 6.0	4.9 - 5.3	4.6 - 4.9	4.2 - 4.5	3.9 - 4.2	3.7 - 3.9
	0.90	9.1 - 10.9	7.1 - 7.7	6.1 - 6.6	5.4 - 5.8	5.0 - 5.4	4.6 - 4.9	4.3 - 4.6	4.0 - 4.3
	0.85	11.0 - 12.0	7.8 - 8.5	6.7 - 7.2	5.9 - 6.4	5.5 - 5.8	5.0 - 5.3	4.7 - 5.0	4.4 - 4.6
	0.75	12.1 - 12.5	8.6 - 8.8	7.3 - 7.5	6.5 - 6.8	5.9 - 6.3	5.4 - 5.7	5.1 - 5.3	4.7 - 4.9
No. 8 (2.36 mm) Sieve (12.5 mm SMA, 9.5 mm SMA)	1.00	0.00 - 5.3	0.00 - 4.2	0.00 - 3.6	0.00 - 3.2	0.00 - 3.0	0.00 - 2.7	0.00 - 2.6	0.00 - 2.4
	0.98	5.4 - 6.0	4.3 - 4.7	3.7 - 4.0	3.3 - 3.6	3.1 - 3.4	2.8 - 3.1	2.7 - 2.9	2.5 - 2.7
	0.95	6.1 - 6.8	4.8 - 5.3	4.1 - 4.5	3.7 - 4.0	3.5 - 3.7	3.2 - 3.4	3.0 - 3.2	2.8 - 2.9
	0.90	6.9 - 8.2	5.4 - 5.8	4.6 - 5.0	4.1 - 4.5	3.8 - 4.0	3.5 - 3.7	3.3 - 3.5	3.0 - 3.2
	0.85	8.3 - 9.0	5.9 - 6.4	5.1 - 5.4	4.6 - 4.8	4.1 - 4.4	3.8 - 4.0	3.6 - 3.8	3.3 - 3.4
	0.75	9.1 - 9.4	6.5 - 6.6	5.5 - 5.0	4.9 - 5.1	4.5 - 4.7	4.1 - 4.3	3.9 - 4.0	3.5 - 3.7
No. 8 (2.36 mm) Sieve for OGFC and PEM mixes: When the mean of the deviations from the Job Mix Formula for a particular lot exceeds the tolerance for a 1.00 pay factor in the appropriate column, the lot will be paid for at 0.50 of the Contract Price.									

TABLE 11—MIXTURE ACCEPTANCE SCHEDULE—SUBSURFACE MIXES

Mixture Characteristics	Pay Factor	Mean of the Deviations from the Job Mix Formula							
		1 Test	2 Tests	3 Tests	4 Tests	5 Tests	6 Tests	7 Tests	8 Tests
Asphalt Cement Content (Extraction, Ignition)	1.00	0.00 - 0.80	0.00 - 0.61	0.00 - 0.52	0.00 - 0.46	0.00 - 0.43	0.00 - 0.39	0.00 - 0.36	0.00 - 0.34
	0.95	0.81 - 0.90	0.62 - 0.68	0.53 - 0.58	0.47 - 0.51	0.44 - 0.47	0.40 - 0.43	0.37 - 0.40	0.35 - 0.37
	0.90	0.91 - 1.00	0.69 - 0.75	0.59 - 0.64	0.52 - 0.56	0.48 - 0.52	0.44 - 0.47	0.41 - 0.44	0.38 - 0.41
	0.80	1.01 - 1.19	0.76 - 0.82	0.65 - 0.69	0.57 - 0.61	0.53 - 0.56	0.48 - 0.51	0.45 - 0.47	0.42 - 0.44
	0.70	1.20 - 1.40	0.83 - 0.85	0.70 - 0.72	0.62 - 0.64	0.57 - 0.59	0.52 - 0.55	0.48 - 0.51	0.45 - 0.48
	0.50	1.41 - 1.60	0.86 - 0.88	0.73 - 0.75	0.65 - 0.67	0.60 - 0.63	0.56 - 0.60	0.52 - 0.56	0.49 - 0.52
1/2 in. (12.5 mm) Sieve (25 mm Superpave)	1.00	0.00 - 12.9	0.00 - 8.1	0.00 - 6.9	0.00 - 6.1	0.00 - 5.5	0.00 - 5.0	0.00 - 4.7	0.00 - 4.4
	0.98	13.0 - 14.0	8.2 - 9.1	7.0 - 7.7	6.2 - 6.8	5.6 - 6.1	5.1 - 5.6	4.8 - 5.2	4.5 - 4.9
	0.95	14.1 - 15.0	9.2 - 10.1	7.8 - 8.5	6.9 - 7.5	6.2 - 6.7	5.7 - 6.1	5.3 - 5.7	5.0 - 5.4
	0.90	15.1 - 16.0	10.2 - 11.1	8.6 - 9.3	7.6 - 8.2	6.8 - 7.4	6.2 - 6.7	5.8 - 6.3	5.5 - 5.9
	0.85	16.1 - 17.0	11.2 - 11.5	9.4 - 9.6	8.3 - 8.6	7.5 - 7.8	6.8 - 7.0	6.4 - 6.5	6.0 - 6.1
	0.80	17.1 - 18.0	11.6 - 11.9	9.7 - 9.9	8.7 - 9.0	7.9 - 8.1	7.1 - 7.3	6.6 - 6.8	6.2 - 6.4
1/2 in. (12.5 mm) Sieve (19 mm SMA)	1.00	0.00 - 9.7	0.00 - 6.0	0.00 - 5.2	0.00 - 4.6	0.00 - 4.1	0.00 - 3.8	0.00 - 3.5	0.00 - 3.3
	0.98	9.8 - 10.5	6.2 - 6.8	5.3 - 5.8	4.7 - 5.1	4.2 - 4.6	3.9 - 4.2	3.6 - 3.9	3.4 - 3.7
	0.95	10.6 - 11.2	6.9 - 7.8	5.9 - 6.4	5.2 - 5.6	4.7 - 5.0	4.3 - 4.6	4.0 - 4.3	3.8 - 4.0
	0.90	11.3 - 12.0	7.9 - 8.3	6.5 - 7.0	5.7 - 6.1	5.1 - 5.6	4.7 - 5.0	4.4 - 4.7	4.1 - 4.4
	0.85	12.1 - 12.8	8.4 - 8.6	7.1 - 7.2	6.2 - 6.5	5.7 - 5.9	5.1 - 5.3	4.8 - 4.9	4.5 - 5.6
	0.80	12.9 - 13.5	8.7 - 8.9	7.3 - 7.4	6.6 - 6.8	6.0 - 6.1	5.4 - 5.5	5.0 - 5.1	4.7 - 4.8
3/8 in. (9.5 mm) Sieve (19 mm Superpave, 12.5 mm Superpave)	1.00	0.00 - 10.0	0.00 - 7.5	0.00 - 6.3	0.00 - 5.6	0.00 - 5.2	0.00 - 4.7	0.00 - 4.4	0.00 - 4.1
	0.98	10.1 - 11.9	7.6 - 8.4	6.4 - 7.0	5.7 - 6.3	5.3 - 5.8	4.8 - 5.3	4.5 - 5.0	4.2 - 4.6
	0.95	12.0 - 13.0	8.5 - 9.3	7.1 - 7.7	6.4 - 6.9	5.9 - 6.3	5.4 - 5.8	5.1 - 5.4	4.7 - 5.0
	0.90	13.1 - 14.0	9.4 - 10.2	7.8 - 8.6	7.0 - 7.6	6.4 - 6.9	5.9 - 6.3	5.5 - 5.9	5.1 - 5.5

Mixture Characteristics	Pay Factor	Mean of the Deviations from the Job Mix Formula							
		1 Test	2 Tests	3 Tests	4 Tests	5 Tests	6 Tests	7 Tests	8 Tests
	0.85	14.1 - 14.5	10.3 - 10.5	8.7 - 8.9	7.7 - 8.0	7.0 - 7.5	6.4 - 6.8	6.0 - 6.4	5.6 - 6.0
	0.80	14.6 - 15.0	10.6 - 10.8	9.0 - 9.2	8.1 - 8.4	7.6 - 7.8	6.9 - 7.3	6.5 - 6.8	6.1 - 6.5
No. 4 (4.75 mm) Sieve (9.5 mm Superpave)	1.00	0.00 - 10.0	0.00 - 7.6	0.00 - 6.3	0.00 - 5.8	0.00 - 5.4	0.00 - 4.9	0.00 - 4.6	0.00 - 4.3
	0.98	10.1 - 11.9	7.7 - 8.5	6.4 - 6.9	5.9 - 6.4	5.5 - 5.9	5.0 - 5.4	4.7 - 5.0	4.4 - 4.7
	0.95	12.0 - 13.0	8.6 - 9.4	7.0 - 7.5	6.5 - 7.0	6.0 - 6.5	5.5 - 5.9	5.1 - 5.5	4.8 - 5.1
	0.90	13.1 - 14.0	9.5 - 10.2	7.6 - 8.0	7.1 - 7.6	6.6 - 7.0	6.0 - 6.4	5.6 - 5.9	5.2 - 5.5
	0.85	14.1 - 14.5	10.3 - 10.5	8.1 - 8.3	7.7 - 8.0	7.1 - 7.5	6.5 - 6.9	6.0 - 6.4	5.6 - 5.9
	0.80	14.6 - 15.0	10.6 - 10.8	8.4 - 8.6	8.1 - 8.4	7.6 - 8.0	7.0 - 7.4	6.5 - 6.8	6.0 - 6.3
No. 8 (2.36 mm) Sieve (All mixes except SMA)	1.00	0.00 - 8.0	0.00 - 6.3	0.00 - 5.4	0.00 - 4.8	0.00 - 4.5	0.00 - 4.1	0.00 - 3.8	0.00 - 3.6
	0.98	8.1 - 9.0	6.4 - 7.0	5.5 - 6.0	4.9 - 5.3	4.6 - 4.9	4.2 - 4.5	3.9 - 4.2	3.7 - 3.9
	0.95	9.1 - 10.0	7.1 - 7.7	6.1 - 6.6	5.4 - 5.8	5.0 - 5.4	4.6 - 4.9	4.3 - 4.6	4.0 - 4.3
	0.90	10.1 - 11.9	7.8 - 8.5	6.7 - 7.2	5.9 - 6.4	5.5 - 5.8	5.0 - 5.3	4.7 - 5.0	4.4 - 4.6
	0.85	12.0 - 13.0	8.6 - 8.8	7.3 - 7.5	6.5 - 6.8	5.9 - 6.3	5.4 - 5.7	5.1 - 5.3	4.7 - 4.9
	0.75	13.1 - 14.0	8.9 - 9.1	7.6 - 7.8	6.9 - 7.2	6.4 - 6.6	5.8 - 6.1	5.4 - 5.7	5.0 - 5.3
No. 8 (2.36 mm) Sieve (19 mm SMA)	1.00	0.00 - 6.0	0.00 - 4.7	0.00 - 4.1	0.00 - 3.6	0.00 - 3.4	0.00 - 3.1	0.00 - 2.9	0.00 - 2.4
	0.98	6.1 - 6.8	4.8 - 5.2	4.2 - 4.5	3.7 - 4.0	3.5 - 3.7	3.2 - 3.4	3.0 - 3.2	2.8 - 2.9
	0.95	6.9 - 7.5	5.3 - 5.8	4.6 - 5.0	4.1 - 4.4	3.8 - 4.0	3.5 - 3.7	3.3 - 3.5	3.0 - 3.2
	0.90	7.6 - 8.9	5.9 - 6.4	5.1 - 5.4	4.5 - 4.8	4.1 - 4.4	3.8 - 4.0	3.6 - 3.8	3.3 - 3.5
	0.85	9.0 - 9.8	6.5 - 6.6	5.5 - 5.6	4.9 - 5.1	4.5 - 4.7	4.1 - 4.3	3.9 - 4.0	3.6 - 3.7
	0.75	9.9 - 10.5	6.7 - 6.8	5.7 - 5.9	5.2 - 5.4	4.8 - 5.0	4.4 - 4.6	4.1 - 4.3	3.8 - 4..0

E. Segregated Mixture

Prevent mixture placement yielding a segregated mat by following production, storage, loading, placing, and handling procedures. Ensure needed plant modifications and provide necessary auxiliary equipment. (See Subsection 400.1.01, *Definitions*.)

If the mixture is segregated in the finished mat, the Department will take actions based on the degree of segregation. The actions are described below.

1. Unquestionably Unacceptable Segregation

   When the Engineer determines the segregation in the finished mat is unquestionably unacceptable, follow these measures:

   a. Suspend Work and require the Contractor to take positive corrective action. The Department will evaluate the segregated areas to determine the extent of the corrective work to the in-place mat as follows:

      - Perform extraction and gradation analysis by taking 6 in. (150 mm) cores from typical, visually unacceptable segregated areas.
      - Determine the corrective work according to Subsection 400.3.06.E.3.

   b. Require the Contractor to submit a written plan of measures and actions to prevent further segregation. Work will not continue until the plan is submitted to and approved by the Department.

   c. When work resumes, place a test section not to exceed 500 tons (500 Mg) of the affected mixture for the Department to evaluate. If a few loads show that corrective actions were not adequate, follow the measures above beginning with step 1.a. above. If the problem is solved, work may continue.

2. Unacceptable Segregation Suspected

   When the Engineer observes segregation in the finished mat and the work may be unacceptable, follow these measures:

   a. Allow work to continue at Contractor's risk.

   b. Require Contractor to immediately and continually adjust operation until the visually apparent segregated areas are eliminated from the finished mat. The Department will immediately investigate to determine the severity of the apparent segregation as follows:

      - Take 6 in. (150 mm) cores from typical areas of suspect segregation.
      - Test the cores for compliance with the mixture control tolerances in Section 828.

   When these tolerances are exceeded, suspend work for corrective action as outlined in Subsection 400.3.06.E.3.

3. Corrective Work

   a. Remove and replace (at the Contractor's expense) any segregated area where the gradation on the control sieves is found to vary 10 percent or more from the approved job mix formula, the asphalt cement varies 1.0% or more from the approved job mix formula, or if in-place air voids exceed 13.5% based on GDT 39. The control sieves for each mix type are shown in Subsection 400.5.01.B *Determine Lot Acceptance*.

   b. Subsurface mixes. For subsurface mixes, limit removal and replacement to the full lane width and no less than 10 ft. (3 m) long and as approved by the Engineer.

   c. Surface Mixes. For surface mixes, ensure that removal and replacement is not less than the full width of the affected lane and no less than the length of the affected areas as determined by the Engineer.

   d. Surface tolerance requirements apply to the corrected areas for both subsurface and surface mixes.

400.3.7 Contractor Warranty and Maintenance

A. Contractor's Record

Maintain a dated, written record of the most recent plant calibration. Keep this record available for the Engineer's inspection at all times. Maintain records in the form of:

- Graphs
- Tables
- Charts
- Mechanically prepared data

400.4 Measurement

Thickness and spread rate tolerances for the various mixtures are specified in Subsection 400.4.A.2.b, Table 12, Thickness and Spread Rate Tolerance at Any Given Location. These tolerances are applied as outlined below:

A. Hot Mix Asphaltic Concrete Paid for by Weight

1. Plans Designate a Spread Rate

   a. Thickness Determinations. Thickness determinations are not required when the plans designate a spread rate per square yard (meter).

   If the spread rate exceeds the upper limits outlined in the Subsection 400.4.A.2.b, Table 12, *Thickness and Spread Rate Tolerance at Any Given Location*, the mix in excess will not be paid for.

   If the rate of spread is less than the lower limit, correct the deficient course by overlaying the entire lot.

   The mixture used for correcting deficient areas is paid for at the Contract Unit Price of the course being corrected and is subject to the Mixture Acceptance Schedule—Table 10 or 11.

   b. Recalculate the Total Spread Rate. After the deficient hot mix course has been corrected, the total spread rate for that lot is recalculated, and mix in excess of the upper tolerance limit as outlined in the Subsection 400.4.A.2.b, Table 12, *Thickness and Spread Rate Tolerance at Any Given Location* is not paid for.

   The quantity of material placed on irregular areas such as driveways, turnouts, intersections, feather edge section, etc., is deducted from the final spread determination for each lot.

2. Plans Designate Thickness

   If the average thickness exceeds the tolerances specified in the Subsection 400.4.A.2.b, Table 12, *Thickness and Spread Rate Tolerance at Any Given Location*, the Engineer shall take cores to determine the area of excess thickness. Excess quantity will not be paid for.

   If the average thickness is deficient by more than the tolerances specified in the Thickness and Spread Rate Tolerance at Any Given Location table below, the Engineer shall take additional cores to determine the area of deficient thickness. Correct areas with thickness deficiencies as follows:

   a. Overlay the deficient area with the same mixture type being corrected or with an approved surface mixture. The overlay shall extend for a minimum of 300 ft. (90 m) for the full width of the course.

   b. Ensure that the corrected surface course complies with Subsection 400.3.06.C.1, *Visual and Straightedge Inspection*. The mixture required to correct a deficient area is paid for at the Contract Unit Price of the course being corrected.

   The mixture is subject to the Mixture Acceptance Schedule—Table 10 or 11. The quantity of the additional mixture shall not exceed the required calculated quantity used to increase the average thickness of the overlaid section to the maximum tolerance allowed under the following table.

TABLE 12—THICKNESS AND SPREAD RATE TOLERANCE AT ANY GIVEN LOCATION

Course	Thickness Specified	Spread Rate Specified
Asphaltic concrete base course	± 0.5 in. (± 13 mm)	± 55 lbs./yd^2 (30 kg/m^2)
Intermediate and/or wearing course	± 0.25 in. (± 6 mm)	± 27.5 lbs./yd^2 (15 kg/m^2)
Overall of any combination of 1 and 2	± 0.5 in. (± 13 mm)	± 55 lbs./yd^2 (30 kg/m^2)

Note: For asphaltic concrete 9.5 mm OGFC and 12.5 mm OGFC, control the spread rate per lot within 7 lbs./yd^2 (4 kg/m^2) of the designated spread rate. For asphaltic concrete 12.5 mm PEM, control the spread rate per lot within 10 lbs./yd^2 (6 kg/m^2) of the designated spreadrate.

Note: Thickness and spread rate tolerances are provided to allow normal variations within a given lot. Do not continuously operate at a thickness of spread rate notspecified.

When the plans specify a thickness, the Engineer may take as many cores as necessary to determine the average thickness of the intermediate or surface course. The Engineer shall take a minimum of one core per 1,000 ft. (300 m) per two lanes of roadway. Thickness will be determined by average measurements of each core according to GDT 42.

If the average exceeds the tolerances specified in the *Subsection 400.4.A.2.b, Table 12, Thickness and Spread Rate Tolerance at Any Given Location*, additional cores will be taken to determine the area of excess thickness and excess tonnage will not be paid for.

B. Hot Mix Asphaltic Concrete Paid for by Square Yard (Meter)

1. The thickness of the base course or the intermediate or surface course will be determined by the Department by cutting cores and the thickness will be determined by averaging the measurements of eachcore.
2. If any measurement is deficient in thickness more than the tolerances given in the table above, additional cores will be taken by the Department to determine the area of thickness deficiency. Correct thickness deficiency areas as follows:
   a. Overlay the deficient area with the same type mixtures being corrected or with surface mixture. Extend the overlay at least 300 ft. (90 m) for the full width of thecourse.
   b. Ensure the corrected surface course complies with Subsection 400.3.06.C.1, *Visual and Straightedge Inspection*.
   c. The mixture is subject to the Mixture Acceptance Schedule—Table 10 or 11.
3. No extra payment is made for mixtures used forcorrection.
4. No extra payment is made for thickness in excess of thatspecified.

C. Asphaltic Concrete

Hot mix asphaltic concrete, complete in place and accepted, is measured in tons (megagrams) or square yards (meters) as indicated in the Proposal. If payment is by the ton (megagram), the actual weight is determined by weighing each loaded vehicle on the required motor truck scale as the material is hauled to the roadway, or by using recorded weights if a digital recording device isused.

The weight measured includes all materials. No deductions are made for the weight of the individual ingredients. The actual weight is the pay weight except when the aggregates used have a combined bulk specific gravity greater than 2.75. In this case the pay weight is determined according to the following formula:

$$T1 = T \times \left\{ \frac{\% AC + \left(\frac{\% \text{ Aggregate} \times 2.75}{\text{combined bulk Specific Gravity}} \right) + \% Y}{100} \right\}$$

Where:

T1	Pay weight, tonnage (Mg)
T=	Actual weight
% AC=	Percent asphalt cement by weight of total mixture
% Aggregate =	Percent aggregate by weight of total mixture minus the hydrated lime
Combined Bulk Sp. Gr.=	Calculated combined bulk specific gravity of various mineral aggregates used in the mixture
% Y=	Percent hydrated lime by weight of mineral aggregate

D. Bituminous Material

Bituminous material is not measured for separate payment.

E. Hydrated Lime

When hydrated lime is used as an anti-stripping additive, it is not measured for separate payment.

F. Field Laboratory

The field laboratory required in this specification is not measured for separate payment.

G. Asphaltic Concrete Leveling

Payment of hot mix asphaltic concrete leveling, regardless of the type mix, is full compensation for furnishing materials, bituminous materials, and hydrated lime (when required) for patching and repair of minor defects, surface preparation, cleaning, hauling, mixing, spreading, and rolling.

Mixture for leveling courses is subject to the acceptance schedule as stated in Subsection 400.3.06.A and Subsection 400.3.06.B.

H. Asphaltic Concrete Patching

Hot mix asphaltic concrete patching, regardless of the type mix, is paid for at the Contract Unit Price per ton (Megagram), complete in place and accepted. Payment is full compensation for:

- Furnishing materials such as bituminous material and hydrated lime (when required)
- Preparing surface to be patched
- Cutting areas to be patched, trimmed, and cleaned
- Hauling, mixing, placing, and compacting the materials

When mixture for patching is paid for by the Department, ensure the mixture is subject to the acceptance schedule as stated in Subsection 400.3.06.A.

400.4.01 Limits

When the asphaltic concrete is paid for by the square yard (meter) and multiple lifts are used, the number and thickness of the lifts are subject to the Engineer's approval and are used to prorate the pay factor for theaffected roadway section.

400.5 Payment

When materials or construction are not within the tolerances in this specification, the Contract Price will be adjusted according to Subsection 106.03, *Samples, Tests, Cited Specifications* and Subsection 400.3.06, *QualityAcceptance*.

Hot mix asphaltic concrete of the various types are paid for at the Contract Unit Price per ton (megagram) or per square yard (meter). Payment is full compensation for furnishing and placing materials including asphalt cement, hydrated lime when required, approved additives, and for cleaning and repairing, preparing surfaces, hauling, mixing, spreading, rolling, and performing other operations to complete the Contract Item.

Payment will be made under:

Item No. 400	Asphaltic concrete type Superpave, group-blend, Includingpolymer-modified bituminous materials and hydrated lime	Per ton (megagram)
Item No. 400	Asphaltic concrete type, Superpave, group-blend, including bituminous materials and hydrated lime	Per ton (megagram)
Item No. 400	Asphaltic concrete type Superpave, group-blend, Includingbituminous materials, Gilsonite modifier, and hydrated lime	Per ton (megagram)
Item No. 400	_____inches asphaltic concrete, typeSuperpave, group-blend including bituminous materials, Gilsonite modifier and hydrated lime	Per square yard (meter)
Item No. 400	Asphaltic concrete type Stone Matrix Asphalt, group-blend, including polymer-modified bituminous materials and hydrated lime	Per ton (megagram)
Item No. 400	Asphaltic concrete type OGFC, group 2 only, includingbituminous materials and hydrated lime	Per ton (megagram)
Item No. 400	Asphaltic concrete type OGFC, group 2 only, including polymer-modified bituminous materials and hydrated lime	Per ton (megagram)
Item No. 400	Asphaltic concrete type Porous European Mix, group 2 only,including polymer-modified bituminous materials and hydrated lime	Per ton (megagram)

400.5.01 Adjustments

A. Materials Produced and Placed During the Adjustment Period

An adjustment period is allowed at the start of mixing operations for each type of mix placed on the Contract. Asphaltic Concrete OGFC or PEM shall be granted an adjustment period for the first 500 tons (500 Mg) produced for the Contract. A new adjustment period shall not be granted for a change of producer, mix design or asphalt plant location. The adjustment period is provided to adjust or correct the mix and to establish the construction procedures and sequence of operations.

The adjustment period consists of the tons (megagrams) of the affected mix produced and placed on the first day of operation. If this quantity is less than 500 tons (500 Mg), the Engineer may combine the tons (megagrams) produced and placed on the first day of operation with the tons (megagrams) produced and placed on the next production day of the affected mix for the adjustment period.

The material produced and placed during the mixture adjustment period is one lot. If the mix is adjusted during this period, a new lot may be necessary, but a new adjustment period will not bepermitted.

This material shall be paid for at 100 percent of the Contract Unit Price provided it meets the minimum requirements for a 1.00 pay factor for asphalt cement content and a 0.90 pay factor for gradation in the Mixture Acceptance Schedule—Table 10 or 11.

If the material placed during the adjustment period fails to meet the above requirements, it will be paid for using the applicable acceptance schedule. However, when mixture used for leveling at a spread rate of 90 lbs./yd² (50 kg/m²) or less is also used for the surface mix at a spread rate greater than 90 lbs./yd² (50 kg/m²), an additional adjustment period will be allowed for compaction only. This material will be paid for at a 1.00 pay factor provided it:

- Meets the minimum requirements for a 1.00 pay factor in the Mixture Acceptance Schedule—Table 10 or 11 for both asphalt content and gradation.
- Meets the minimum requirements for a 0.90 pay factor in Table 13 of Subsection 400.5.01C, *Calculate Mean Pavement Air Voids*.

Mixture which does not meet these requirements shall be paid for using the applicable acceptance schedule.

B. Determine Lot Acceptance

Pay factor adjustments are based on control sieves and asphalt cement content. The control sieves used in the mixture acceptance schedule for the various types of mix are indicated below:

Control Sieves Used in the Mixture Acceptance Schedule	
Asphaltic concrete 25 mm Superpave	1/2 in., No. 8 (12.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 19 mm SMA	1/2 in., No. 8 (12.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 19 mm Superpave	3/8 in., No. 8 (9.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 12.5 mm Superpave	3/8 in., No. 8 (9.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 12.5 mm SMA	3/8 in., No. 8 (9.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 12.5 mm PEM	3/8 in., No. 8 (9.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 12.5 mm OGFC	3/8 in., No. 8 (9.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 9.5 mm Superpave	No. 4, No. 8 (4.75 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 9.5 mm SMA	No. 4, No. 8 (4.75 mm, 2.36 mm) sieves and asphalt cement
concrete 9.5 mm OGFC	No. 4, No. 8 (4.75 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 4.75 mm Mix	No. 8 (2.36 mm) sieve and asphalt cement

For projects which do not have milling quantities established as a Pay Item, the Department will pay for 12.5 mm OGFC and PEM placed on ramps and end of project transitions under the appropriate mixture pay item, but the mix shall be subject to the same gradation and control sieve requirements as asphaltic concrete 9.5 mm OGFC. Add polymer-modified bituminous material, hydrated lime, and stabilizing fiber to this mix.

The Department will perform the following tasks:

1. Using the Mixture Acceptance Schedule—Table 10 or 11, determine the mean of the deviations from the job mix formula per test results per lot.
2. Determine this mean by averaging the actual numeric value of the individual deviations from the job mix formula; disregard whether the deviations are positive or negative amounts.
3. Use the Asphalt Cement Content and Aggregate Gradation of Asphalt Concrete Mixture Acceptance Schedule—Table 10 to determine acceptance of surface mixes and the Mixture Acceptance Schedule—Table 11 to determine acceptance of subsurface mixes.

On Contracts involving 1,000 tons (1000 Mg) or less of asphaltic concrete, the mixture is accepted for 100 percent payment of the asphaltic concrete Unit Price provided it meets the following:

1. Minimum requirements for a 1.00 pay factor for asphalt cement content and a 0.90 pay factor for gradation in the applicable Mixture Acceptance Schedule—Table 10 or 11.
2. Minimum requirements for a 0.90 pay factor in Table 13 of Subsection 400.5.01C, *Calculate Pavement Mean Air Voids*.

If the material placed on Contracts involving 1,000 tons (1000 Mg) or less of asphaltic concrete does not meet the above requirements, the material will be paid for using the applicable acceptance schedule.

C. Calculate Pavement Mean Air Voids

The Department will determine the percent of maximum air voids for each lot by dividing the pavement mean air voids by the maximum pavement mean air voids acceptable.

The Department will determine the payment for each lot by multiplying the Contract Unit Price by the adjusted pay factor shown in the following Air Voids Acceptance schedule:

TABLE 13 - AIR VOIDS ACCEPTANCE SCHEDULE

Pay Factor	Percent of Maximum Air Voids (Lot Average of Tests)	Percent of Maximum Air Voids (Lot Average all Tests) (for Reevaluations)
1.00	≤100	≤100
0.97	100.1 — 105	100.1 — 104
0.95	105.1 — 112	104.1— 109
0.90	112.1 — 124	109.1 — 118
0.80	124.1 — 149	118.1 — 136
0.70	149.1 —172	136.1 — 153
0.50	172.1 — 191	153.1 — 166

When recommended by the Office of Materials and Testing, Lots receiving less than 0.5 pay factor shall be removed and replaced at the Contractor's expense.

When the range tolerance is exceeded, the Department will apply a pay factor of 0.95 as described in Subsection 400.3.06.B.2.

D. Asphaltic Concrete for Temporary Detours

Hot mix asphaltic concrete placed on temporary detours not to remain in place as part of the permanent pavement does not require hydrated lime. Hot mix used for this purpose is paid for at an adjusted Contract Price. Ensure the payment for this item covers all cost of construction, maintenance and removal of all temporary mix. Ensure hot mix asphaltic concrete placed as temporary mix meets requirements established in Subsection 400.3.05.F.

Where the Contract Price of the asphaltic concrete for permanent pavement is let by the ton (megagram), the Contract Price for the asphaltic concrete placed on temporary detours is adjusted by subtracting $0.75/ton ($0.85/mg) of mix used.

Where the Contract price of the mix in the permanent pavement is based on the square yard (meter), obtain the adjusted price for the same mix used on the temporary detour by subtracting $0.04/yd^2 ($0.05/m^2) per 1 in. (25 mm) plan depth.

Further price adjustments required in Subsection 400.3.06, *Quality Acceptance*, which are based on the appropriate adjusted Contract Price for mix used in the temporary detour work shall apply should temporary mix be left in place. Ensure hot mix asphalt produced as temporary mix containing no hydrated lime is removed and replaced with permanent mix containing hydrated lime.

E. Determine Lot Payment

Determine the lot payment as follows:

1. When one of the pay factors for a specific acceptance lot is less than 1.0, determine the payment for the lot by multiplying the Contract Unit Price by the adjusted pay factor.
2. When two or more pay factors for a specific acceptance lot are less than 1.0, determine the adjusted payment by multiplying the Contract Unit Price by the lowest pay factor.

If the mean of the deviations from the job mix formula of the tests for a sieve or asphalt cement content exceeds the tolerances established in the Mixture Acceptance Schedule—Table 10 or 11 and if the Engineer determines that the material need not be removed and replaced, the lot may be accepted at an adjusted unit price as determined by the Engineer. If the pavement mean air voids exceed the tolerances established in the Air Voids Acceptance Schedule – Table 13, remove and replace the materials at the Contractor's expense.

If the Engineer determines the material is not acceptable to leave in place, remove and replace the materials at the Contractor's expense.

Section 828—Hot Mix Asphaltic Concrete Mixtures

828.1 General Description

This specification includes the requirements for hot mix asphaltic concrete mixtures, including:

- Open-graded surface mixtures (OGFC and PEM)
- Stone Matrix Asphalt mixtures (SMA)
- Superpave mixtures
- Fine-graded (4.75 mm) mixtures

828.1.1 Definitions

The Nominal Maximum Sieve Size is one standard sieve size larger than the first sieve to retain more than ten percent of the aggregate, per AASHTO R35. Mixture types inthis section are identified according to Nominal Maximum Sieve Size.

828.1.2 Related References

A. Standard Specifications

Section 400-Hot Mix Asphaltic Concrete Construction

Section 402-Hot Mix Recycled Asphaltic Concrete

Section 800–Coarse Aggregate

Section 802–Aggregates for Asphaltic Concrete

Section 819–Fiber Stabilizing Additives

Section 820–Asphalt Cement

Section 831–Admixtures

Section 882–Lime

Section 883–Mineral Filler

B. Referenced Documents

AASHTO R30

AASHTO R35

AASHTO T 321

AASHTO T 112

AASHTO T 209

AASHTO T 305

AASHTO T 312

AASHTO T 245

AASHTO T 324

AASHTO T 340

SOP-36

SOP-2

GDT 1

GDT 56

GDT 63

GDT 66

GDT 114

GDT 115

GDT 123

QPL 1

QPL 2

QPL 7

QPL 26

QPL 41

QPL 77

QPL 81

828.2 Materials

A. Requirements

Use approved hot mix asphalt concrete mixtures that meet the following requirements:

1. Produce each asphalt mixture according to a Department approved Job Mix Formula and Asphalt Mix Design, see Subsection 400.1 for submittal and approval of Job Mix Formulas.
2. Ensure individual acceptance test results meet the Mixture Control Tolerances specified in the appropriate table below, Subsections 828.2.01 through 828.2.04.
3. Ensure the Engineer approves all materials used to prepare and place the mixtures before incorporating them into the Work. Use only the ingredients listed in the approved Asphalt Mix Design and Job Mix Formula. For virgin aggregates use sources meeting the requirements of Section 802 and are listed in QPL 1 or QPL 2; for mixes in which local sand is permitted, use the approved sand source identified in the mix design. For mixtures containing Reclaimed Asphalt Pavement (RAP), use only RAP from the approved stockpile identified in the mix design. Use asphalt cement meeting the requirements of Section 820, from a source listed in QPL 7.
4. Obtain approved SMA mix designs, Superpave mix designs and 4.75 mm mix designs from a mix design laboratory certified by the Department. Obtain approved mix designs for types PEM and OGFC mixtures from the Department's Office of Materials, which produces and furnishes these mix designs.
5. Ensure all SMA mix designs are designed in accordance with GDT-123 (“Determining the Design Proportions of Stone Matrix Asphalt Mixtures”). Ensure SMA mix designs are verified and approved by the Department prior to use. Ensure Superpave and 4.75 mm mix designs are designed in accordance with SOP-2 ("Control of Superpave Bituminous Mixture Designs") and are approved by the Department as provided therein. Ensure these mixes are designed by a laboratory and technician certified in accordance with SOP-36, ("Certification of Laboratories and Personnel for Design of SMA and Superpave Asphalt Mixtures").
6. Use only mixtures composed of the aggregate groups and blends indicated in the Proposal and Plans by their pay item designations, defined as follows:

TABLE 1 – AGGREGATE GROUPS

Pay Item Designation	Allowable Aggregate Groups
Group I or II	Group I, Group II, or Blend I
Group II only	Group II only
Blend I	Either 100% Group II material or a blend of Group I and Group II. Do not use Group I material for more than 60%, by weight, of the total aggregate nor more than 50%, by weight, of the coarse aggregatefraction.

7. For patching or leveling use Group I, Group II, or Blend I. Mix types for patching and leveling are specified in Subsection 400.3.03.B.
8. Include lime (hydrated lime) from an approved source and meeting the requirements of Section 882 in all paving courses except as otherwise provided in the Contract. For a list of approved sources of lime, see QPL 41.
   a. Add lime to each mixture at the rate prescribed in the approved mixdesign.
   b. Ensure mix designs using only virgin aggregate include lime at a minimum rate of 1.00% of the total dry aggregate weight. Ensure mix designs using RAP include lime at a minimum rate equal to 1.00% of the virgin aggregate fraction plus 0.50% of the aggregate in the RAPfraction.
   c. Add more lime or add lime plus an approved Heat-Stable Anti-Stripping Additive meeting the requirements of Section 831, if necessary to meet requirements for mixture properties, and pursuant toan approved mix design. However, the Department will not make additional payment for these materials. For a list of sources of Heat-Stable Anti-Stripping Additives, see QPL26.
   d. Where specifically allowed in the contract on LARP, airport, and parking lot projects, an approved Heat-Stable Anti-Stripping Additive meeting the requirements of Section 831 may be substituted for hydrated lime. Ensure the mix gradation is adjusted to replace the lime with an equivalent volume of fines passing the 0.075 mm sieve. Add Heat-Stable Anti-stripping Additive at a minimum rate of 0.5 percent of the asphalt cement portion.
9. Use performance grade PG 64-22 or PG 67-22 asphalt cement in all mix designs and mixtures except as follows:
   a. The State Materials Engineer will determine the performance grade to be used, based on Table 2 – Binders Selection Guideline for Reclaimed Asphalt Pavement (RAP) Mixtures, AASHTO M323 and laboratory testing results as required in Section 828.2.B for mixtures containing ≥ 25% equivalent binder replacement for RAP/RAS mixtures.
   b. Use only grade PG 76-22, excluding shoulder construction in the following mixes: all SMA, 12.5 mm PEM, 9.5 mm and 12.5 mm OGFC, 12.5 mm Superpave, on projects with two-way ADT greater than 25,000; and in all mixtures for which polymer-modified asphalt is specified in the pay item.
10. Use of local sand is restricted as follows:
   a. Do not place mixtures containing local sand on the traveled way of the mainline or ramps of the Interstate System. Mixtures with local sand may be used for shoulder construction on these facilities.
   b. Ensure local sand will not constitute more than 20 % of the total aggregate weight of any mix design or production mix.
   c. Subject to the above limits, 19 mm, 12.5 mm, and 9.5 mm Superpave mix designs and 4.75 mm mix designs containing local sand may be used on projects with a current ADT not exceeding 4,000 VPD providing that all performance testing meets specified requirements.
   d. 25 mm Superpave mix designs containing not more than 20 % local sand may be used on allfacilities except the main line and ramps of the Interstate System.
   e. Obtain local sand for use in asphalt mixtures from a source approved by the Department.

f. Approval of local sand sources: The Department will sample, test, and approve sources of local sand. Ensure local sand contains no more than 7.0% clay by weight and is free of foreign substances, roots, twigs, and other organic matter. Ensure sand is free of clay lumps, as determined by AASHTO T 112, and has a sand equivalent value exceeding 25%, as determined by GDT63.

B. Fabrication

1. Design procedures: For all Superpave and 4.75 mm mixes, ensure conformance with the Superpave System for Volumetric Design (AASHTO T 312 and AASHTO R30), as adapted in SOP-2. Ensure Superpave mixes are designed at a design gyration number (N_{des}) of 65 gyrations and initial gyration number (N_{ini}) of6gyrations. Ensure 4.75 mm mixes, (N_{des}) are designed at 50 gyrations, and (N_{ini}) at 6 gyrations. Open-graded mix designs will be designed by the Department in accordance with GDT 114. In all cases, the procedure for measuring Maximum Specific Gravity (G_{mm}) is AASHTO T 209. In addition to gradation and volumetric analysis, ensure mix designs include the following performance tests, as applicable.

2. Performance Test:

   a. Permeability test: Ensure Superpave and Stone Matrix mix designs include testing according to GDT -1 Measurement of Water Permeability of Compacted Asphalt Paving Mixtures. Ensure specimen air voids for this test are 6.0 ±1.0 %. The average permeability of three specimens may not exceed 3.60 ft per day (125 ×10−5cm per sec).

   b. Moisture susceptibility test: Fabricate and test specimens in accordance with GDT 66, when required by the Office of Materials and Testing due to visible signs of stripping in laboratory fabricated or plant produced asphaltic concrete mixtures, ensure specimen air voids for this test are 7.0 ±1.0% forall mixes excluding Stone Matrix mixes. Ensure specimen air voids for this test are 6.0 ± 1.0% for Stone Matrix mixes. The minimum tensile splitting ratio is 0.80, except a tensile splitting ratio of no less than 0.70 may be acceptable if all individual strength values exceed 100 psi (690 kPa). Ensure average splitting strength of the three conditioned and three controlled samples are not less than 60 psi (415 kPa) for either group. Ensure retention of coating as determined by GDT 56 is not less than95%.

   c. Hamburg Wheel-Tracking Test for rutting and moisture susceptibility test: Ensure mix designs of all mix types except Open-graded Surface Mixes (OGFC and PEM), and Open-graded Crack Relief Interlayer (OGI) mix, include testing in accordance with AASHTO T 324. Ensure specimen air voids for this test are 7.0 ± 1.0% for all mix types and at a testing temperature of 50°C (122°F). Use the testing and acceptance criteria established in Table 2.

TABLE 2 – HAMBURG WHEEL TRACKING DEVICE TESTING AND ACCEPTANCECRITERIA

Binder Performance Grade (PG)	Mix Type	Number of Passes	Maximum Rut Depth	Stripping Inflection Point
PG 64-22 and PG 67-22	4.75 mm, 9.5 mm SP Type I, and 9.5 mm SP Type II	15,000	≤ 12.5 mm	> 15,000
PG 64-22 and PG 67-22	12.5 mm SP, 19 mm SP and 25 mm SP	20,000	≤ 12.5 mm	> 20,000
PG 76-22	All Mix types	20,000	≤ 12.5 mm	> 20,000

Tested specimens shall be inspected for any visible signs of stripping and any mix design's tested specimens that fail to maintain 95% of asphalt cement coating, as described in GDT 56 section D.2.d, will be required to meet specified requirements for GDT 66 as detailed in828.2.B.2.b.

   d. Fatigue testing: The Department may verify dense-graded mix designs by fatigue testing according to AASHTO T 321 or other procedure approved by the Department.

C. Acceptance

See Subsection 106.03 and Section 400. Ensure individual test results meet the Mixture Control Tolerances listed in Subsections 828.2, 828.2.01 ,828.2.02, 828.2.03, or 828.2.04, whichever applies with the followingexception. Ensure field verification results for rutting susceptibility tests performed on laboratory fabricated and/or roadway cores obtained from asphalt plant produced mixtures meet specified requirements for AASHTO T 324 as detailed in Subsection 828.2.B.2.c. All GDOT approved mix designs are required to have full field mix design verifications, using plant produced mixture, sampled by the contractor and submitted to the applicable GDOT laboratory (Central or District) at a minimum of once per two years. Field mix design verification results that fail to comply with performance testing specified in Subsection 828.2.B will require a complete laboratory mix design verification, to be completed by the original mix designer, for continued use of that design. If a mix design has not been produced within two years, a full field mix design verification will be sampled by the contractor and submitted to the applicable GDOT laboratory (Central or District) on the first Lot produced thereafter. Any mix design that fails to meet performance test requirements established in Subsection 828.2.B, using laboratory fabricated specimens due to failing field mix design results, may subject that mix design to invalidation after the field mix design verification results are confirmed with a second field mix design verification. Field mix design verifications as specified in Section 402, Section 400, SOP 2 and GSP 21, are not precluded by the requirements specifiedherein.

D. Materials Warranty

See General Provisions 101 through 150.

828.2.1 Open-Graded Surface Mixtures

A. Requirements

Produce the mixture according to an approved mix design and Job Mix Formula. Ensure Open-Graded Surface Mixtures meet the following mixture control tolerances and mix designcriteria:

Sieve Size	Mixture Control Tolerance, %	Design Gradation Limits, % Passing		
		9.5 mm OGFC	12.5 mm OGFC	12.5 mm PEM
3/4 in. (19 mm) sieve	±0.0		100*	100*
1/2 in. (12.5 mm) sieve	±6.1	100*	85-100	80-100
3/8 in. (9.5 mm) sieve	±5.6	85-100	55-75	35-60
No. 4 (4.75 mm) sieve	±5.7	20-40	15-25	10-25
No. 8 (2.36 mm) sieve	±4.6	5-10	5-10	5-10
No. 200 (75 µm) sieve	±2.0	2-4	2-4	1-4
Range for % AC	±0.4	6.0-7.25	5.75-7.25	5.5-7.0
Class of stone (Section 800)		“A” only	“A” only	“A” only
Drain-down (AASHTO T305), %		<0.3	<0.3	<0.3

* Mixture control tolerance is not applicable to this sieve for thismix.

1. In 12.5 mm and 9.5 mm OGFC and 12.5 mm PEM mixes, use only PG 76-22 asphalt cement (specified in Section 820).
2. Ensure all OGFC and PEM mixes include a stabilizing fiber of the type (cellulose or mineral) specified in the mix design and meeting the requirements of Section 819. Ensure the dosage rate is as specified in the mix design and sufficient to prevent drain-down exceeding the abovetolerance.

B. Fabrication

See Section 400.

828.2.2 Stone Matrix Asphalt Mixtures

A. Requirements

Produce the mixture according to an approved mix design and Job Mix Formula. Ensure Stone Matrix Asphalt mixtures meet the following mixture control tolerances and mix design criteria:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing		
		9.5 mm SMA	12.5 mm SMA	19 mm SMA
1 in. (25 mm) sieve	±0.0			100*
3/4 in. (19 mm) sieve	±7.0	100*	100*	90-100
1/2 in. (12.5 mm) sieve	±6.1	98-100**	85-100	44-70
3/8 in. (9.5 mm) sieve	±5.6	70-100	50-75	25-60
No. 4 (4.75 mm) sieve	±5.7	28-50	20-28	20-28
No. 8 (2.36) mm sieve	±4.6	15-30	16-24	15-22
No. 50 (300 µm) sieve	±3.8	10-17	10-20	10-20
No. 200 (75 µm) sieve	±2.0	8-13	8-12	8-12
Range for % AC (Note 1)	±0.4 (Note 2)	6.0-7.5	5.8-7.5	5.5-7.5
Design optimum air voids (%)		3.5 ±0.5	3.5 ±0.5	3.5 ±0.5
% aggregate voids filled with AC (VFA)		70-90	70-90	70-90
Tensile splitting ratio after freeze-thaw cycle GDT-66		80%	80%	80%
Drain-down (AASHTO T305), %		<0.3	<0.3	<0.3

*Mixture control tolerance is not applicable to this sieve for this mix.

**Mixture control tolerance is ± 2.0% for this sieve for 9.5 mm SMA mixes placed at spread rates greater than 135 lb./yd^2. For 9.5 mm SMA mixes placed at spread rates of 135 lb./yd^2 or less, 100 % passing is required on this sieve.

Note 1: Range for % AC is Original Optimum AC (OOAC) at 35 gyrations (Gyratory compactor) or 50 blows (Marshall compactor) prior to Corrected Optimum AC (COAC) calculation detailed in GDT 123 (Appendix A)

Note 2: Quality Acceptance Test Results for AC content that deviate > ± 0.3% from the approved Job Mix Formula (JMF) consistently over three lots may subject the mix to a revised AC content on project JMF at the discretion of the State Materials Engineer based on statistical trend.

1. Ensure SMA mixtures are compacted at 35 gyrations with the Superpave Gyratory compactor or 50 blows with the Marshall compactor.
2. Ensure SMA mixtures contain mineral filler and fiber stabilizing additives and meet the following requirements:
   a. Asphalt cement grade PG-76-22 (specified in Section 820) is required in all SMA mixtures.
   b. Aggregates for SMA meet the requirements of Subsection 802.2.02.A.3.
   c. Use the approved mineral filler specified in the mix design and meeting the requirements of Section 883 Approved sources of mineral filler are listed in QPL 81.

   Use the approved Fiber Stabilizing Additive of the type (cellulose or mineral) specified in the mix design and meeting the requirements of Section 819. Approved sources of Fiber Stabilizing Additive are listed in QPL 77.

The dosage rate will be as specified in the mix design and sufficient to prevent drain-down exceeding the above tolerance.

B. Fabrication

See Section 400.

828.2.3 Superpave Asphalt Concrete Mixtures

A. Requirements for Superpave Mixtures (except Parking Lot Mixtures)

Produce the mixture according to an approved mix design and Job Mix Formula. Ensure Superpave Asphalt Concrete mixtures meet the following mixture control tolerances and mix design limits:

1. Gradation limits for Superpave mixtures are as follows:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing				
		9.5 mm Superpave Type I	9.5 mm Superpave Type II	12.5 mm Superpave (Note 1)	19 mm Superpave	25 mm Superpave
1½ in. (37.5 mm)						100*
1 in. (25.0 mm)	± 8.0			100*	100*	90-100
3/4 in. (19.0 mm)	±8.0**	100*	100*	98-100****	90-100	55-89**
1/2 in. (12.5 mm)	±6.0***	98-100****	98-100****	90-100	60-89***	50-70
3/8 in. (9.5 mm)	±5.6	90-100	90-100	70-89	55-75	
No. 4 (4.75 mm)	±5.6	65-85	55-75			
No. 8 (2.36 mm)	±4.6	48-55	42-47	38-46	32-36	30-36
No. 200 (75 µm)	±2.0	5.0-7.0	5.0-7.0	4.5-7.0	4.0-6.0	3.5-6.0
Range for % AC (Note 3)	± 0.4 (Note 2)	5.50-7.25	5.25-7.00	5.00-6.25	4.25-5.50	4.00-5.25

* Mixture control tolerance is not applicable to this sieve for this mix.

** Ensure mixture control tolerance is within ± 10.0% for this sieve for 25 mm Superpave.

***Ensure mixture control tolerance is within ± 8.0% for this sieve for 19 mm Superpave.

***Ensure mixture control tolerance is within ± 2.0% for this sieve for 12.5 mm and 9.5 mm mixes.

Note 1: Use PG 76-22 in 12.5 mm Superpave, excluding shoulder construction, on all projects with ADT greater than 25,000 as detailed in the Contract Pay Item.

Note 2: Quality Acceptance Test Results for AC content deviating > ± 0.3 % from the approved Job Mix Formula (JMF) consistently over three Lots may subject the mix to a revised AC content on the project JMF at the discretion of the State Materials Engineer based on statistical trend.

Note 3: Range for % AC is Original Optimum AC (OOAC) at 65 gyrations prior to the Corrected Optimum AC (COAC) calculation detailed in SOP 2 (Appendix D).

2. Volumetric limits are as follows:

Design Parameter	Mix Type	Limits
% of Max. Specific Gravity (Gmm) at design gyrations, (Ndes)	All	96%
% Gmm at the initial number of gyrations, Ni	All	91.5% maximum
% voids filled with asphalt (VFA) at Ndes	9.5 mm Type I	Min. 72; Max. 80
	9.5 Type II and 12.5 mm	Min. 72; Max. 76
	19 mm	Min. 71; Max 76
	25 mm	Min. 69; Max 76
Fines to effective asphalt binder ratio (F/Pbe)	9.5 mm Type I	0.6 to 1.4
	All other types	0.8 to 1.6
Minimum Film Thickness (microns)*	All	> 7.00
Minimum % Voids in Mineral Aggregate (VMA) Note: VMA shall be calculated using the effective specific gravity of the aggregate (Gse). See SOP-2SP.	25 mm	13.0
	19 mm	14.0
	12.5 mm	15.0
	9.5 Type I	16.0
	9.5 Type II	16.0

*Superpave Mixtures approved prior to January 31, 2012, may be adjusted to meet Minimum Film Thickness requirements by the State Materials Engineer.

B. Requirements for Superpave Parking Lot Mixes (NOT FOR STANDARD HIGHWAY/STREET PAVING)

1. Surface layers for parking facilities:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing		
		4.75 mm Mix	9.5 mm Superpave Type I	9.5 mm Superpave Type II
1 in. (25.0 mm) sieve	± 8.0			
3/4 in. (19.0 mm) sieve	±8.0**		100*	100*
1/2 in. (12.5 mm) sieve	±6.0	100*	98-100****	98-100****
3/8 in. (9.5 mm) sieve	±5.6	90-100	90-100	90-100
No. 4 (4.75 mm) sieve	±5.6	75-95	65-85	55-75
No. 8 (2.36 mm) sieve	±4.6	60-65	48-55	42-47
No. 50 (300 µm) sieve	+3.8	20-50		
No. 200 (75 µm) sieve	±2.0	4-12	5.0-7.0	5.0-7.0
Range for Total AC	+ 0.4	6.00 - 7.50	5.50 - 7.25	5.25 - 7.00

2. Subsurface layers for parking facilities:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing		
		12.5 mm Superpave	19 mm Superpave	25 mm Superpave
				100*
1 in. (25.0 mm) sieve	± 8.0	100*	100*	90-100
3/4 in. (19.0 mm) sieve	±8.0**	98-100****	90-100	55-89**
1/2 in. (12.5 mm) sieve	±6.0***	90-100	60-89***	50-70
3/8 in. (9.5 mm) sieve	±5.6	70-89	55-75	
No. 8 (2.36 mm) sieve	±4.6	38-46	32-36	30-36
No. 200 (75 µm) sieve	±2.0	4.5-7.0	4.0-6.0	3.5-6.0
Range for Total AC	+ 0.4	5.00 - 6.25	4.25 - 5.50	4.00 - 5.25

All * and notes apply to both 828.2.03.B.1 and 828.2.03.B.2.

*Mixture control tolerance is not applicable to this sieve for this mix.

**Ensure mixture control tolerance is within ±10.0% for this sieve for 25 mm Superpave mixes.

*** Ensure mixture control tolerance is within ±8.0% for this sieve for 19 mm Superpave mixes.

****Ensure mixture control tolerance is within ±2.0% for this sieve for 12.5 mm and 9.5 mm Superpave mixes.

Note 1: Quality Acceptance Test Results for AC content deviating > ± 0.3 % from the approved Job Mix Formula (JMF) consistently over three Lots may subject the mix to a revised AC content on the project JMF at the discretion of the State Materials Engineer based on statistical trend.

Note 2: Range for % AC is Original Optimum AC (OOAC) at 65 gyrations prior to the Corrected Optimum AC (COAC) calculation detailed in SOP 2 (Appendix D).

3. Volumetric limits for parking facilities are as follows:

Design Parameter	Mix Type	Limits
% of Max. Specific Gravity (Gmm) at design gyrations, Ndes)	All	96%
% Gmm at the initial number of gyrations, Ni	All	91.5 % maximum
% voids filled with asphalt (VFA) at Ndes	9.5 mm Type I	Min. 72; Max. 80
	9.5 Type II and 12.5 mm	Min. 72; Max. 78
	19 and 25 mm	Min. 71; Max 76
Fines to effective asphalt binder ration (F/Pbe)	9.5 mm Type I	0.6 to 1.4
	All other types	0.8 to 1.6
Minimum Film Thickness (microns)*	4.75 mm	> 6.00
	All other types	> 7.00
Minimum % Voids in Mineral Aggregate (VMA)	25 mm	13.0

Design Parameter	Mix Type	Limits
Note: VMA shall be calculated using the effective specific gravity of the aggregate (Gse). See SOP-2	19 mm	14.0
	12.5 mm	15.0
	9.5 mm Types I, II	16.0

* Mixtures approved prior to January 31, 2012, may be adjusted to meet Minimum Film Thickness requirements by the State Materials Engineer.

C. Fabrication

See Section 400.

828.2.4 Fine-Graded Mixtures

A. Requirements

Produce the mixture according to an approved mix design and Job Mix Formula. Ensure that fine-graded mixtures meet the following mixture control tolerances and design limits:

ASPHALTIC CONCRETE - 4.75 mm Mix		
Sieve Size	**Mixture Control Tolerance**	**Design Gradation Limits, % passing**
1/2 in. (12.5 mm) sieve*	±0.0	100*
3/8 in. (9.5 mm) sieve	±5.6	90-100
No. 4 (4.75 mm) sieve	±5.7	75-95
No. 8 (2.36 mm) sieve	±4.6	60-65
No. 50 (300 μm) sieve	±3.8	20-50
No. 200 (75 μm) sieve	±2.0	4-12
Range for % AC	±0.4	6.00 – 7.50
Design optimum air voids (%)		4.0 – 7.0
% Aggregate voids filled with AC		60 - 80
Minimum Film Thickness (microns)		> 6.00

* Mixture control tolerance is not applicable to this sieve for this mix.

Note 1: Quality Acceptance Test Results for AC content deviating > ± 0.3 % from the approved Job Mix Formula (JMF) consistently over three Lots may subject the mix to a revised AC content on the project JMF at the discretion of the State Materials Engineer based on statistical trend.

Note 2: Range for % AC is Original Optimum AC (OOAC) at 50 gyrations prior to the Corrected Optimum AC (COAC) calculation detailed in SOP 2 (Appendix D).

B. Fabrication

See Section 400.

C. Acceptance

See Subsection 106.3 and Section 400. Ensure individual test results meet the Mixture Control Tolerances listed in Subsections 828.2, 828.2.01, 828.2.02, 828.2.03, 828.2.04, whichever applies.

D. Materials Warranty

See General Provisions 101 through 150.

DOT and QCT's Technicians

Plant Check List

OMR-TM–144
(8/31/05)

Testing Management Field Technician
CHECK LIST

Contractor:_____ Location:_____
Type Plant:_____ Date: _/_____/_____ District_____
QCT Name_____ ID #:_____ Level:_____

YES NO

_____1. Is a QCT at the plant during production (excluding lunch or break time)?
_____2. Are random numbers being selected before production begins?
_____3. Are the loads selected by random number being sampled and the ticket signed?
_____4. Is the diary maintained daily and all the required data entered?
_____5. Is the MSDS sheet posted in the plant lab if chemical is used for extraction?
_____6. Is the sample size correct for the type of mix being produced?
_____7. Is dried aggregate from the acceptance test, referee and comparison portions of the sample being saved and labeled as required?
_____8. Is the temperature being monitored and recorded?
_____9. Is the thermometer being calibrated each week and recorded as required?
_____10. Are haul vehicles being properly inspected (tarps, strapping, insulation, releasing agent)?
_____11. Is the QCT notifying the T.M.O.S. and T.S.E. of all tests out of Section 828?
_____12. Does the QCT have an approved JMF for all DOT projects?
_____13. Are correct materials being added to mix (aggregates, lime, additives, AC and rap from approved stockpile)?
_____14. Is the QCT plant rating being forwarded to District lab by the 2nd working day of each month?
_____15. Are Daily, Master and Interlock check procedures posted in the control room? (If **"NO"** contact the TSE)
_____16. Is annual plant inspection, quality control plans and SOP 15 posted in the plant lab?
_____17. Are the interlocks working (additive, RAP, Fiber, Mineral filler, etc.)?
_____18. Are AC, lime and miscellaneous samples being taken and submitted to the lab as required?
_____19. Are daily lime checks performed and results recorded in diary as required?
_____20. Are Master lime calibration checks performed and recorded in dairy twice per week as required?
_____21. Are aggregate stockpiles improperly constructed, contaminated or segregated?
_____22. Is the loader operator using the proper handling procedures when moving aggregate?
_____23. Are asphalt plant scale certifications current (AC, Aggregate, platform, batch, etc.)? Date?_____ by _____
_____24. Are 159's being up-loaded per lot daily as required?
_____25. Is testing equipment in proper working condition (scales, sieves, oven, extractor, etc)?
_____26. Are paper files established for projects and all 159-5's and random number sheets placed in the project files daily?
_____27. Are **CPW Renewal Posted** or a copy of **CPW certificate** if his/her name isn't on the renewal list in the plant control room?
_____28. Is a copy of the **QCT Certification** posted in the plant lab**?**

Remarks: .
_____
_____
_____
_____

DOT Inspector:_____

OMR-TM-143
(REV.8/24/05)

DEPARTMENT OF TRANSPORTATION – OFFICE OF MATERIALS AND RESEARCH
QUALITY CONTROL TECHNICIAN PLANT CHECK LIST

CONTRACTOR_____ **LOCATION:**_____
Make of Plant_____ **Type Plant:**_____ **Plant Code:**_____
Week of____/____/____ **District:** **Inspected By:**_____
(Print Name)_____

YES NO

_____ 1. Is CPW Renewal document or Certificate displayed in the control room in full view?
_____ 2. Is CPW using his or her own seal?
_____ 3. Is CPW maintaining sufficient checks on all vehicle weights to assure that trucks exceeding the gross weight limits are not dispatched?
_____ 4. Is a copy of SOP-15 posted in control room?
_____ 5. Are all scales zeroed daily or when necessary?
_____ 6. When were aggregate, asphalt, and truck scales last inspected and by whom?
Date: / / DOT:_____ AGR.:_____ PRV.:_____
_____ 7. Are aggregate stockpiles visually inspected for proper construction, segregation, contamination and proper handling procedures?
_____ 8. Do cold aggregate feeders and bins appear to be in good mechanical condition?
_____ 9. Are cold aggregate feeders maintaining a uniform feed?
_____ 10. Are dryer, dust collector and/or bag house visually inspected for problems?
_____ 11. Is Liquid asphalt heated to proper temperature?
_____ 12. Does temperature indicating device function properly?
_____ 13. Is mixture temperature maintained in accordance with specified temperature?
_____ 14. Do any valves or gates leak?
_____ 15. Is the mix segregated?
_____ 16. If silo is used as surge bin, is material maintained well above the cone level?
_____ 17. Do silo indicators operate properly?
_____ 18. Are Truckers using a QPL approved releasing agent? Source:_____
_____ 19. Are truck beds being inspected for excess releasing agents before being loaded?
_____ 20. Are trucks visually inspected for proper cover, temperature holes, identification Numbers and the use of diesel fuel?
_____ 21. Is the aggregate, liquid AC and lime from an approved source?
Aggregate Source _____
Liquid AC Source _____
Lime Source_____
_____ 22. Does contractor have an adequate quality control program and information pertaining to this program posted in the lab?
_____ 23. Are Testing Management Operations Supervisor, Technical Service Engineer and Quality Control Technician Level II Manager notified when an acceptance sample fails?
_____ 24. Are DOT Personnel submitting Compaction Reports in two days?
(If you check "NO", contact TMOS immediately.)
_____ 25. Are Daily Lime check, Master Lime Check and Interlock System Check procedures posted in control room of Asphalt Plant? (If you check "NO", notify TSE)
_____ 26. Are loaded and unloaded weight checks being performed by DOT personnel and documented in plant diary?
_____ 27. Are paper files established on all projects and all 159-5's, worksheets and random number sheets placed in these files daily?
_____ 28. Is a file for incomplete 159-5's set up in full view for incomplete 159-5's?
_____ 29. Is incomplete 159-5's reported to Testing Management Operations Supervisor within two working day

Signature of Quality Control Technician _____

QCT LEVEL 1 TEST CHECKLIST

Before you schedule your written Exam, ask yourselfthefollowing.

Are you familiarwith:	YES	NO
GSP-15		
GSP-21		
AASHTO T-11		
GDT-38		
GDT-39		
GDT-73		
GDT-83		
GDT-125		
Section 400 of the Standard Specifications		
Section 828 of the Standard Specifications		
Calculating AC Content(Extraction)		
Determining the AC content by using the burnoven ticket		
Calculating Gradation		
Determining pay factors for PlantSamples		
Determining pay factors for RoadwayVoids		
Void Range and Penalty		
The Adjustment period for plant androadway		
Calculating Voids		
Calculating Daily Lime Checks(Volumetric)		
Calculating Daily Lime Checks(Depleting)		
Calculating Bi-Weekly LimeChecks(Depleting)		
Calculating Bi-WeeklyLimeChecks(Volumetric)		

Examples

GDT-38

Total Mass(g): 1565.1

Agg. Dry Mass(g): 1488.0

Sieves	Weight	% RET.	% Pass
1 in	0	0	100
¾ in	0	0	100
½ in	54.9	3.7	96.3
3/8 in	279.7	18.8	81.2
No. 8	865.3	58.2	41.8
No. 200	1379.2	92.7	7.3

Aggregate Gradation Calculations

- **Formula:** $P = 100 - \frac{R}{T} \times 100$
- P = Accumulative percent passing by weight of total aggregate
- R = Accumulative weight of aggregate retained on sieve
- T = Total weight of extracted aggregate

GDT-39

Calculate the bulk specific gravity of the uncoated test specimen as follows:

$$\text{Bulk Specific Gravity} = \frac{A}{B-C} \text{ where}$$

A = weight of dry sample in air in grams

B = weight of surface-dry sample in air in grams

C = weight of sample in water in grams

Determine the density of a specimen taken from compacted mixture as follows:

Roadway Core Density = Bulk Specific Gravity of Specimen * Specific Gravity of Water (62.4)

Determine the in-place air voids of a specimen taken from compacted mixture as follows:

{(100) – [(Density of Specimen ÷ Theoretical density) * (100)]}

OBTAIN CORE DENSITIES

Sample Numbers					
Site	1	2	3	4	5
Air Weight	1598.6	1446.7	1262.2	1365.1	1417.5
SSD Weight or Wax Weight	1604.1	1458.0	1267.6	1371.2	1424.3
Water Weight	928.8	837.4	733.7	800.7	820.3
Difference **(SSD – Water Weight)**	675.3	620.6	533.9	570.5	604
Specific Gravity **(Air Weight ÷ Difference)**	2.367	2.331	2.364	2.392	2.346
Density **(Specific Gravity x 62.4)**	147.7	145.5	147.5	149.3	146.4

GDT-73 (Method A)

Example #1

This example uses Method A to calculate the random tests for each sublot.
You are given the following:
Plant production: 2,000 to 2,500 tons (4 to 5 samples)
Average load of haul vehicles: 20 tons
a. Therefore, use 25 loads (500 tons / 20 tons = 25 loads) for the sublots.
b. Place 25 tokens numbered 1 through 25 in a container.
c. Draw a token from the container.
d. Record the number and return it to the container.
e. Calculate the sublots to be tested as follows:

Sample	Calculation	Load
1	Token #1 drawn = 1	= 1st Load
2	Token #16 drawn = 16 + 25	= 41th Load
3	Token #21 drawn = 21 + 25 + 25	= 71th Load
4	Token #6 drawn = 6 + 25 + 25 + 25	= 81th Load
5	Token #11 drawn = 11 + 25 + 25 + 25 + 25	= 111th Load

GDT-73 (Method A)

Example #2

Use the following information to calculate random sample loads utilizing Method B:

Plant production = 2,000 to 2,500 tons daily

Average load of haul vehicles = 20 tons

500 ton sublots

Tokens drawn: 10, 8, 16, 24, 2

Sample # 1 = Load 10

Sample # 2 = Load 33

Sample # 3 = Load 66

Sample # 4 = Load 99

Sample # 5 = Load 102

GDT-83

Binder Calculations

To calculate percent binder in sample.

- **Final weight of silica**
- **Minus the beginning weight**
- **Equal the difference.**
- **Add the difference to the weight of the dry sample extracted aggregate**
- **Equal the total dry weight of the extracted aggregate.**

Sample No. _____ Type of Mix 19mm SP Time _____
Temp. _____ Final Wt. SILICA 226.0
Total Wt. _____ Begin Wt. Silica 124.0
Dry Wt. _____ Diff. 102.0
Diff. Wt. _____ + Dry Sample 2130
% AC _____ Total Dry Wt. 2232.0
Job Mix AC 4.90 Lime Check (%) _____
Strip Test _____ Time _____

SIEVES	WEIGHT	% RET.	% PASS	DEV.	JMF
19mm	32.4				100.0
12.5mm	252.0				86.0
9.5mm	803.5				65.0
2.36mm	1562.4				32.0
300µm	1930.7				12.0
75µm	2113.7				5.0

Date _____ Lot No. _____ Load No. _____
REMARKS:
INSPECTOR _____

Binder Calculations

- **Subtract the total weight of the sample**
- **Minus the total dry weight**
- **Equal the difference.**

Example

- **2346.3 - 2232.0 = 114.3**

- **Divide the difference by the total weight of the sample times 100 equal the percent AC.**

Example

- **114.3 ÷ 2346.0 x 100 = 4.87**

Sample No. _____ Type of Mix 19mmSP Time _____
Temp. _____ Final Wt. SILICA 226.0
Total Wt. 2346.3 Begin Wt. Silica 124.0
Dry Wt. 2232.0 Diff. 102.0
Diff. Wt. 114.3 + Dry Sample 2130
% AC 4.87 Total Dry Wt. 2232.0
Job Mix AC 4.90 Lime Check (%) _____
Strip Test _____ Time _____

SIEVES	WEIGHT	% RET.	% PASS	DEV.	JMF
19mm	32				100.0
12.5mm	336.5				86.0
9.5mm	766.8				65.0
2.36mm	1491.0				32.0
300µm	1842.5				12.0
75µm	2017.1				5.0

Date _____ Lot No. _____ Load No. _____

REMARKS:

GDT-125

TO CALCULATE THE AC FROM THE BURN TICKET:

% LOSS
- % TEMP COMP
+ CALIB. FACTOR
EQUALS % AC

- **Determine the AC Content based on the information given:**
- **Total Mass of Sample:** 2031.0 grams
- **Aggregate Dry Mass (including -200 & Ash):** 1927.1grams
- **Aggregate Dry Mass (Post Wash):** 1870.4grams
- **Ignition Oven Ticket**
- ----------
- Elapsed Time: 5:00
- Sample Weight: 2031g
- Weight Loss: 103.9g
- Percent Loss: 5.12%
- Temp Comp: 0.15
- Calib. Factor: - 0.28%
- Bitumen Ratio: 5.26%

AC Content = 5.25%

Section 400 Pay Factors

- Determine the “Applied Pay Factor” for the “type mix” listed, based on the asphalt cement content and sieve analysis.

Type Mix	Used As	Total Samples	Lot No.	A.C. %	3/8-in (9.5mm)	#8 (2.36mm)	Pay Factor
12.5mm SP	Surface	2	1	.42	8.6	6.6	1.00

Type Mix	Used As	Total Samples	Lot No.	A.C. %	½-in (12.5mm)	#8 (2.36mm)	Pay Factor
25mm SP	Subsurface	3	5	.75	9.4	6.7	.50

Type Mix	Used As	Total Samples	Lot No.	A.C. %	3/8-in (9.5mm)	#8 (2.36mm)	Pay Factor
12.5mm OGFC	Surface	3	8	.51	5.9	5.2	.50

Lime Checks

Master Lime Check

- **Example of Depleting Master Lime Check in lbs.:**

- Original lime pod weight ----------355lbs.
- 150 lbs. hung on weigh pod, scale reading-------496 lbs.

- 355 lbs. + 150 lbs. = 505 lbs. (scales should be reading)
- 505 lbs. – 496 lbs.(scale reading) = 9 lbs. difference
- (9/150) x 100= 6%

- Master Lime Check was out of tolerance **6%**

Master Lime Check

- **Example of Depleting Master Lime Check in tons:**

- Original lime pod weight ----------0.185tons.
- 150 lbs. hung on weigh pod, scale reading-------0.261tons.

- .185 tons X 2000= 370 lbs.
- .261 tons X 2000= 522 lbs.
- 370 lbs. + 150 lbs.= 520lbs.(scales should be reading)
- 522 lbs.(scale reading) – 520 lbs.(scales should be reading) = 2lbs.
- (2/150) X 100= 1.33%

- Master Lime Check was in tolerance @**1.33%**

Daily Lime Check

- **Example of a Daily Lime Check in lbs.:**

- Plant produces 180 tons dry aggregate per hour

- 320 lbs. Original lime scale weight
- 255 lbs. Lime scales reading after 1minute

- 320lbs – 255lbs = 65lbs lime in 1 minute
- 65 X magic 3 = 195
- 195/180= **1.08%**

Daily Lime Check

- **Example of a Daily Lime Check in tons:**

- Plant is inducing 190 tons dry aggregate per hour
- Plant is inducing 35 tons of dry RAP per hour
- 0.16 ton is the Original lime scale weight
- 0.12 ton is the lime scales reading after 1 minute

- .16 ton - .12 ton= 0.04 ton lime in 1minute
- 0.04 ton X 2000= 80 lbs. lime in 1minute
- 80 X magic 3= 240
- 190 tons dry agg. + 35 tons dry rap = 225 tons of total agg per hour
- 240/225= **1.07%**