

ALDOT-370-90
QUALITY CONTROL AND QUALITY ASSURANCE PROCEDURES AND
RESPONSIBILITIES FOR ASPHALT PLANT MIX PRODUCTION

1. Scope

- 1.1 This procedure outlines the Contractor's and the Alabama Department of Transportation's (ALDOT) responsibilities during the production and lab testing of asphalt plant mix for ALDOT projects. This procedure also establishes the minimum requirements for the Contractor's quality control (QC) plan for asphalt plants, required inspections, sampling and testing necessary to verify materials and product conformance to ALDOT specifications, and handling and distribution of test results and reports.

2. Referenced Documents

- 2.1 ALDOT Standard Specifications For Highway Construction and Special Provisions
- Section 106 Control of Materials
 - Section 410 Asphalt Pavements
 - Section 424 Superpave Bituminous Concrete Base, Binder, and Wearing Surface Layers
- 2.2 ALDOT Procedures
- ALDOT 155 Asphalt Plant Check List
 - ALDOT 210 Selecting Samples by the Random Numbers Method
 - ALDOT 324 Requirements for Plants Producing Asphalt Pavement Mixtures
 - ALDOT 349 Hot Mix Asphalt Testing Equipment
 - ALDOT 372 Approval of Recycled Asphalt Pavement & Reclaimed Asphalt Shingles
 - ALDOT 374 Certification Program for Hot Mix Asphalt Technicians
 - ALDOT 381 Method for Correlation of Marshall Hammers
- 2.3 BMT Forms
- BMT 20 Asphalt Plant Mixture Test Report
- 2.4 Materials, Sources, and Devices with Special Acceptance Requirements (MSDSAR) Manual
- List I-1 Aggregates
 - List I-4 Producers of Asphalt Products

- List I-5 Hot Mix Asphalt Plants
- List II-6 Hot Mix Asphalt Release Coating For Truck Beds
- List II-23 Admixtures for Asphalt Pavement
- List II-27 Warm Mix Asphalt Products & Processes

2.5 AASHTO Standards

- R42 Developing a Quality Assurance Plan for Hot Mix Asphalt (HMA)
- T 168 Standard Method of Test for Sampling Bituminous Paving Mixtures
- T 209 Standard Method of test for Theoretical Maximum Specific Gravity (Gmm) and Density of Hot Mix Asphalt (HMA)
- T 248 Standard Method of Test for Reducing Samples of Aggregate to Testing Size

3. Definitions

- 3.1 ALDOT (or the “Department”) – Alabama Department of Transportation, or any contracted affiliate acting on behalf of the Department.
- 3.2 HMA – Hot Mix Asphalt – Mixture of asphalt binder (Cement) and aggregate, which is produced at an elevated temperature (generally between 300-350°F) in an asphalt plant.
- 3.3 Inspector – An ALDOT employee/representative that is a certified by ALDOT as an Asphalt Level 1 Laboratory Technician.
- 3.4 Job Mix Formula (JMF) – The ALDOT approved asphalt mixture design.
- 3.5 LOT – unit of measure for asphalt plant mix used to determine frequency of testing and representing either 2800 tons for Superpave mixes or 2000 tons for open graded friction course (OGFC) mixes.

Note: A lot may be less than the tonnage given above if the lot has been terminated in accordance with the specifications, the total tonnage of asphalt on a project is less than 2000 or 2800 tons, or the ending tonnage of pay item is less than tonnage the normal required lot tonnage.

- 3.6 Pay Factor – A factor that is applied to the bid price of the asphalt mix placed. For example a pay factor of 1.00 means the Contractor will receive 100% of the bid price. A pay factor of 0.95 means the Contractor will receive 95% of the bid price.
- 3.7 Quality Control Technician – A Contractor employee that is certified by ALDOT as an Asphalt Level 1 Laboratory Technician.
- 3.8 Quality Control Sample (or “Acceptance Sample”) – The sample taken and tested by the Contractor. This sample is split into the Contractor’s primary acceptance sample and ALDOT’s Referee Sample.

- 3.9 Quality Assurance Sample (or “Verification Sample”) – The sample taken, usually on the prior or next truck after the Quality Control Sample, by the Contractor and tested by ALDOT to verify the Quality Control Sample. This sample is split into ALDOT’s Verification sample and the Contractor’s additional sample for comparison.
- 3.10 RAP – Recycled Asphalt Pavement – Processed millings from pre-existing roadway
- 3.11 RAS – Reclaimed Asphalt Shingles
- 3.12 Referee Sample – The sample to be tested by the Bureau of Materials and Tests in the event test results are not comparable between quality control and quality assurance samples.
- 3.13 WMA – Warm Mix Asphalt – processes or additives to allow mixture production and placement to occur at temperatures (30-100°F) lower than conventional HMA without sacrificing performance.

4. Contractor Responsibilities

- 4.1 General Requirements - The Contractor shall perform all inspections and testing required, verifying product conformance to the contract and all applicable ALDOT specifications.
- 4.2 **Quality Control Plan** –
The Contractor shall develop, adopt, and submit in writing a proposed Quality Control Plan for verification to the Materials and Tests Engineer during the annual plant inspection or as required by Area Materials Engineer. The plan shall contain the Contractor’s sampling, testing, and inspection procedures and frequencies necessary to maintain constant production control. The minimum required sampling and testing schedule is outlined in **Section 106** of the ALDOT Specifications. The Contractor shall keep a copy of the Quality Control Plan at all production plants, and make it available to both ALDOT and Contractor employees.

The Quality Control plan shall include the following minimum required items:

- 4.2.1 **Stockpiles** –
 - Incoming aggregate processing (gradation, identification of piles, inspections for segregation, etc.),
 - Daily inspections of stockpiles (segregation, identification, use of stockpile, etc.),
 - Verification of aggregate from **MSDSAR List I-1**.
- 4.2.1.1 The Contractor shall establish and maintain an effective method for controlling materials not meeting the specifications of the mix. This method will include procedures for identification and disposal of any non-conforming materials located in the stockpiles. This method shall be included into the Contractor’s Quality Control Plan.

4.2.2 **Cold Bins –**

- Calibrate the cold feed gate settings to observe the operation of cold feed for uniformity,
- Observe the loading of bins to ensure that correct procedures (no segregation, overflow of materials, correct materials, etc.) are followed
- Calibrate the moisture probes according to the manufacturer's recommendation or determine moisture at least every eight hours of plant operation.

4.2.3 **RAP/RAS Stockpiles –**

Shall be in conformance with **ALDOT-372**.

4.2.4 **Dryer –**

- Daily observations of the burner, ensuring working correctly,
- Pyrometer operation and calibration.

4.2.5 **Trucks –**

Daily inspection of trucks to ensure the following:

- Truck beds are clean,
- A 3/8" hole the side of the truck for checking temperatures is present,
- Segregation does not occur when loading,
- The truck is equipped with a functional tarp. Mesh tarps are not allowed.

4.2.6 **Asphalt Cement –**

- Verification that asphalt used is from **MSDSAR List I-4**,
- A copy of all asphalt temperature-viscosity curves generated by the supplier is maintained.

4.2.7 **Equipment calibrations –**

Ensure that all applicable equipment is calibrated, including:

- Lab equipment (Ovens, Scales, Thermometers, etc.),
- Truck Scales,
- Temperature recorders and controllers
- Aggregate, RAP and RAS feed bins.

4.2.8 The Contractor shall include provisions in his plan for the following items:

- Checking the mixing times of the plant,
- The operation of the weigh buckets and scales,
- The operation of the mixer blades in the mixer, condition of the blades and clearance,
- The determination of the gradations for the gate calibrations on the feed bins,
- The determination process of the moisture control,
- The overall plant calibration processes.

4.3 All plants producing asphalt mixtures shall be listed in **MSDSAR List I-5** and maintained in accordance with **ALDOT-324**.

4.4 All quality control sampling and testing shall be performed in accordance with **Section 106 of ALDOT Standard Specifications**.

4.5 **Control Charts –**

4.5.1 The Contractor is required to maintain all current control charts in accordance with **AASHTO R 42, Section 12.4** in the laboratory where they are readily available. The target value, individual values, running average of last four samples, and upper/lower limits (where applicable) shall be plotted for the following parameters:

- Gradation of aggregate and RAP/RAS stockpiles
- Asphalt cement content of hot mix, RAP, and RAS
- Stability and flow (for Marshall mix designs)
- Bulk specific gravity of compacted HMA
- Percent air voids of laboratory compacted samples
- Voids in the mineral aggregate (VMA) of laboratory compacted samples
- Theoretical maximum density
- Mixture gradation of each control sieves as noted on the JMF
- Dust-to-asphalt ratio.

4.5.2 A copy of the control charts shall be given to the ALDOT Inspector at the end of each lot.

NOTE: The Charts will be used to determine if the asphalt mix production is in control.

4.5.3 The Contractor shall be responsible for the process control of all materials, blending, mixing, and placing operations.

4.6 **Contractor Personnel –**

4.6.1 The Contractor shall have certified personnel at the plant during production and on the roadway during placement of the asphalt. The technicians shall be certified according to **ALDOT 374**.

4.6.2 The Contractor shall employ an Asphalt Level III Mix Design Technician who will be responsible for the development of all mix designs.

4.6.3 The Contractor shall have present at the production plant, an Asphalt Level I Laboratory Technician who shall be responsible for conducting the Contractor's sampling and testing of plant mix asphalt.

4.6.4 The Contractor shall have at least one Roadway HMA Pavement Technician on site at the roadway when producing and placing any layer of plant mix asphalt.

4.6.5 In addition, the Contractor shall have an Asphalt Level II Quality Manager Technician readily available during the production and placement of plant mix asphalt.

- When it becomes evident to the Department that the Quality Control Technician cannot perform as required by the position, the Department will revoke the certifications and require appropriate replacements of personnel in accordance with **ALDOT 374**.
- The Contractor's quality control procedures, inspection, and tests shall be documented and that information shall be made available to the Department on a daily basis throughout the duration of the job.

4.7 **Laboratory and Equipment –**

- The Contractor shall provide and be responsible for maintaining a fully equipped laboratory at the production plant.
- The laboratory shall meet the requirements given in **Subarticle 106.03(d) of ALDOT Standard Specifications** and **ALDOT-349**.
- The Contractor's laboratory shall have enough space and independent testing equipment for the Department's inspector to share the laboratory. The Contractor is responsible for the laboratory building; the Department is responsible for the independent testing equipment (scales, manometers, sieves, and compactors).
- All testing equipment shall be checked and calibrated in accordance with the applicable standards and as directed by the Bureau of Materials and Tests.
- In addition to the above requirements, the Contractor's Marshall Hammer used for verification testing shall be correlated with the Materials and Tests' Marshall Hammer as outlined in **ALDOT-381**.
- Other requirements are located in **ALDOT-324** and **ALDOT-155**.

4.8 **Sampling and Testing**

- 4.8.1 The Contractor's Quality Control Technician shall take a sample of hot mix/warm mix from a loaded truck when directed by the Department (approximately 130 lbs. (60 kg)) according to **AASHTO T 168**. Immediately after the truck has completed loading and moves to the sampling stand, obtain at least three approximate equal samples, avoiding the extreme top surface. Take care to avoid contamination and/or segregation.
- 4.8.2 Split this sample into two 65 lb. (30 kg) samples, the Contractor's sample and the referee sample using a splitter or quartering procedure as prescribed in **AASHTO T 248**.
- 4.8.3 Give the referee sample to the Department (in case it is needed later) and run all needed tests on the Contractor's sample.
- 4.8.4 Using a flat non-absorptive surface (that may be heated), reduce the sample by **AASHTO T-248 (Method B)** to the required amount to compact specimens and determine the maximum gravity of the mix.
- 4.8.5 Compact two specimens when making 150 mm diameter specimens.

- When using slag as an aggregate, compact one additional specimen;
- Determine the average bulk specific gravity of all the specimens,
- Disregard the specimen's individual bulk specific gravity that is furthest from that average and
- Then re-compute the average bulk specific gravity using the remaining specimens for determining the laboratory compacted air voids.

4.8.6 Determine the maximum gravity of the mix by **AASHTO T-209**. The maximum gravity used to compute Contractor air voids is the average of the last four maximum gravity test results.

- At startup of Lot one (1), the original maximum gravity is used, then an average of the first gravity and the second maximum gravities are averaged, then the average of the first, second, and third maximum gravity test results are averaged until four results are available to use.
- These carry over from day-to-day in a continuous running average of the last four test results.
- This running average is used by the Department and the Contractor to determine the percent of maximum gravity for mat density (roadway compaction).
- When slag is used as an aggregate, the Contractor shall use a running average of the last four bulk specific gravity determinations to calculate air voids.
- The Department will not use a running average to calculate air voids.

4.8.7 An independent sample for the Department's sample shall be taken from the next loaded truck when directed by the Department (approximately 130 lbs. (60 kg)) according to **AASHTO T 168** as listed in 4.8.1.

4.8.8 Split this sample into two 65 lb. (30 kg) samples, the Department's sample and the Contractor verification sample (the Contractor may test this sample if desired; it is not required).

4.9 **Documentation -**

- The Contractor shall maintain documentation of all inspections and tests. The documentation shall indicate the nature and number of tests produced, test results, the number and type of deficiencies found, the quantities approved and rejected, and the nature of any corrective action taken if needed.
- The Contractor's proposed documentation procedures will be subject to the review and approval of the Department prior to the start of work.
- The Department will also perform compliance checks during the progression of the work.
- All inspections and test results of conforming and non-conforming materials shall be documented on approved forms and charts which shall be kept up to date and complete, and shall be available at all times to the Department during the performance of the work.
- Test properties for materials and mixtures shall be documented on a **BMT 20** form in accordance with the applicable requirements of the Department.

- All charts and records documenting the Contractor's quality control tests and inspections shall become the property of the Department in the form of an electronic document(s) upon completion of the work.

4.10 Corrective Actions –

- The Contractor shall take prompt action to correct any equipment malfunctions, process changes, or other problems which have resulted or could result in the furnishing of materials, products, or completed construction not conforming to the requirements of the contract or specifications.
- Should it become evident to the Department that the Contractor is not controlling the process and is making no effort to take corrective action, the Department will require that plant operations for ALDOT projects be ceased until such time as the Contractor can demonstrate that he can and will control the process. If the Contractor's production is ceased, an offsite trial batch of approximately 25 to 30 tons will be used to determine if the Contractor can start back up on the project. The decision to start back up is after the trial batch has been tested and meets the approval of the Engineer.

4.11 When any of the following occur, no plant mix produced may be accepted by the Department until the mixture is tested and shown to be within specification limits:

- VMA results are out of tolerance on two (2) consecutive acceptance tests.
- Gradation results are out of tolerance on the same control sieves as specified on the JMF on two (2) consecutive acceptance tests.
- Dust-to-Asphalt ratio results are out of tolerance on two (2) consecutive acceptance tests.

Note: *If the Contractor's production is ceased by the Department, the Contractor shall follow procedures outlined in Subarticle 410.08(c) of ALDOT Standard Specifications to re-start production.*

4.12 Sampling methods and testing procedures used by the Contractor to determine quality conformance of the materials and mix shall be the same as those used by the Department.

4.13 The Department reserves the right to inspect materials not manufactured within the Contractor's facility. The Department inspection will not constitute acceptance nor shall it in any way replace the Contractor's inspection or otherwise relieve the Contractor of his responsibility to furnish acceptable materials and product. Subcontracted or purchased materials shall be inspected by the Contractor when received, to ensure conformance to contract requirements and ALDOT specifications. The Contractor shall report to the Department any nonconformance found in a Department-approved material source and shall require the supplier to take necessary corrective action before using the material.

5. Department Responsibilities

5.1 The Department will approve material and mix designs, inspect plants and equipment, and monitor control of the operations to assure conformity with the applicable specifications. This will include the Contractor's field laboratory and equipment to ensure

it is in accordance with **ALDOT-349**. The Department's Quality Assurance Plan is further detailed in **Section 106 of ALDOT Standard Specifications**.

- 5.2 The Department reserves the right to sample and test the mixture at any time and to make and test specimens at the production plant or at the roadway for comparative and verification purposes. The information will be used to assure the Contractor is producing the mixture as per the JMF submitted to the Department for the project and to determine if the mixture meets the required specifications.
- 5.3 The Department will ensure all contractual requirements and specifications are met for the project by quality assurance testing and inspection of the Contractor's quality control by use of the following methods:
 - 5.3.1 Monitor the Contractor's sampling and testing processes for compliance with applicable AASHTO Standards and ALDOT specifications.
 - 5.3.2 Select random numbers, in accordance with **ALDOT-210**, to determine sampling times for both Contractor and Department samples. Contractor should be notified approximately fifteen (15) minutes prior to sampling time. All acceptance testing will be monitored by the Department.
 - 5.3.3 Direct the Contractor to collect a verification sample following each acceptance sample (typically taken from the subsequent truck). Store all verification samples and randomly select a minimum of one sample per LOT per day for verification testing. Perform verification testing on testing equipment furnished by the Department, independent from the Contractor's testing equipment.
 - 5.3.4 Randomly select one of the stored samples and run verification tests.
 - 5.3.5 Visually inspect all aspects of the plant operation, including but not limited to stockpiles for contamination and segregation, cold feed bins for proper operation, asphalt mixtures for segregation and drain-down, or any other unusual conditions.
 - 5.3.6 Visually inspect all trucks for clean truck beds and good coating of release agent. The inspector will verify the release agent is from an approved manufacturer via **MSDSAR List II-06, Hot Mix Asphalt Release Coating for Truck Beds**.
 - 5.3.7 Perform required testing on roadway cores and secure the cores in a locked storage area until the LOT is complete. Once test results have been determined, the Project Manager and the ALDOT Roadway technician shall be notified of the results.

Note: Secured roadway cores shall only be accessible by the Department. Cores may be discarded after the closure of the LOT.
 - 5.3.8 Compare ALDOT quality assurance test results to the Contractor's acceptance test results according to **Table V of Section 410 of ALDOT Standard Specifications**.

5.3.9 Determine the pay factor for the LOT per **Article 410.08 of ALDOT Standard Specifications**.

5.3.10 Submit referee samples to the Bureau of Materials and Tests, Central Laboratory when required by **Item 106.09(c)4 of ALDOT Standard Specifications**.

Note: *Referee samples not needed for dispute resolution may be discarded after the closure of the LOT.*

5.3.11 Check Contractor's documentation, including raw data computations, control charts (if applicable), test reports, etc.

5.4 The inspector will keep a plant diary that will remain at the plant during production. Diary reports should include but are not limited to:

- Project production information (Project, pay item, and LOT numbers)
- Contractor's testing procedures and compliance with specifications
- Corrective Actions
- Notes from stockpile inspections
- General equipment inspections of the production plant
- Daily random numbers and corresponding tonnages
- Times samples were taken each day
- Truck temperatures

6. Evaluation/Distribution of Test Reports

6.1 The Contractor shall report all Quality Control/Acceptance test results on a **BMT-20** form.

6.2 The ALDOT inspector will report the Quality Assurance/Verification test results on a separate **BMT-20** form.

6.3 **BMT-20** forms shall be organized according to each production LOT for a particular pay item. Test results for separate pay items shall be reported on separate **BMT-20** forms.

6.4 Tonnage of plant mix produced using the same job-mix formula for different pay items may be combined for testing. For payment purposes, the tonnage for each pay item shall be reported on each respective **BMT-20**.

6.5 The minimum test parameters included on the **BMT-20** test report shall be as follows :

- Air Voids
- Asphalt Content
- Dust-to-Asphalt Ratio
- VMA (Voids in Mineral Aggregate)
- Gradation – noting all sieves out of tolerance

6.6 The Contractor and ALDOT shall not use the same **BMT-20** Form. The ALDOT inspector shall receive a copy of the Contractor's original **BMT-20** to be submitted with the workbook. The Department will make every effort to issue test reports no later than the close of business the next normal working day.

6.7 The inspector will issue all test reports to the respective ALDOT project office at the close of each LOT.

7. Allowed Variation and Redesigning the Job Mix Formula

7.1 The Job Mix Formula must be redesigned if the following occurs:

- The source of aggregate, RAP, RAS, or **PG Grade of** liquid asphalt binder changes and/or,
- The gradation variation is greater than the requirements given in **Item 410.02(d)7 of ALDOT Standard Specifications** for the gradation from the job mix formula and/or,
- A component percentage varies by more than 25% of that shown on the job-mix formula.

Notes:

1. *For those components shown as 20% or more, a variation of 25% of the percentage for that component shown on the job mix formula is allowed.*
2. *For those components shown as less than 20% a variation of ± 5 percent is allowed.*
3. *However, do not exceed the maximum percentages allowed by the specifications for limestone and other polish-prone aggregate or maximum amount allowed for RAP and RAS and.*
4. *And do not fall below the minimum requirements for crushed particle count, fine aggregate angularity, etc.*

Example:

For a job-mix formula based on a Section 424 Superpave wearing surface mix, ¾" (19 mm) maximum aggregate size, the allowable percentage variation would be according to the following table:

Job Mix Formula	Material Description	Allowed Variance	Allowable Variation
15	¾ in. (19 mm) Slag	<20% = ±5%	10 – 20
40	½ in. (13 mm) - Dust Slag	25% = ±10%	30 - 50
20	Natural Fine Aggregate	25% = ±5%, with FAA Requirement	15 - 25
25	Limestone (BPN 25)	Limestone Restriction (BPN) 25% = - 6% or +5%	19 - 30

- 7.2 Should the Contractor wish to revise the JMF, a written request shall be submitted to the Materials and Tests Engineer for approval.
- 7.3 The Materials and Tests Engineer must approve the request prior to permitting the change to be made.
- 7.4 After approval of the JMF, adjustments for individual sieve sizes will be allowed provided the adjustments fall within the tolerances found in **Item 410.02(d)7 of ALDOT Standard Specifications.**
 - 7.4.1 ± 7% for the No. 4 (4.75 mm) and larger sieves
 - 7.4.2 ± 4% for the No. 8 (2.36 mm) through the No. 100 (150 µm) sieve
 - 7.4.3 ± 2% for the No. 200 (75 µm) sieve
 - 7.4.4 ± 0.40% for the asphalt cement