SUBJECT: QUALITY CONTROL AND QUALITY ASSURANCE PROCEDURE FOR HOT MIX ASPHALT (HMA) PRODUCTION

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<thead>
<tr>
<th>APPROVED: /s/ John E. Rondinaro 11/13/19</th>
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<tbody>
<tr>
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<tr>
<th>Supersedes: MP 401</th>
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</thead>
<tbody>
<tr>
<td>Dated: May 2013</td>
</tr>
</tbody>
</table>

### I. SCOPE

II. GENERAL ................................................................. 4

A. Technician Certification .................................................. 4

B. Quality Control .............................................................. 4

1. Quality Control Plan (QCP) ............................................. 4

2. Plan Administrator ......................................................... 5

3. Quality Control Technician .............................................. 5

4. Aggregate Management .................................................... 5

   a. General ....................................................................... 5

   b. Friction Aggregate Management .................................... 6

   c. Aggregate Specific Gravity .......................................... 6

   d. Aggregate Consensus Properties ................................... 6

5. Reclaimed Asphalt Pavement (RAP) ...................................... 6

6. QC/QA Process Control Documentation ................................ 6

C. Quality Assurance ............................................................ 7

D. Hot Mix Asphalt Plant Requirements .................................. 8

   1. General ....................................................................... 8

   2. Annual Approval .......................................................... 8

   3. Scales, Continuous Weigh Systems and Meters .................... 8

E. Plant Lots and Sublots ......................................................... 8

   1. Plant Lot ...................................................................... 8

      a. Certified Lot .......................................................... 8

      b. Production Lot ........................................................ 8

   2. Plant Sublot .................................................................. 8

      a. Early Termination of a Sublot ...................................... 9

      b. Request for Larger Sublot .......................................... 9

   3. Mixture Storage ............................................................. 9

   4. Night Production ............................................................ 9

III. PRODUCTION ................................................................. 10

A. Preparation of PG Binder .................................................. 10

B. Preparation of Aggregates .................................................. 10

   1. Batch Plants ................................................................... 10

   2. Drum Mix Plants .......................................................... 10

C. Gradation Targets ............................................................. 10

D. Production Gradation Tolerance .......................................... 10

E. HMA Production in Automatic Mode .................................... 11

F. Mixing ............................................................................. 12

   1. Requirements for Mixes without RAP in Batch Plants .......... 12

   2. Requirements for Drum Mix Plants and for Mixes with RAP in Batch Plants ...... 12
G. Plant Production Monitoring .......................................................... 12
   1. Process Control ........................................................................ 12
   2. Automation and Recordation ................................................... 12
   3. Mixture PG Binder content ...................................................... 12
   4. Mix Design Production Suspension Criteria .................................. 12
H. Determination of HMA Quantity .................................................. 13
I. Equipment Failure ........................................................................ 13
   1. Printer Breakdown ................................................................... 13
   2. Gyratory Compactor Breakdown .............................................. 13
J. Delivery Ticket ............................................................................. 13

IV. SAMPLING and TESTING ............................................................. 15
   A. General Sampling and Testing .................................................. 16
      1. QC Sampling and Testing ...................................................... 16
         a. Certified Lot ...................................................................... 16
         b. Production Lot ................................................................... 16
      2. QA Sampling and Testing ...................................................... 16
         a. Certified Lot ...................................................................... 16
         b. Production Lot ................................................................... 16
         c. Dispute Sample .................................................................. 17
   B. Random Sample Determination .................................................. 17
      1. QC Random Sample ................................................................ 17
      2. QA Random Sample ................................................................ 17
      3. Criteria for Adjusting Random Sample Point(s) ......................... 17
         a. Damaged/Non-Representative Samples .............................. 17
         b. Early Termination of a Sublot ............................................. 18
         c. Production Stops Earlier Than Expected ............................ 18
   C. PG Binder Sample ..................................................................... 18
   D. Gradation Sample ...................................................................... 18
      1. Mix QAF Based on Air Voids .................................................. 18
   E. Air Void Analysis ...................................................................... 19
   F. Friction .................................................................................... 20
   G. Precision and Rounding ............................................................ 20
   H. Retaining Samples ................................................................... 20

V. ΔQC/QA TEST RESULT VALIDATION (for Production of Volumetric Mixes > 500 tons) .................................................. 21
   A. Single Sublot Validation .......................................................... 21
   B. Multiple Sublot Validation Process ........................................... 21
   C. Validation Dispute Process ...................................................... 22
      1. Specific Gravity Validation Dispute Process ......................... 22

VI. DETERMINING QUALITY ADJUSTMENT FACTORS (QAF) ............................................................................... 22
   A. Certified Production ≤ 500 Tons and Production of Non-Volumetric Mixes ............................................................................. 22
   B. Production > 500 Tons .............................................................. 23
      1. QAF Based on Air Voids .......................................................... 23
   C. Special Situations ..................................................................... 24
      1. Verification Status .................................................................. 24
      2. First Lot of a Production Status JMF Each Year ...................... 25
      3. QC and/or QA Sublot Results Not Available .......................... 25
         a. Either Only QC Results or Only QA Results ....................... 25
         b. No Results Obtained ......................................................... 25
      4. Dispute Sample Specimens Do Not Meet Allowable Specimen Tolerance .............................................................. 25
      5. Sublots with Calculated QAF of 0.85 .................................... 26
I. SCOPE

This procedure describes routine Quality Control and Quality Assurance activities performed during the production of Hot Mix Asphalt (HMA). This Materials Procedure also applies to Warm Mix Asphalt (WMA) with modifications recommended by the Technology supplier. When Reclaimed Asphalt Shingles (RAS) is allowed for use, the provisions of Reclaimed Asphalt Pavement (RAP) in this document shall apply.

II. GENERAL

A. Technician Certification.

The Quality Control Technician (QCT) and the Quality Assurance Technician (QAT) must each possess a current New York Construction Materials Association Certification or its equivalent such as New England Transportation Technician Certification Program (NETTCP), as determined by the Director, Materials Bureau.

B. Quality Control.

Quality Control (QC) is defined as all activities required for the production of Hot Mix Asphalt (HMA) that meets all specification requirements. The Producer shall incorporate a Quality Control system for HMA and be responsible for all QC activities at the production facilities.

The Department will monitor the Producer’s conformance to the quality control plan, specification and this materials procedure, including testing and retaining QC samples for specification conformance and technician proficiency.

1. Quality Control Plan (QCP). The Producer shall provide a QCP to the Regional Materials Engineer (RME) that outlines all phases of HMA production. The QCP will serve as an official agreement with the Department and it will outline all QC activities performed to ensure the HMA production is in compliance with the specification requirements. The RME may require additional information to be included for unique situations pertaining to the Region. When developing a Control Plan, do not rewrite portions of the specifications in the Control Plan or include copies of forms supplied by the Department.

- The QCP will list the Control Plan Administrator, a designated assistant, and all personnel associated with HMA production, including their title, name, phone number, and function necessary to implement the QC program. Each page will be numbered (Page # of #) and will include two “Initial/Date” lines at the bottom of each page.

- The Producer shall submit the QCP to the RME for initial approval at least 21 calendar days prior to HMA production for the Department.

- After the QCP has been assigned initial approval, the Producer shall submit a statement outlining the QCP’s status to the RME each subsequent year at least 21 calendar days prior to any HMA production. The Producer shall submit amendments to the QCP, including personnel changes, for approval with the annual statement and as changes occur during the construction season. All modifications to procedures, equipment, and forms shall be included with explanations for these modifications.

- The Producer is responsible for administering the approved QCP.

- The Department reserves the right to stop production in the event the QCP, or any part thereof, is not being followed.

- A separate QCP is required for each production facility site. However, when more than one plant is located at a production facility site, only one QCP is required.
2. **Plan Administrator.** The Plan Administrator is a representative of the HMA Producer and shall have full authority to institute all operations of the QCP.

- The Plan Administrator is responsible to ensure all requirements are in conformance with the specification and this procedure.
- The Plan Administrator's signature shall be legally binding.
- One Plan Administrator may be responsible for multiple production locations.
- An Assistant Plan Administrator may be designated in the absence of the Plan Administrator.
- The Plan Administrator or Assistant Plan Administrator shall be available to communicate with Department personnel at all times.
- The Department may stop production when the Plan Administrator or Assistant Plan Administrator is not available.
- The Plan Administrator or Assistant Plan Administrator is also responsible for the following:
  - Location and control of friction aggregate stockpiles.
  - Outlining testing frequencies, testing procedures, and documentation procedures.
  - Periodic verification during production that the proper friction aggregate and the correct amount of friction aggregate is being included into the mix as outlined in Materials Method (MM) 28 Friction Aggregate Control and Test Procedures.
  - Documentation of all friction related activities (e.g. corrections to problems, modifications to friction aggregate mix controls and routine friction aggregate inspections during production) on Form BR 303 Quality Control Daily Diary.

3. **Quality Control Technician.** All QC activities are the responsibility of the Quality Control Technician (QCT).

- The production facility must have at least one certified QCT at each production facility site. Non-certified technicians may be utilized to supplement a certified QCT.
- HMA production will not be accepted unless a certified QCT is present during production. The lone exception is if the RME waives the requirement of the QCT’s presence for lots of 500 tons or less.
- Technicians associated with private (third party) testing organizations must meet the requirements specified above.
- The QCT is responsible for taking possession, and testing the QC sample.

The Department reserves the right to stop plant production in the event unacceptable QCT performance is noted. The RME or representative will immediately inform the Plan Administrator of the reason(s) for stopping production. The Department may require the Producer to replace unacceptable technicians before HMA production is allowed to continue. Annual and follow up IAST evaluation will be used to evaluate technician proficiency as well as analysis of routine QC/QA data.

4. **Aggregate Management.**

a. **General.** The Producer shall keep all Department-approved aggregates from different sources separate from each other unless approved by the RME. The Producer shall separate all Department approved aggregates from non-approved aggregates. The Producer shall stockpile all aggregates, including RAP, on free draining and clean bases such that the aggregates are not contaminated with foreign materials.
b. Friction Aggregate Management. The Producer shall provide training to plant process control personnel regarding friction aggregate stockpiling, blending and batching procedures and/or verification testing at the plant facility. If necessary, provide additional training during the production season. Also, list the names of each individual and the training received and maintain this record at the plant facility for review by Department representatives. As a minimum, the following personnel must be thoroughly familiar with all friction aggregate control procedures.

- Plan Administrator and Assistant Plan Administrator
- Plant Superintendent
- Quality Control Technician
- HMA Plant Operator
- Loader Operator/Truck Driver feeding HMA Plant

c. Aggregate Specific Gravity. Aggregate specific gravity testing is required for volumetric mix designs and when testing for Uncompacted Void Content (UVC) for coarse and fine aggregates. The Producer shall determine aggregate specific gravities at the beginning of each production season and at a minimum of one every 120 calendar days or as modified by the RME during the production season using test methods outlined in MM 5.16. The results shall be submitted to the RME with the mixture design submission. More frequent testing may be required for UVC and aggregate specific gravity variability as outlined in the quality control plan. Coarse aggregate specific gravity may be determined on an aggregate blend in-lieu of testing each aggregate size designation (i.e. 1A’s, 1’s, and 2’s). Document test results as required in Section II.B.6. QC/QA Process Control Documentation, below.

The aggregate specific gravities that are used to determine mixture volumetric properties during mixture verification and plant production monitoring will be based on the running average of the last six tests that were performed on each source. If an aggregate source does not have a history of six specific gravity tests, it must be tested a minimum of three times for specific gravity prior to use in volumetric mixes. The average of those three tests will be used for initial production.

d. Aggregate Consensus Properties. The Producer shall determine coarse and fine aggregate UVC for the No. 1 stone only using AASHTO T 326 Method C and passing the No. 8 (2.36 mm) sieve using AASHTO T 304 Method C respectively and percent flat and elongated particles for coarse aggregate retained on the 3/8-inch (9.5 mm) sieve using ASTM D 4791 at the beginning of each production season and at a minimum of every 120 calendar days or as modified by the RME during the production season using test methods outlined in MM 5.16. More frequent testing may be required in the quality control plan based on aggregate variability. The test results shall be documented as required in Section II.B.6. QC/QA Process Control Documentation below.

5. Reclaimed Asphalt Pavement (RAP). When RAP is used in the production of HMA, the proportion of RAP in the mixture can be reduced up to 5% below the original design proportion without having to submit a new design.

6. QC/QA Process Control Documentation. The QCT shall maintain all process control test data at each plant facility. This test data must be kept in a ringed type book or other format acceptable to the RME and stored in the facility laboratory. All test data is required to be legible and updated within a 24-hour period following each plant lot production. As a minimum, this book must contain the Control Plan, JMFs, test data summaries, daily production quantities, and aggregate specific gravity and consensus property test results.

The QCT shall:

- Document all test data on a BR 331 Production Summary Sheet. A separate production summary sheet is required for each mix design produced.
- Document all process control actions on a BR 303 Quality Control Daily Diary.
• Document storage location of material produced. Document storage location of a sample taken for testing.

The Producer shall use the applicable forms from the list below during production and shipping of HMA to Department projects. Official forms are available through the Regional Materials Engineer or at https://www.dot.ny.gov/divisions/engineering/technical-services/materials-bureau/forms-manuals

<table>
<thead>
<tr>
<th>Form Name</th>
<th>Form No.</th>
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<tbody>
<tr>
<td>Hot Bin Analysis - Volumetric</td>
<td>BR 154</td>
</tr>
<tr>
<td>Drum Mix Plant Production - Volumetric</td>
<td>BR 157</td>
</tr>
<tr>
<td>Drum Mix Plant Production - Non-Volumetric</td>
<td>BR 159</td>
</tr>
<tr>
<td>Hot Bin Analysis - Non-Volumetric</td>
<td>BR 161</td>
</tr>
<tr>
<td>Quality Control Daily Diary</td>
<td>BR 303</td>
</tr>
<tr>
<td>Quality Control HMA Certification</td>
<td>BR 307</td>
</tr>
<tr>
<td>Computation of Daily QAF for Air Voids Controlled Mixtures</td>
<td>BR 324a</td>
</tr>
<tr>
<td>Computation of Volumetric Mix Properties</td>
<td>BR 328</td>
</tr>
<tr>
<td>Determination of % NC in Superpave Mixes</td>
<td>BR 330</td>
</tr>
<tr>
<td>Production Summary Sheet</td>
<td>BR 331</td>
</tr>
<tr>
<td>Daily HMA Authorized Shipments</td>
<td>BR 343a</td>
</tr>
</tbody>
</table>

The use of control charts to monitor mix properties is highly recommended to assist the QCT in identifying trends, and when used, include them in the Test Data Binder.

C. Quality Assurance.

Quality Assurance (QA) is defined as all activities performed by the Department to assure that HMA production meets the specification requirements. The Quality Assurance Technician (QAT) is responsible for all Department QA activities. QAT responsibilities include:

• Overseeing non-certified technicians utilized to supplement certified QATs.

• Routinely monitoring and verifying HMA quality control sampling and testing procedures.

• Routinely monitoring the production process and determining if the Control Plan is being followed as submitted.

• Directing sampling, taking possession of, and testing the Quality Assurance sample to validate the QCT’s results.

• Reviewing the QCT’s documentation
  
  o Review the summary sheets, verify the results were documented correctly, and initial the forms where applicable.
  
  o Review plant production documentation, including the automation printouts for completeness, accuracy, and specification conformance.
  
  o Review the QC Plant Diary and verify the daily process control information is documented by the QCT on a daily basis as required by the Control Plan.

• Determining the Quality Adjustment Factor (QAF) for each production lot.

The Producer reserves the right to request, in writing, the replacement of a QAT in the event unacceptable performance is noted. The Plan Administrator or representative will immediately inform the RME of the reason(s) for the Producer’s concern. Annual and follow up IAST evaluation will be used to evaluate technician proficiency.

Some general, non-mix specific QA testing, such as aggregate specific gravity, friction and consensus properties testing, may be sampled and tested by the Region or Main Office Materials.
D. Hot Mix Asphalt Plant Requirements.

1. General. HMA mixing plants must be of sufficient design and capacity to produce HMA as specified. HMA mixing plants that differ from conventional designs will be considered for use by the Director, Materials Bureau. HMA plant requirements are in Appendix A – HMA Plant Requirements.

2. Annual Approval. Each HMA mixing plant requires initial and annual approval by the Director, Materials Bureau. The RME may disapprove the use of a previously approved mixing plant at any time for non-conformance of the requirements. Once disapproved, production for Department projects will not be allowed until corrective measures have been implemented to the satisfaction of the RME.

3. Scales, Continuous Weigh Systems and Meters. The Producer shall perform tests on scales, continuous weigh systems, and meters for accuracy, at no cost to the Department. These tests must be performed by a qualified technician using procedures outlined in Materials Method (MM) 27, Plant Equipment Inspection Manual. The test must be performed at the following frequency:

- Annually, prior to use for Department work.
- At intervals of not more than 90 calendar days.
- Whenever the plant changes location.
- At any time directed by the RME.

The Producer shall provide a cradle or test platform, approved by the RME, for each scale and at least 10 certified 50 lbs. (25 kg) test weights for performing scale accuracy tests. The certification of compliance for the test weights must be made available upon request at the time of the scale accuracy test. The use of a set of test weights for multiple facilities may be permitted, providing that the test weights are available for use within one hour after request. The Producer shall provide sufficient number of test weights to test belt scales within the production range. When directed by the Regional Director, the Producer shall protect the scales, and displays from manipulation by locking or sealing. Any evidence of tampering will be cause for rejection.

E. Plant Lots and Sublots.

1. Plant Lot. A plant lot is defined as the quantity, in tons, of HMA produced per plant for each mix design in one day, whether daytime or nighttime production. The Producer must notify the RME when continuous production is anticipated at least one day prior to any production of this type. If a plant is producing continuously for a calendar day or more, the plant lot will be defined according to 4. Night Production, below.

   When different mix designs are produced on the same day, then each mix design represents a separate plant lot.

   For each mix design produced, the QCT will assign plant lots numbered consecutively throughout the production season starting with the number one at the beginning of each calendar year’s production and increase the lot number by one.

   a. Certified Lot. Plant lot quantities of volumetric mixes of 500 tons or less may be certified by the QCT. Non-volumetric HMA mixes produced for applications such as permeable base, shim, curb, driveway, patching, temporary pavement, etc. will also be certified regardless of the daily quantity produced for that purpose. All certified production must meet the requirements outlined in this procedure and specification. The RME may waive the presence of the QCT for any certified production less than 500 tons.

   b. Production Lot. A plant lot with quantities of volumetric mixes greater than 500 tons requires both QC and independent QA testing.

2. Plant Sublot. A Plant lot is divided into sublots. A sublot is defined as a portion of a plant lot not to exceed 1000 tons. A production lot may be divided into equal size sublots less than 1000
tons each if the Producer notifies the RME or the QAT prior to each day's production. When production for the last sublot of the day exceeds 1000 tons by less than 150 tons, the excess will be incorporated into the previous sublot. The sublots are assigned a consecutive letter (A-E) on a daily basis.

Note: When a Lot has multiple sublots and one of the sublots has an assigned QAF of 0.85, the sublot with QAF of 0.85 will be evaluated as a separate Lot. The assigned letters for the remaining sublots shall be revised accordingly.

a. **Early Termination of a Sublot.** The QCT may request to terminate a sublot early under any of the following which could result in a QAF < 1.00:

   - Review of the QCT or QAT random sample heights during gyration of the specimen
   - The random sample test results
   - Process control information

   The QCT shall contact the RME prior to terminating a sublot. New sublots and random sample points will be determined based on the quantity of stored material and remaining production as described in Section IV.B.3.b. Early Termination of a Sublot. Terminating more than one sublot per lot will result in a stop production order for that mix design until the issue can be resolved.

b. **Request for Larger Sublot.** If daily production of a mix design is greater than 3000 tons, the producer may request the sublot size be increased to 1250 tons. This request should be included in the facilities control plan.

3. **Mixture Storage.** HMA mixtures may be held in holding bins which are especially designed for that purpose. The holding bins require initial approval by the Director, Materials Bureau as described in Appendix A, II. Hot Mix Asphalt Holding Bins. If the HMA mixture from a holding bin shows signs of aggregate segregation, PG Binder migration, PG Binder hardening, or improper temperature control, delivery from the holding bin shall be discontinued until satisfactory results can be achieved to the satisfaction of the RME.

   When volumetric mixtures are stored prior to delivery, the stored quantity will be incorporated into the plant lot associated with the date of delivery. If there is no production to incorporate into, consider the stored quantity a new plant lot.

   When non-volumetric mixtures are stored prior to delivery, incorporate the stored quantity into the plant lot associated with the date of production. The lot number and daily QAF determined during production will be associated with the stored quantity.

   The Producer must have a process to identify the storage location of all material being produced. The Producer will also note any change to storage location. The Producer should be able to approximate when any material in a storage facility was produced in terms of tonnage.

4. **Night Production.** If continuously producing for a calendar day or more, the plant lot will be defined when the plant's employee shift change occurs. The plant lots for stored material will be associated as specified in Section II.E.3. Mixture Storage, above.
III. PRODUCTION

A. Preparation of PG Binder. The Producer shall heat the PG Binder to the temperature recommended by the PG Binder supplier in a manner that will avoid overheating and provide a continuous supply to the mixer at a uniform temperature.

B. Preparation of Aggregates.

1. Batch Plants. When a batch plant is located at an approved aggregate processing facility, aggregate is permitted to be transferred from the facilities discharge point to the plant's cold feed bin. However, if the RME determines that the results of aggregate gradation or moisture content are non-uniform, this transfer of aggregate will no longer be permitted.

   The Producer shall dry the aggregates for the mixture and heat to the required temperature. Aggregates are considered dry when the moisture content just prior to batching does not exceed 0.5 percent of oven-dried weight. Drying and heating must not damage or contaminate the aggregate. After heating and drying, the Producer shall screen the aggregates into fractions and place into separate compartments.

   When RAP is weighed in the common scale or separately, the RAP design batch weight must be increased to compensate for moisture content. RAP may be batched between the aggregates when weighed in the common scale. All requirements pertaining to aggregates apply to RAP, including the equipment requirements for automated proportioning and recordation stipulated for aggregates in Appendix A, I. HMA Mixing Plant, except that the automation system must adjust for the binder contribution from the RAP and it must be printed on the ticket.

2. Drum Mix Plants. Direct transfer of aggregates from the processing facility's discharge point to the plant's cold feed bin is not permitted.

   The aggregates for the mixture must be from supplies having a uniform gradation and moisture content. The aggregates must have stable moisture contents as determined by the QCT.

   Determine the final acceptance for aggregate gradation from samples of the composite aggregate taken by the automatic sampling device described in Appendix A, C. 7. Automatic Aggregate Sampling Device.

   The Producer shall introduce RAP into the drum so that it will not come in direct contact with the burner flame. Mixing RAP with other aggregates must occur before the asphalt binder introduction point. All requirements pertaining to aggregates apply to RAP including the equipment requirements for automated proportioning and recordation outlined in Appendix A, I. HMA Mixing Plant. In addition, RAP shall be added with a maximum variation of 0.5 percent of the total weight of HMA per interval of time. RAP shall be accumulatively recorded as dry material separately from other aggregates.

C. Gradation Targets. The Producer is responsible for notifying the RME of any changes to gradation targets prior to starting that day's production by email or fax. Failure to notify the RME of the target changes prior to starting production will result in using the previous day's targets. The gradation target for each sieve must be within a maximum of 5% from the targets on the current JMF in Production Status. The targets are not allowed to fall outside the design Control Points.

D. Production Gradation Tolerance. The HMA gradation shall be within the production tolerances specified in Table 1 based on the targets specified under Section III.C. Gradation Targets above. Table 1 does not apply to permeable base and shim. See Table 401-1 in §401 for these two items. The QCT shall take corrective action when the gradation test value(s) falls outside the allowable production tolerance.
### TABLE 1 – PRODUCTION GRADATION TOLERANCE

<table>
<thead>
<tr>
<th>Sieve Size Inch (mm)</th>
<th>1½ (37.5)</th>
<th>1 (25.0)</th>
<th>¾ (19.0)</th>
<th>½ (12.5)</th>
<th>⅓ (9.5)</th>
<th>¼ (6.3)</th>
<th>No. 4 (4.75)</th>
<th>No. 8 (2.36)</th>
<th>No. 16 (1.180)</th>
<th>No. 30 (0.600)</th>
<th>No. 50 (0.300)</th>
<th>No. 100 (0.150)</th>
<th>No. 200 (0.075)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Mixes except 6.3</td>
<td>±5</td>
<td>±5</td>
<td>±5</td>
<td>±5</td>
<td>±5</td>
<td>±5</td>
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</tr>
<tr>
<td>6.3 HMA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>±4</td>
<td>±4</td>
<td>±3</td>
<td>±3</td>
<td>±2</td>
<td>±2</td>
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**NOTE:**
1. The production tolerance does not apply to Maximum aggregate sieve size for any mix type except for 9.5 Top Course HMA and 19 Binder Course HMA mixes.
2. For 9.5 Top Course HMA and 19 Binder Course HMA mixes, the allowable production range is 95 - 100% since the control point for these mixtures is 97% at the ½ inch (12.5 mm) and 1-inch (25 mm) sieves respectively.

### E. HMA Production in Automatic Mode.
All production shall be in the automatic mode. When the automatic proportioning system interrupts production due to a component batched outside the allowable automation production tolerances, the Producer must correct the problem immediately. No more than 5 batches per sublot are allowed to be out of tolerance. When the number of out of tolerance batches exceeds 5 for a sublot, the QCT shall terminate production of the mix and contact the Regional Materials Office. Production of the mix will not resume until the RME is satisfied that appropriate action(s) have been taken to minimize HMA production outside the allowable tolerance. The following shall apply to determine if HMA mixture produced outside the allowable tolerances may be shipped to a project:

- **Between Single and Double Tolerance:** Mixture produced with a component batch weight outside the allowable automation tolerance, but not more than double the tolerance, may be shipped when all of the following occur:
  - Fewer than 5 previous batches for the sublot have been out of tolerance.
  - The QCT verifies the asphalt content of the batch is within the acceptable production range for the mix based on the target asphalt content and actual batch weights.
  - The QCT writes the actual asphalt content on the ticket and initials the batch ticket certifying that the asphalt content is within the acceptable production range and the batch is acceptable to ship.
  - The QCT provides a copy of the initialed out-of-tolerance batch ticket to the QAT and documents the out of tolerance batch in the QC Diary.

  Payment will not be made for out-of-tolerance batches shipped to the project that are not certified by the QCT or that exceed the allowable 5 batches per sublot.

- **More than Double Tolerance:** Any HMA mixture produced with a component batch weight that exceeds double the allowable automation tolerance shall not be shipped to the project. If the mixture is shipped, the following shall apply:
  - If the mixture is loaded directly into a truck from the pugmill, payment for the entire truck load of material shall not be made.
  - If the mixture is loaded into trucks from a silo, payment shall not be made for 20 tons of mixture for each batch that is out of double tolerance and shipped.

The only exception to the above requirements is batches that are smaller than the recommended minimum batch size at the request of the agency (ex. 1 ton of material requested by a maintenance crew that is not in a silo).
F. **Mixing.** The mixer shall be capable of producing a well-coated and homogeneous mixture at the specified temperature. The finished mixture must contain a minimum percentage of fully coated particles of 85% for base course and 95% for binder and surface course. The procedure for determining particle coating is available from the RME.

1. **Requirements for Mixes without RAP in Batch Plants.** The volume of aggregates and PG Binder in the mixer shall not extend above the tips of the mixing blades and shall not exceed the manufacturer's rated capacity of the mixer. The total quantity of material mixed shall not be less than 50% of the manufacturer's rated capacity of the mixer.

   The standard dry and wet mixing times for batch plants are 15 and 45 seconds, respectively. Any deviation from standard mixing times must meet the requirements outlined below and be approved by the RME.

   a. **Base Course Mixes.** The base course mixes shall be dried for at least the period of time necessary to discharge all aggregates into the mixer. The wet mixing period must then commence and continue until at least 85% of the coarse aggregate particles are fully coated or the finish mixing time exceeds ten seconds, whichever is longer.

   b. **Top and Binder Course Mixes.** The top and binder course mixes shall be dried for at least the period of time necessary to discharge all aggregates into the mixer or 10 seconds, whichever is longer. The wet mixing period must then commence and continue until at least 95% of the coarse aggregate particles are fully coated or the finish mixing time exceeds 10 seconds, whichever is longer.

2. **Requirements for Drum Mix Plants and for Mixes with RAP in Batch Plants.** The moisture content of the mixture upon discharge into the haul unit will not exceed 0.5% when tested in accordance with procedures referenced in Table 4 – Sampling and Testing, of this Materials Procedure.

G. **Plant Production Monitoring**

1. **Process Control.** The QCT may test any portion of a plant lot for process control. Based on the test results of process control testing, the QCT may make adjustments to the production to assure the mix design aggregate targets and the volumetrics, i.e., air voids, VMA, VFB, are within the specification limits. The results obtained from samples during process control will not be used for calculating QAF.

2. **Automation and Recordation.** The QCT shall check the automation inputs at the beginning of the day for the design to be produced and then routinely monitor the plant automation and recordation system and verify that all design ingredients are programmed correctly and produced within production tolerances. The QAT shall review the automation production records for specification conformance and may also monitor the plant automation and recordation system for additional quality assurance. These records are required to be stored at the production facility site by the Producer and be available for review.

3. **Mixture PG Binder Content.** QCT shall routinely monitor the plant automation system and recordation system to verify the PG binder content is within the production target with a production tolerance of 0.1%. PG binder content cannot be below the minimum design requirement in MM 5.16 for the appropriate nominal maximum aggregate size. If the binder content is below the minimum design requirement, the QCT must make necessary adjustments to increase the binder content to the minimum required and should strive to meet the mix design target value.

4. **Mix Design Production Suspension Criteria.** If 3 of the last 5 production lots for a mix design result in daily QAFs < 1.00 and/or any volumetric property outside of the production tolerances (including Verification Status production), the RME may suspend production of the mix design. The RME may rescind production status mix designs if the cause for the low QAFs cannot be determined and corrected. When a design is rescinded, no additional changes are allowed and a complete redesign is required as specified in MM 5.16.
H. Determination of HMA Quantity. The Producer is required to determine the quantity of each plant lot produced and delivered to the project on a daily basis. The QAT should routinely verify the quantity. The quantity shall be measured by the number of actual tons to the nearest 0.01 tons of each mix type produced at the plant facility. The quantity shall be determined from the automated proportioning system or the delivery vehicle weigh system. The quantity may be obtained directly from the automated system printout, calculated based on the automated measured amount or obtained directly from the vehicle weigh system recordation.

I. Equipment Failure

1. Printer Breakdown. When the automated proportioning system or delivery weigh system printer is not properly working, the producer shall notify the QAT at the plant site. When a QAT is not present, the producer shall notify the RME immediately. Production is allowed during the breakdown period providing the tons produced are properly documented as outlined by the RME. The breakdown period shall not exceed 48 hours.

2. Gyratory Compactor Breakdown. When a breakdown of gyratory compactor occurs, the RME will be notified immediately. The RME may allow production to continue for an initial limited time period (not to exceed 48 hours). Mix type, placement location, test results and/or any problems occurring with the mixture at the plant or project will be primary considerations for determining if, and how long, production will be allowed to continue. When permitted during the breakdown period, the following shall apply:

- HMA samples (enough for at least 2 specimens) will be taken at the normal specified required frequency and sent to the Regional Laboratory for testing until the gyratory compactor is repaired,
- Aggregate gradations and asphalt content will be performed and recorded for each sublot produced during the breakdown period.
- The final QAF shall be determined in accordance with this document.

J. Delivery Ticket. Each delivery vehicle supplying HMA production to the project site must be accompanied with a delivery ticket meeting the requirements outlined in §401-4, Method of Measurement. All delivery tickets must be coded as outlined in Table 2 - Delivery Ticket Mix Coding. The mix codes may be printed by the automated proportioning system or the delivery vehicle weigh system. The delivery ticket must also include the Site Manager Mix ID as outlined in Table 3, Site Manager Mix ID. The RME will provide the appropriate Mix ID for each mix design. All delivery ticket information including the mix codes must be legible. The QAT will spot check the delivery tickets for specification conformance.
### TABLE 2 - DELIVERY TICKET MIX CODING

<table>
<thead>
<tr>
<th>Mix Type</th>
<th>Code</th>
<th>Code Type</th>
<th>Design ESAL</th>
<th>Code</th>
<th>Mix Type</th>
<th>Code</th>
<th>PG Binder Type</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.3³</td>
<td>06</td>
<td>F1, F2, F3, or F9</td>
<td>&lt;0.3 million</td>
<td>1</td>
<td>HMA</td>
<td>H</td>
<td>PG 58E-34</td>
<td>A</td>
</tr>
<tr>
<td>9.5</td>
<td>09</td>
<td>F1, F2, F3, or F9</td>
<td>&lt;30 million</td>
<td>2</td>
<td>WMA</td>
<td>W</td>
<td>PG 64S-22</td>
<td>B</td>
</tr>
<tr>
<td>12.5</td>
<td>12</td>
<td>F1, F2, F3, or F9</td>
<td>&gt;30 million</td>
<td>3</td>
<td>OTHER</td>
<td>G</td>
<td>PG 64E-22</td>
<td>E</td>
</tr>
<tr>
<td>19.0</td>
<td>19</td>
<td>F1, F2, F3, or F9</td>
<td>&lt;30 million</td>
<td>2</td>
<td>WMA</td>
<td>W</td>
<td>PG 64S-22</td>
<td>B</td>
</tr>
<tr>
<td>25.0</td>
<td>25</td>
<td>F1, F2, F3, or F9</td>
<td>&gt;30 million</td>
<td>3</td>
<td>OTHER</td>
<td>G</td>
<td>PG 64E-22</td>
<td>E</td>
</tr>
<tr>
<td>37.5</td>
<td>37</td>
<td>F1, F2, F3, or F9</td>
<td>&gt;30 million</td>
<td>3</td>
<td>OTHER</td>
<td>G</td>
<td>PG 64E-22</td>
<td>E</td>
</tr>
</tbody>
</table>

**Notes:**
1. Friction Aggregate Classification Codes.
2. “F” in the PG Binder Type Codes was excluded to avoid conflict with the Friction designation.
3. Example - Delivery Ticket Mix Coding: 12.5 top course mix, Upstate high traffic volume (i.e. F2 friction aggregate required), <30 million ESAL design, HMA, PG 64S-22 results in the following Mix Code: 12F22HB.

### TABLE 3 – SITE MANAGER MIX ID

<table>
<thead>
<tr>
<th>Box Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example Mix ID</td>
<td>H</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Boxes 1-5 – Five-digit plant facility number
Boxes 6 & 7 – Two Digit Year
Boxes 8-10 – Mix sequence code

Example Mix ID - H012308001, assigned by the RME, represents mix “001” (Boxes 8-10), developed in 2008 (Boxes 6 and 7), produced at plant H0123 (Boxes 1-5)
### IV. SAMPLING AND TESTING

#### TABLE 4 – SAMPLING AND TESTING

<table>
<thead>
<tr>
<th>Plant Test Property</th>
<th>Sample Location</th>
<th>Test Method</th>
<th>Minimum Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Quality Control</td>
</tr>
<tr>
<td>Aggregate Gradation</td>
<td>See Appendix E</td>
<td>AASHTO T27</td>
<td>1 per lot if QAF</td>
</tr>
<tr>
<td></td>
<td>Test Method 3</td>
<td></td>
<td>based on Air Voids</td>
</tr>
<tr>
<td>Aggregate Moisture</td>
<td></td>
<td>AASHTO T 255</td>
<td>1 per lot 5</td>
</tr>
<tr>
<td>Air Voids</td>
<td>Haul Unit</td>
<td>MM 5.16 and</td>
<td>1 per sublot 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AASHTO T269</td>
<td></td>
</tr>
<tr>
<td>Mix Moisture</td>
<td>Haul Unit</td>
<td>AASHTO T 329</td>
<td>1 per lot 1,3,6</td>
</tr>
<tr>
<td>Mix Temperature</td>
<td>Plant &amp; Haul Unit</td>
<td>N/A</td>
<td>2 per sublot</td>
</tr>
<tr>
<td>PG Binder Content</td>
<td>Haul Unit</td>
<td>Automation, Ignition Oven (NY 400-13C), or AASHTO T 164 Method A or B</td>
<td>1 per sublot</td>
</tr>
<tr>
<td>RAP Binder Content</td>
<td>Representative Sample</td>
<td>AASHTO T 164 Method A or B or Ignition Oven (NY400-13C)</td>
<td>1 per day or as per control plan</td>
</tr>
<tr>
<td>RAP Gradation</td>
<td>Appendix E</td>
<td>AASHTO T27</td>
<td>1 per day or as per control plan</td>
</tr>
<tr>
<td>RAP Moisture</td>
<td>Appendix E</td>
<td>Test Method 2</td>
<td>1 per day or as per control plan</td>
</tr>
<tr>
<td>Asphalt Binder Sampling</td>
<td>Appendix E</td>
<td>Test Method 1</td>
<td>1 per day 4,6</td>
</tr>
<tr>
<td>Friction Aggregate</td>
<td>MM 28</td>
<td>MM 28</td>
<td>As Outlined in MM 28</td>
</tr>
<tr>
<td>Dust/Binder Ratio</td>
<td>Haul Unit</td>
<td>AASHTO T 11</td>
<td>1 per sublot 9</td>
</tr>
</tbody>
</table>

**Notes:**
1. Required for drum mix plants, but optional for batch plants or as requested by the RME.
2. Required for volumetric mixes only (i.e. QAF based on air voids).
3. Required for batch and drum mix plants when producing mixes containing RAP.
4. The Department is responsible for sample submission.
5. Required for drum mix plants only.
6. May be modified by the RME.
7. This is the minimum QA sampling frequency. Testing more than 1 QA sample is optional provided the conditions of section IV.A.2. QA Sampling and Testing and section V. B. Multiple Sublot Validation Process do not require testing.
8. AASHTO T166 (Method A) and T209. NYSDOT requires a mechanical device be used to continuously agitate the container and contents during the vacuum period in AASHTO T209.
9. May be calculated using the dry method. See Appendix B.
A. General Sampling and Testing. See Appendix B – Additional Testing information for additional testing details. Mix sampling shall be conducted per AASHTO-R 97, Sampling Asphalt Mixtures.

1. QC Sampling and Testing. All required Quality Control testing shall be performed or supervised by a certified Quality Control Technician (QCT). Required QC testing frequencies and requirements are based on the anticipated daily production of the mix design.

   a. Certified Lot. As defined in Section II. E. 1. a. Certified Lot.

   - The QCT will test for PG binder content and gradation.

   - The QCT will check and initial the batch tickets to ensure compliance with all batching requirements prior to certifying the production, i.e., produced in automatic mode.

   - Friction aggregate samples must be tested as outlined in Materials Method (MM) 28, Friction Aggregate Control and Test Procedures, for all certified production placed in pavement surface courses requiring friction aggregate.

   b. Production Lot. As defined in Section II. E. 1. b. Production Lot.

   - QC testing is according to the frequencies and test methods outlined in Table 4 – Sampling and Testing.

2. QA Sampling and Testing. All Quality Assurance testing must be performed by or supervised by a certified Quality Assurance Technician. QA testing will occur the same day the mix is produced unless the QCT and RME mutually agree the QA sample can be tested the next day due to higher than normal testing in the plant lab on a given day. In that case, the QAT must either maintain custody of the sample or appropriately seal the sample to prevent tampering. QA testing frequencies and requirements are based on the anticipated daily production of the mix design. QA samples must be of sufficient size to obtain a split sample to be used as a dispute sample.

   Note: If the QCT is obtaining the QA and dispute samples, the QAT must witness the sampling and take immediate possession of the samples.

   a. Certified Lot. As defined in Section II. E. 1. a. Certified Lot.

   - QA testing is not required for every sublot. However, the frequency of QA testing (PG binder and gradation) is expected to be at least one test per accumulated 1000 tons of production.

   - The RME may request QA testing to verify PG binder content and gradation as a condition of acceptance, primarily when it is noted that a producer consistently and repeatedly only produces \( \leq 500 \) tons/day of a mix.

   - To provide an opportunity for companion QC samples to be taken, the RME will notify the producer if QA sampling is anticipated.

   - The RME will determine if QA testing is needed based on risk, type of mix and use of the material being produced, as well as, previous test results from the facility.

   - QAT sampling of Certified Lots will consist of enough material for two (2) samples. Material not meeting specification requirements at the plant lab will result in testing the QA split sample at the Producer’s facility or Regional Lab.
b. **Production Lot.** As defined in *Section II. E. 1. b. Production Lot.*

- The QAT is required to sample every subplot.
- At a minimum, the QAT must test according to Table 4 – *Sampling and Testing.*
- The QAT may test any or all the QA random samples to verify the QCT’s test results, even if not required.

c. **Dispute Sample.** The dispute sample will be a split of the QA sample. The dispute sample will only be tested if a QC test result fails to validate using the QA sample results. See *Section V. ΔQC/QA Test Result Validation,* for additional information.

**B. Random Sample Determination.** Required QC and QA samples used to determine the mixture QAF must be taken at random locations when production is greater than 500 tons. The random QC and QA sample point(s) will be determined using the Random Numbers Table supplied to the QCTs and QATs annually from the RMEs. The Random Numbers Tables for use by the QCT and QAT are exclusive to each and will be generated and distributed to the RMEs by the Materials Bureau every year by March 1st. Other acceptable methods may be used as determined by the RME.

1. **QC Random Sample.** The sample point(s) will be determined in the following manner:

- The QCT will use anticipated daily production (announced to the RME the previous day) to calculate the sample point.
- The appropriate value from the QCT Random Numbers Table will then be multiplied by the anticipated production amount.
- If the value calculated for the sample point yields a number less than the first 75 tons, the sample point shall be equal to 75 tons.
- The QCT must document the location of stored material the sample was taken from in the QC diary.

2. **QA Random Sample.** The QAT will request a sample within +/- 150 tons from the QAT’s random sample point. The QAT sample will not be taken within the first 75 tons produced for volumetric testing. The QAT will perform one test per subplot, unless modified by the RME.

3. **Criteria for Adjusting Random Sample Point(s).**

a. **Damaged/Non-Representative Samples.** The QCT or QAT will resample HMA mixture immediately, prior to making any production changes, when:

i. The bulk specific gravities of the compacted specimens or maximum theoretical specific gravity test results exceed the tolerances specified in Table 5 - *Allowable Specimen Tolerance.* If the difference between specimen test results from the same sample exceeds the allowable specimen tolerances, the specimens are not valid and the test results cannot be used in the calculation of the daily QAF. This determination is done prior to calculating air voids.
ii. The HMA sample is damaged, i.e., a gyratory specimen is damaged, HMA sample dropped, etc.
### TABLE 5 - ALLOWABLE SPECIMEN TOLERANCE

<table>
<thead>
<tr>
<th>Number of Specimens</th>
<th>All Mix Types with QAF Based on Air Voids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bulk Specific Gravity</td>
</tr>
<tr>
<td>2</td>
<td>0.020</td>
</tr>
<tr>
<td>3</td>
<td>0.023</td>
</tr>
<tr>
<td>4</td>
<td>0.025</td>
</tr>
</tbody>
</table>

1. The number of specimens per sample according to producer's quality control plan.
2. If a compacted specimen does not meet the height requirement in AASHTO T312, it is not a valid specimen.
3. Allowable Maximum Specific Gravity Tolerance for 37.5 mix is 0.019.

**b. Early Termination of a Sublot.** The required QC and QA samples must be taken prior to terminating a sublot. If the QCT elects to terminate a sublot early, and either the QC or QA random sample has not been taken, the sample point will be adjusted and the sample taken immediately, prior to terminating the sublot. When a sublot is terminated, the QCT may consider and evaluate material stored at the time of termination as a separate, distinct sublot if the producer elects to continue delivering it to NYSDOT administered projects, including permit and local let projects. Before the stored material can be considered a separate and distinct sublot, the QCT must be able to document and track the quantity and location of that material to ensure the required QC and QA samples are taken. New QC and QA random sample points must be determined for each sublot created or modified as a result of terminating a sublot. If less than 150 tons of material is stored at the time of termination, the stored material will be considered part of the terminated sublot. Stored quantities between 150 and 1000 tons will be considered a sublot and the remaining anticipated production quantity will be used to calculate new sublots. When more than 1000 tons of material is stored, the first 1000 tons will be considered a sublot. The remaining stored material above 1000 tons will be added to the remaining anticipated production with the total used to calculate new sublots.

**c. Production Stops Earlier Than Expected.** If production is expected to stop prior to the QC or QA random sample point, recalculate the random point based on the revised anticipated production quantity, if appropriate. In some situations, samples may need to be taken, immediately.

**C. PG Binder Sample.** The QCT will obtain PG binder samples using the procedures outlined in Table 4 – Sampling and Testing. A minimum of one sample is required for each production day, but may be increased at the discretion of the RME. The samples must be identified and stored at the facility site. The Department will supply sample containers and forms, and will be responsible for submission of the samples to the Main Office for testing at a frequency outlined in Table 4. The QAT should witness, if possible, the sampling procedures on a random basis to assure the PG Binder is sampled from the appropriate tank. When PG Binder is stored over the winter, the QAT must submit the sample to be tested by the Department to verify the PG Binder meets the specified grade. The sample will be clearly labeled “First Day of Production” so it can be prioritized for testing.

**D. Gradation Sample.**

1. **Mix QAF Based on Air Voids.** The required gradation sample must be taken within 75 tons of the required mixture random sample point. Perform a minimum of one mix gradation analysis for each lot produced. An ignition furnace can be used to prepare samples for an aggregate gradation analysis using the procedures outlined in Test Method NY 400-13C.
E. Air Void Analysis. This is only required for mixes with QAF based on air voids. Prepare gyratory compacted specimens following AASHTO T312 using the appropriate specimen mixture design level as specified in Table 6, Mixture Design Level and the compaction temperature cannot exceed 325°F.

<table>
<thead>
<tr>
<th>TABLE 6 – MIXTURE DESIGN LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculated ESALs (million)</td>
</tr>
<tr>
<td>&lt;0.3</td>
</tr>
<tr>
<td>≥0.30 to &lt;30</td>
</tr>
<tr>
<td>≥30</td>
</tr>
</tbody>
</table>

The air void content will be determined using the procedures outlined in MM 5.16, AASHTO T269, AASHTO T166 (Method A), and T209. NYSDOT requires a mechanical device be used to continuously agitate the container and contents during the vacuum period in AASHTO T209.

AASHTO T 209 requires a 4000g sample to determine the maximum specific gravity for 37.5 Base Course HMA mixtures, but to help eliminate the hardship of testing a large sample, the following method will be used:

- Both the QCT and the QAT will be testing two Rice samples (max. S.G.) for 37.5 HMA mixture. The samples will be labeled A and B just as is done currently for other HMA mixtures. The average of the two samples will be calculated only if they are within the acceptable testing tolerance, i.e. between A and B samples.

- Each pycnometer will be filled as much as possible without overfilling and have room to close the lid properly. This will help in reducing any errors due to the large aggregates in the mix.

- If the QCT and QAT results validate, then the QCT results will be used to calculate the air voids and the QAF.

- If the QCT and QAT values do not validate, then the Dispute resolution will be followed just as under the other type mixes.

In conjunction with the air void content, the Voids in Mineral Aggregate (VMA) and Voids Filled with Binder (VFB), must be calculated as outlined in MM 5.16. If the VMA falls outside the tolerance value shown in Table 7 – Volumetric Tolerance, the QCT shall make the necessary adjustments to the design to meet the design requirements. The design may be rescinded as outlined in MM 5.16.

<table>
<thead>
<tr>
<th>TABLE 7 – VOLUMETRIC TOLERANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mix Type</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>All HMA Mixes except 12.5 Top Course</td>
</tr>
<tr>
<td>12.5 Top Course HMA Mix</td>
</tr>
</tbody>
</table>
F. Friction. The QCT will perform all QC friction aggregate sampling and testing using procedures outlined in Materials Method (MM) 28 for all surface courses to assure the aggregate will meet the requirements of §401-2.02, Aggregates. Friction testing will be performed at the production facility site at frequencies outlined in MM 28 or as noted on the JMF. The following action/suspension guidelines are required to be followed by the QCT:

- If the friction test results are greater than the JMF requirements, continue process control.
- If the friction test results are greater than the specification requirements, but less than the JMF requirements, aggregate adjustments must be made and the friction property retested.
- If the friction test results are less than the specification requirements, production must be stopped, the RME notified, the problem corrected, and the friction property retested. The retested friction property must be in specification conformance before production can be resumed.

The QAT will sample aggregate and submit for friction testing as outlined in MM 28. As a QA procedure, the QAT will also monitor friction aggregate properties following the above action/suspension guidelines which are required to be followed by the QCT.

G. Precision & Rounding.

Test results of QC/QA samples should be reported as follows:

- All bulk and maximum theoretical specific gravities will be reported to the nearest 0.001.
- All Air Void results will be reported to the nearest 0.01%.
- All aggregate gradation test values reported to the nearest 0.1%.
- Rounding Test Results. For reporting the results, use the following rules for rounding off for all calculations:
  - When the digit to be dropped (1 digit beyond the significant digit) is less than 5, the preceding digit will not change.
  - When the digit to be dropped (1 digit beyond the significant digit) is 5 or greater, the preceding digit will be increased by 1.

H. Retaining Samples. The QCT must identify and retain all samples used to determine payment. Samples may be discarded once the QC samples have been validated by the QAT.
V. ΔQC/QA TEST RESULT VALIDATION (for Production of Volumetric Mixes > 500 Tons)

A. Single Sublot Validation.  The QC test results for each sublot must be validated by QA test results prior to being used to determine the sublot QAF.  To validate the QC test results, the absolute difference between the QC and QA test results must be determined.  If the absolute difference does not exceed the applicable ΔValue listed in Table 8 - Volumetric ΔValues below, the QC test result is validated.

<table>
<thead>
<tr>
<th>Mix Type</th>
<th>Δ Value (QC-QA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td></td>
<td>Specific Gravity</td>
</tr>
<tr>
<td>TOP (6.3, 9.5, 12.5)</td>
<td>0.025</td>
</tr>
<tr>
<td>BINDER &amp; BASE (19, 25, 37.5)</td>
<td>0.030</td>
</tr>
</tbody>
</table>

Note: These tolerances are determined based upon Statewide data of all HMA production and may be adjusted in the future as more data is collected and analyzed.

The QCT’s results will be used to determine the QAF for a sublot when the test results for that sublot validate.  When one or more of the QC test results fail to validate, the appropriate dispute process in Section V.C. Validation Dispute Process, below, must be followed to determine if the QC or QA test results should be used to determine the sublot QAF.  If any QC test result still fails to validate through the dispute process, the QA test results will be used to determine the sublot QAF as described in the dispute process.

B. Multiple Sublot Validation Process.  Each QC sublot will be validated with the corresponding QA sublot following the process in A. Single Sublot Validation, above.  The RME may allow QA results from one sublot to cross-validate QC results from adjacent sublots within the same lot.  “Cross-sublot” validation reduces the need to test multiple QA samples when production is consistent and QC results validate.  See Appendix I – Cross-Sublot Validation Charts for various scenarios of appropriate cross-sublot validation.

Once the QAT validates a sublot in accordance with Table 4 – Sampling and Testing, the QAT will only be required then to test for bulk and maximum theoretical (Rice) specific gravity to validate any additional sublots in the production lot.

When the QAT does not plan on testing the QA sample for a sublot, the QC test results for that sublot must be compared to the nearest QA results, in terms of tonnage.  The QAT will determine if the QC results validate following the process for single sublot validation.  If the QC results validate, they can be used to determine the QAF for that sublot.

If one or more of the QC test results fail to validate, the QA sample representing the same sublot as the QC test results must be tested in accordance with Table 4 – Sampling and Testing and used to validate all the applicable QC test results for that sublot following the process in Section V.A. Single Sublot Validation, above, not just the test result(s) that failed the “cross-sublot” validation.

Note: QA samples must be taken, but not necessarily tested, if the random sample point for the sublot occurs prior to validating the QC results for the same sublot.  QA random sample points cannot be adjusted waiting to see if QC results validate by “cross-sublot” validation.  If QC sublot results validate by the “cross-sublot” validation process prior to the QA sample being taken for that sublot, the RME may waive the QA sample requirement for that sublot.
C. **Validation Dispute Process.** The dispute sample for the sublot will be tested as a final check to determine if the QC test results validate. Use the appropriate dispute process below to determine the test results to be used to determine the sublot QAF. The QC test result will be compared to the dispute sample test result following the single sublot validation process. Dispute sample results will be available within 2 business days of the dispute being initiated unless the RME and QCT mutually agree to a longer time period for a specific reason, such as scheduling a different QAT to test the dispute sample at the plant lab rather than the Region lab.

1. **Specific Gravity Validation Dispute Process.** The RME will have the dispute sample tested for the property that did not validate. If agreeable to the producer and RME, the same QAT may test the dispute sample at the plant laboratory. If it is not agreeable for the same QAT to test the dispute sample, another QAT will test the sample. The RME will determine if the dispute sample will be tested at the plant laboratory or Regional laboratory when a different QAT is required to test the sample. If the difference between the QCT and dispute sample test results is within the applicable ΔQC/QA tolerances listed in Table 8, above, the QCT’s result validates and can be used to determine air voids for payment. If the dispute sample result does not validate the QCT’s result, the QAT’s original results for the sublot will be used to determine payment.

VI. **DETERMINING QUALITY ADJUSTMENT FACTORS (QAF)**

When the mixture is designed and produced using volumetrics, the QAF will be calculated using the mixture Air Void. For all certified mixtures (volumetric and non-volumetric), the QAF will be calculated based on Table 9 **QAF Based on Gradation for Certified Production.** The QAT is responsible for calculating and transmitting the final QAF to the project. The QAT will use a BR 343a, *Daily Hot Mix Asphalt Authorized Shipments*, to transmit the final QAF for each Lot and the daily production quantity to the project. When a Lot has more than one sublot and one of the sublots has a QAF of 0.85, that sublot will be evaluated as a separate Lot and a separate BR 343a will be transmitted to the project.

A. **Certified Production (≤ 500 Tons and Production of Non-Volumetric Mixes).** The Producer is responsible for transmitting a BR 307, *Quality Control Hot Mix Asphalt Certification*, to the project no later than the end of the next work day for production quantities less than or equal to 500 tons or used for placements of non-volumetric HMA mixes as described in **Section II. E. 1. a. Certified Lot.** The RME may direct a BR 307 to be submitted to the Regional Office. A QAF of 1.00 will be assigned to material meeting the specification requirements as certified by the QCT. If QA testing is performed, the QAF will be determined for each sieve according to Table 9 – **QAF Based on Gradation for Certified Production.** A QAF of 0.85 will be assigned to material that fails to meet the specification requirements as certified by the QCT.
### TABLE 9 - QAF BASED ON GRADATION FOR CERTIFIED PRODUCTION

<table>
<thead>
<tr>
<th>Absolute Difference Value</th>
<th>Quality Adjustment Factor (QAF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Test Value - JMF Target Value)</td>
<td></td>
</tr>
<tr>
<td><strong>Sieve Size</strong></td>
<td><strong>Sieve Size</strong></td>
</tr>
<tr>
<td><strong>#50 and Larger</strong></td>
<td><strong>#80 and #100</strong></td>
</tr>
<tr>
<td>(300 μm and Larger)</td>
<td>(180 μm and 150 μm)</td>
</tr>
<tr>
<td>0.0 – 8.0</td>
<td>0.0 – 6.0</td>
</tr>
<tr>
<td>Over 8.0</td>
<td>Over 6.0</td>
</tr>
</tbody>
</table>

1. PG binder content, based on automation, must be within ±0.2% of the current mix production target value on file with the RME and cannot be more than 0.1% below the minimum design requirement for the mix type.

**B. Production > 500 Tons.** The QAT is responsible for calculating and transmitting the final QAF to the project. The QAT will calculate the QAF using BR 324a, *Computation of Daily Quality Adjustment Factors for Air Voids Controlled Mixtures*, by entering the appropriate sample test results determined in Section V. ΔQC/QA Test Result Validation, above. The QAT will use a BR 343a, *Daily Hot Mix Asphalt Authorized Shipments*, to transmit the final QAF and the daily production quantity to the project.

1. **QAF Based on Air Voids.** For each sublot:
   - Calculate the mixture’s air voids using the appropriate sample test results determined in Section V. ΔQC/QA Test Result Validation, above.
   - Calculate the absolute difference between the calculated air void test value and design target air void
   - Determine the sublot QAF according to Table 10 – Sublot QAF Based on Air Voids.

   Gradation and PG binder content must be within the production tolerances shown in Table 11 - Pre-Qualification for Incentive Based on Air Voids, to be eligible for QAF>1.00.

   - A sublot with a QAF of 0.85 will be evaluated as a separate lot. See Section VI.C.5, Sublots with Calculated QAF of 0.85
   - Calculate the Daily QAF, to the nearest 0.01, for the lot according to the following formula:

     \[
     \text{Daily QAF} = \frac{[(\text{Tonnage} \times \text{QAF})_{\text{sublot A}} + (\text{Tonnage} \times \text{QAF})_{\text{sublot B}} + \text{etc}]}{\text{Production Lot Tonnage}}
     \]
### TABLE 10– SUBLOT QAF BASED ON AIR VOIDS

<table>
<thead>
<tr>
<th>Absolute Difference Value (Test Value – 3.5)</th>
<th>Quality Adjustment Factor (QAF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 - 0.17</td>
<td>1.05^1</td>
</tr>
<tr>
<td>0.18 - 0.33</td>
<td>1.04^1</td>
</tr>
<tr>
<td>0.34 - 0.50</td>
<td>1.03^1</td>
</tr>
<tr>
<td>0.51 - 0.67</td>
<td>1.02^1</td>
</tr>
<tr>
<td>0.68 - 0.83</td>
<td>1.01^1</td>
</tr>
<tr>
<td>0.84 - 1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>1.01 - 1.10</td>
<td>0.99</td>
</tr>
<tr>
<td>1.11 - 1.20</td>
<td>0.98</td>
</tr>
<tr>
<td>1.21 - 1.30</td>
<td>0.97</td>
</tr>
<tr>
<td>1.31 - 1.40</td>
<td>0.96</td>
</tr>
<tr>
<td>1.41 - 1.50</td>
<td>0.95</td>
</tr>
<tr>
<td>1.51 - 1.60</td>
<td>0.94</td>
</tr>
<tr>
<td>1.61 - 1.70</td>
<td>0.93</td>
</tr>
<tr>
<td>1.71 - 1.80</td>
<td>0.92</td>
</tr>
<tr>
<td>1.81 - 1.90</td>
<td>0.91</td>
</tr>
<tr>
<td>1.91 - 2.00</td>
<td>0.90</td>
</tr>
<tr>
<td>over 2.00</td>
<td>0.85</td>
</tr>
</tbody>
</table>

1. A sublot QAF of 1.00 will be assigned if any of the QC or QA gradation or PG binder content test results for the sublot exceed the maximum tolerances listed in Table 11 – Pre-Qualification for Incentive Based on Air Voids. When QC or QA gradation results are not available for a sublot, the nearest results, in terms of tonnage, shall be used to determine the sublot's eligibility for incentive payment.

### TABLE 11 – PRE-QUALIFICATION FOR INCENTIVE BASED ON AIR VOIDS

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Difference from Target Value^1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gradation – Sieve # 200 (75 μm)</td>
<td>± 3.0 %</td>
</tr>
<tr>
<td>Gradation – Sieve # 8 (2.36 mm)</td>
<td>± 8.0 %</td>
</tr>
<tr>
<td>Gradation – Sieve # 4 (4.75 mm)</td>
<td>± 8.0 %</td>
</tr>
<tr>
<td>PG Binder Content</td>
<td>± 0.2%^2</td>
</tr>
</tbody>
</table>

1. The PG binder content target value is the current mix design target value on file with the RME.
2. PG binder content, based on automation, cannot be more than 0.1% below the minimum design requirement in MM 5.16 for the appropriate nominal maximum aggregate size.

### C. Special Situations.

Production QAFs for the following special situations will be reported as described below.

1. **Verification Status.** QAFs for production of any HMA job mix formula (JMF) assigned “Verification Status,” as outlined in MM 5.16, will be reported as follows.
   - A Daily QAF of 1.00 will be reported when the calculated Daily QAF is greater than or equal
to 0.90 and less than 1.00.

- The calculated Daily QAF will be reported when it is equal to 0.85 or greater than or equal to 1.00. If production is \( \leq 500 \) tons, the calculated QAF is 0.85 or 1.00.

2. **First Lot of a Production Status JMF Each Year.** Each year, the Daily QAF for the first lot of a HMA JMF assigned “Production Status” as outlined in MM 5.16 will be reported as follows.

- A Daily QAF of 1.00 will be reported when the calculated QAF is greater than or equal to 0.90 and the lot is a single sublot.

- The calculated Daily QAF will be reported when:
  - The lot is more than one sublot
  - The calculated Daily QAF is equal to 0.85, regardless of the number of sublots.

3. **QC and/or QA Sublot Results Not Available.** QCTs and QATs should make every effort to ensure they obtain a sample when production stops earlier than expected or sample specimen results are outside of the acceptable tolerances. In situations where results for one or both samples are not obtained, report the sublot QAF as described below.

**a. Either Only QC Results or Only QA Results.** When either only QC or only QA results are available, report the sublot QAF as listed below. This section does not apply when QC sublot results are validated by QA results from a previous sublot according to B. Multiple Sublot Validation Process.

- A sublot QAF of 1.00 will be reported when the calculated sublot QAF, based on the available test results, is greater than or equal to 0.90.

- The calculated sublot QAF, based on the available test results, will be reported when it is equal to 0.85.

**b. No Results Obtained.** Report the sublot QAF as follows when neither the QC nor QA sample was obtained.

- When a previous sublot exists, a sublot QAF of 1.00 will be reported when the previous sublot QAF is greater than or equal to 1.00. The previous sublot QAF will be reported for both sublots when the previous sublot QAF is less than 1.00.

- When production is limited to a single sublot, the pavement and pavement samples will be evaluated to determine mix acceptability. The evaluation will result in a QAF of 1.00 when the mix is determined to meet specification requirements or 0.85 when the mix is determined not to meet specification requirements and remains in place.

4. **Dispute Sample Specimens Do Not Meet Allowable Specimen Tolerance.** Report the sublot QAF as follows when the dispute sample specimen results are outside the tolerances in Table 5 – Allowable Specimen Tolerance. If more than one of the situations below applies, report the higher QAF.

- When the sublot QAF calculated using the original QA results is greater than or equal to the sublot QAF calculated using the QC results, report the calculated sublot QAF based on the QA results.

- When the sublot QAF calculated using the original QA results is greater than or equal to 0.90 and the sublot QAF calculated using QC results is greater than or equal to 1.00, report the sublot QAF as the higher of 1.00 or the sublot QAF calculated using the original QA results.

- When the sublot QAF calculated using the original QA results is greater than or equal
to 0.90 and the sublot QAF calculated using QC results is less than 1.00, report the sublot QAF based on the QC results.

- When the sublot QAF calculated using the original QA results is 0.85, the pavement and pavement samples will be evaluated to determine mix acceptability and sublot QAF. The dispute sample results may be considered if both the RME and QCT agree they are representative regardless of not meeting the allowable specimen tolerance.

5. **Sublots with Calculated QAF of 0.85.** Sublots represented by a calculated QAF of 0.85 will be reported as a separate Lot and shall be subject to evaluation according to §401-3.10 *Evaluation of Lots Represented by 0.85 QAF.*
APPENDIX A - HMA PLANT REQUIREMENTS

I. HMA Mixing Plant .......................................................................................................................... 28
   A. Requirements for All Plants ........................................................................................................ 28
      1. Equipment for PG Binder Material ..................................................................................... 28
      2. Aggregate Cold Feed Bins .................................................................................................... 28
      3. PG Binder Control Unit ......................................................................................................... 28
      4. Thermometric Equipment ..................................................................................................... 28
      5. Dust Collector ....................................................................................................................... 28
      6. Truck Scales .......................................................................................................................... 28
      7. Safety Requirements ............................................................................................................. 29
      8. RAP Delivery System ........................................................................................................... 29
      9. Inspection Facilities .............................................................................................................. 29
     10. Gyratory Compactor ............................................................................................................. 30
   B. Requirements for Batching Plants .............................................................................................. 31
       1. Drier .................................................................................................................................... 31
       2. Screens .............................................................................................................................. 31
       3. Hot Bins ................................................................................................................................ 31
       4. Hot Bin Sampling Devices .................................................................................................. 31
       5. Weigh Hopper .................................................................................................................... 31
       6. Aggregate and Asphalt Binder Scales ................................................................................ 31
       7. Asphalt Binder Bucket ....................................................................................................... 31
       8. Proportioning Control ......................................................................................................... 32
       9. Recording of Batching ......................................................................................................... 32
      10. Mixer Unit ........................................................................................................................... 33
     11. Control of Mixing Time ......................................................................................................... 33
   C. Requirements for Drum Mix Plants ............................................................................................ 33
       1. Aggregate Feed Bins ............................................................................................................. 33
       2. Mineral Filler System .......................................................................................................... 34
       3. Aggregate Weigh System ..................................................................................................... 34
       4. PG Binder System .............................................................................................................. 34
       5. Proportioning Control ......................................................................................................... 34
       6. Recordation of Proportions .................................................................................................. 35
       7. Automatic Aggregate Sampling Device ................................................................................ 35
       8. Mixer Unit ........................................................................................................................... 35
       9. Truck Scales ........................................................................................................................ 35

II. Hot Mix Asphalt Holding Bins .................................................................................................... 36
    A. Holding Times ....................................................................................................................... 36
    B. Holding Bin Evaluation and Approval ..................................................................................... 36
    C. Quantity Documentation ........................................................................................................ 36
       1. Truck Scale .......................................................................................................................... 36
       2. Weight Box or Hopper ......................................................................................................... 36
I. HMA Mixing Plant

A. Requirements for All Plants

1. Equipment for PG Binder Material. Tanks for the storage of PG Binder must be capable of heating and maintaining the required binder temperature. Where meters are used, the binder temperature at the meter must be within 25°F (15°C) of the temperature for which the meter is calibrated. The Producer shall have separate tanks and pipe lines when asphalt binder and other liquid asphaltic materials are mixed in the same mixer.

All mixing plants shall have a sampling valve designed to be non-clogging, safe and completely divorced from any solvent clean-out operations. For plants having multiple tanks, the sample valve shall be located in the line between the tanks and the mixing plant or in the return line. For plants having only one tank, the sample valve shall be located directly on the tank. The valve must be clearly labeled “Sample Valve”. The type and location of the valve requires the RME’s approval.

2. Aggregate Cold Feed Bins. The Producer shall separate cold feed bins for each aggregate size for the production of HMA mixes. The RME may permit methods of blending. The cold feed bins must be of sufficient size to maintain a continuous and uniform flow of material during HMA production.

3. PG Binder Control Unit. The Producer shall provide a satisfactory means to add the proper amount of PG Binder to the mixture. The Producer shall provide suitable means to maintain the required temperatures of the PG Binder in the pipelines, meters, weigh buckets, spray bars, and other containers or flow lines. When a meter system is used, the plant equipment shall have a by-pass so that the binder quantity and flow rate can be checked in accordance with MM 27.

4. Thermometric Equipment. All plants must have provisions to determine the asphalt binder temperature prior to entry into the mixing unit. Batch plants must have provisions to determine the aggregate temperature during discharge from the dryer. Drum mix plants must have provisions to determine the HMA mixture temperature during discharge from the mixing unit. All temperature measuring devices must be accurate within 5°F (3°C).

5. Dust Collector. All plants shall be equipped with adequate dust collectors constructed to remove or return uniformly all or portions of the collected dust to the system.

6. Truck Scales. Truck scales used, or required to be used at a plant site, must be a platform type scale conforming to the requirements of National Institute of Standards and Technology Handbook 44. Test the truck scales as outlined in Section II. D. 3. Scales, Continuous Weigh Systems and Meters. All truck scales must have sufficient capacity and size to weigh the largest loaded vehicle in one weighing. Combining multiple weighing of a vehicle which is too long for the truck scale is not allowed.

Truck scales used for determining delivered quantity at the mixing plant site shall be equipped with a recording device approved by the Director, Materials Bureau. The recording device must produce a ticket with a time-date print and the following weights:

- Gross weight
- Net weight
- Tare weight

Tare weights of each empty truck for each delivery must be printed on the ticket. Storing of these weights electronically for future use is not permitted. Truck scales shall not be manipulated manually during the printing process. In addition, the truck scale weigh system must be interlocked to allow printing only when the scale has come to a complete rest.
7. Safety Requirements. All mixing plants must be in compliance with all applicable state and federal safety requirements. Provide a platform(s) or other suitable device for accessibility to the top of truck bodies to obtain HMA samples and mix temperatures.

8. RAP Delivery System. RAP, shall be introduced into the plant using equipment specifically designed for recycling. All RAP equipment requires approval of the Director, Materials Bureau. Scalping screens, grizzlies, or similar devices on RAP feed bins shall be installed and must be capable of removing foreign material in excess of 4 inches (100 mm).

9. Inspection Facilities. At each HMA mixing plant site, the Producer shall provide a weatherproof building or trailer type unit for use as a QC/QA inspection facility consisting of a testing laboratory and office. The inspection facility must meet all applicable uniform fire prevention and building code requirements. Partition the QA office area from the testing laboratory. The inspection facility will have a minimum gross area of 25 square yards (22 m²) with a layout providing a minimum internal width of 7 feet (2.1 m) and a ceiling height of not less than 8 feet (2.3 m). The laboratory must have tables, work benches, shelving, and other necessary equipment required for testing HMA. Should the Producer elect or be required to provide additional testing equipment, the internal area shall be increased proportionally to house and operate the additional testing equipment.

When multiple plants are located at one site, the inspection facility will be proportionally larger. The laboratory and office space must be of a sufficient size to accomplish an acceptable performance of QC/QA duties during all HMA production. The inspection facility’s use will be exclusively for its intended purpose and have protection from a noise level greater than an 8-hour weighted average of 85 dBA. The Department will have priority use when more than one inspection authority is using the inspection facility and the testing equipment shall be available to the QAT within two hours of the QAT sample point. The QCT shall be present at the facility until the QAT completes the testing. When QAT is not provided access to the equipment within the time specified above on two occasions shall require the Producer to install additional laboratory facility or supply additional testing equipment to accommodate the lab use to multiple agency or multiple plants.

The inspection facility and the location require the approval of the RME. The inspection facility must have the following well-maintained items: (Note: The Gyratory Compactor, Specimen Mold Assembly, and Specimen Extractor are not required to be onsite at the facility during the inspection; however, they must be onsite during production.)

a. Office Equipment. A standard size office desk having a minimum surface size of 2.5 feet by 5.0 feet (0.75 m by 1.50 m) with drawers and a chair and a fireproof file cabinet with at least two lockable drawers and two keys with access only to Department personnel.

b. First Aid Kit. An adequately stocked first aid kit will be available at the plant site. The laboratory area will have an emergency eye wash station.

c. Toilet. A flush type toilet and necessary supplies. The toilet must be enclosed in a separate room properly vented and complying with applicable sanitary codes. The lavatory shall have running water. When a plant is set up on a temporary basis for a specific project, a portable toilet is acceptable in lieu of the above.

d. Lighting. Electric lights, non-glare type to provide a minimum illumination level of 1100 lux at the desk and work bench level.

e. Laboratory Sink. Sink and faucet having an adequate supply of clean running water.

f. Heating and Cooling. Adequate heating and cooling equipment to maintain an ambient temperature of 70°F +/- 5°F (20°C +/- 3°C)

g. Ventilation. Adequate ventilation system to remove dust and fumes from the laboratory. A 200 ft³/min (6 m³/min), minimum, exhaust hood vented to the atmosphere will be located
over the extractor, sample drying area and aggregate sieve shakers when located inside.

h. **Telephone.** A telephone for the exclusive and private use of Department personnel located in the laboratory office. A fax machine or electronic transmission must be available for Department use.

i. **Potable Water.** A water cooler or other source of potable water will be available at the inspection facility or plant site.

j. **Maintenance.** The inspection facility, office, and testing equipment shall be kept clean and maintained such that they are in good operating condition.

k. **Fire Extinguisher.** A 10-lb (4.5 kg) capacity multi-class ABC fire extinguisher must be furnished and properly maintained and located in the laboratory area.

l. **Extractor.** For plants producing recycled mixtures, the laboratory facility shall be equipped with an ignition oven to determine the binder content.

m. **Coarse and Fine Aggregate Sieve Shaker.** Sieve shakers must meet the requirements of AASHTO T27. When a shaker is located outside the inspection facility, it must be fully under enclosure and weatherproofed.

n. **Sample Splitter.** The sample splitter meeting the requirements of AASHTO T248.

o. **Balances.** Balances meeting the requirements of AASHTO M231, Class G2.

p. **Sample Drying Appliance.** Oven, stove or hot plate of sufficient size for rapidly drying aggregate samples.

q. **Miscellaneous Equipment.** Miscellaneous items including but not limited to, sample containers, scoops, and other equipment deemed necessary by the RME. Sieves of proper size for all mix types produced.

r. **Gyratory Compactor.** Gyratory compactor meeting the requirements of AASHTO T312.

s. **Specimen Mold Assembly.** Mold assembly shall meet the requirements of AASHTO T312. A minimum of four mold assemblies and an adequate supply of paper discs shall be provided.

t. **Specimen Extractor.** The extractor meeting the requirements of AASHTO T312.

u. **Oven.** Shall be a thermostatically controlled, convection type oven having a minimum capacity of 5 ft³ (0.15 m³) to preheat the specimen mold assemblies and asphalt mix samples. The oven must have a controlled temperature range up to 390°F (200°C) with a 5°F (3°C) accuracy throughout the range.

v. **Maximum Specific Gravity Equipment.** Equipment meeting the requirements of AASHTO T209. A mechanical device shall be used to continuously agitate the container and contents during the vacuum period.

w. **Bulk Specific Gravity Equipment.** Equipment meeting the requirements of AASHTO T166.

10. **Gyratory Compactor.** Annually, the gyratory compactor must be calibrated and operated with an internal angle of 1.16 degrees ± 0.02 degree. The internal angle may be set and verified using any suitable device designed for that purpose. If a device requires mixture to set the internal angle, use a 12.5 Top Course HMA mix designed at 75 gyrations. Once the internal angle has been established, the value of the corresponding external angle shall be recorded for monthly verification.
The Producer shall check and verify the external angle which corresponds to the internal angle at least once per month during production season. This information shall be maintained in a log attached to the gyratory compactor or recorded in the Quality Control Daily Diary form when the measurements are made. If the external angle is found to be out of specification, causing the internal angle to be less than 1.14 degrees or more than 1.18 degrees, the provisions of Section III.1.2. Gyratory Compactor Breakdown, shall apply. It is recommended that the ram pressure be checked every month to assure it is within the manufacturer’s requirements.

Additionally, the specimen molds must be checked for wear, bulging, and build up in accordance with AASHTO T312.

Part of the variability or consistency related to gyratory compactors is directly related to the maintenance of the gyratory compactor. The manufacturer’s recommendations must be followed in regard to maintenance of the compactors and the molds. All maintenance and calibration records must be kept with the gyratory compactor.

B. Requirements for Batching Plants

1. **Drier.** Equip the plant with a drier or driers which continuously agitate the aggregate during the heating and drying process. The drier equipment must be capable of supplying uniformly heated and dried material in sufficient quantities equivalent to the operating capacity of the plant.

2. **Screens.** Provide plant screens with nominal capacities in excess of the full capacity of the mixer. The screens must be capable of screening all aggregates to the specified sizes.

3. **Hot Bins.** The plant storage bins must be of sufficient storage capacity to supply the mixer when it is operating at full capacity. The plant must have at least four storage bins so arranged as to assure separate and adequate storage of the appropriate fractions of the aggregates required to give proper proportioning to the mix. Each bin must include an overflow chute of such size and at such location as to prevent backing up of material into other compartments or bins. Each compartment must have an individual outlet gate so that there is no leakage when closed. The gates must quickly and completely cut off the flow of material. Equip bins with devices in the bins at the lower quarter points to indicate when the aggregates fall below this point. Provide a separate dry storage for mineral filler or baghouse fines when they are added to the mixture as a separate material.

4. **Hot Bin Sampling Devices.** Provide adequate facilities to obtain representative aggregate samples from the full width and depth of the discharge area from each aggregate hot storage bin while the plant is in operation. The device must consist of a sampling tray of adequate capacity which is structurally supported during the sampling operation. Alternative sampling device may be provided subject to approval of the RME. Access to sampling facilities must meet the requirements of A. 7. Safety Requirements, above.

5. **Weigh Hopper.** The equipment must include some means for accurately weighing each size of aggregate in a weigh hopper suspended on scales and of ample size to hold a full batch. When the weigh hopper gate is closed, material must not leak into the mixer while weighing a batch.

6. **Aggregate and Asphalt Binder Scales.** Scales must conform to the requirements of the National Institute of Standards and Technology Handbook 44, except that the number of scale divisions must not be less than 500 or greater than 2000. Scales shall be only load cell type scales which indicate the load at all stages of the weighing operation from zero to full capacity. The minimum resolution of digital displays must be equivalent to or less than the minimum graduations on the primary scale. Digital displays must match the primary scale within one graduation. The scales, or the digital displays shall be located such that they are easily readable directly from the operator’s work station. Manipulation of scale weights is not allowed.

7. **Asphalt Binder Bucket.** The asphalt binder bucket must be large enough to handle a batch in a single weighing. Configure the filling system and bucket so that the asphalt binder will not overflow, splash, or spill outside the bucket during filling and weighing. The bucket must be steam
or oil jacketed or equipped with electric heating units. The equipment shall deliver the asphalt binder in a thin uniform sheet or in multiple sprays over the full length of the mixer.

8. **Proportioning Control.** All batch plants must proportion materials by an automatic proportioning system approved by the Director, Materials Bureau. Install the system in a dust and weather protected area of at least 5 square yards (4 m²) with no internal dimension less than 6.5 feet (2 m). The system must accurately proportion various mixture components by mass or volume, and control the cycle sequence and timing during the mixing operation. The entire batching and mixing cycle shall be continuous without any manual operations. There must be an interlock system that will interrupt and stop the automatic batching operations whenever a component proportion exceeds the allowable batching tolerance.

The automatic proportioning system must be capable of consistently delivering individual design components within the full range of batch sizes with the following batching tolerances:

<table>
<thead>
<tr>
<th>TABLE A1 – PLANT AUTOMATION TOLERANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
</tr>
<tr>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Aggregate component</td>
</tr>
<tr>
<td>Mineral Filler</td>
</tr>
<tr>
<td>RAP (separate weigh hopper)</td>
</tr>
<tr>
<td>Asphalt Binder</td>
</tr>
</tbody>
</table>

1. RAP weighed sequentially with aggregates

The preceding percentages are based on the total batch weight of the HMA mixture, except that the zero-return tolerance is based on the minimum batch size. If mineral filler is used, the allowable tolerance for the aggregate component weighed prior to the filler in a cumulative weighing system is 0.5 percent. If a separate tolerance control is not provided for mineral filler, then reduce all aggregate tolerances to 0.5 percent.

9. **Recording of Batching.** All plants shall be equipped with automatic digital recording devices approved by the Director, Materials Bureau. These devices shall be located such that the operator can access and read them from the work station. The recording device must be able to record the quantities of aggregate, RAP, mineral filler, asphalt binder, additives, and the total weight of each batch of HMA mixture produced. All recording of batches must show the day, month, year and time to the nearest minute for each batch. The printout must permanently identify each batch. The Producer shall provide the Department a clear and legible copy of the recording for each batch.

Virgin asphalt binder quantities shall be recorded separately from aggregate and filler and recorded as weight. If measured in volume, gallons (liters), the volume must be converted to weight in pounds (kilograms) at 60°F (15°C).

When RAP is used in the mixture, the moisture and PG binder contents shall be recorded. In addition, the calculated RAP binder percentage in the mix shall be recorded separate from the calculated virgin PG binder percentage. When RAP is weighed using a separate weigh hopper, the moisture compensated weight (dry weight) of RAP shall be recorded.

The weights as indicated on the batching scale or display shall be recorded within an accuracy of 1 scale graduation or increment. The minimum resolution of digital recorders shall be equivalent to or less than the minimum graduation or increment on the scale or display.

Any additives (i.e. anti-strip, latex, warm mix asphalt technologies) added to the mixture at the plant shall be recorded in accordance with the Department directives.
Automation systems installed shall clearly identify on the recordation when a batch is initiated without satisfying all conditions of fully automated production under these specifications. The recordation shall also identify when the system is taken out of the fully automated mode during the batching sequence. The recordation must provide a clear identification when an out of tolerance condition is accepted during batching, when a system produces a “demonstration” or “simulated” batch, and when a system reprints a batch ticket.

In addition to the above information, if the automation is capable of making batches other than standard sizes (full, ½ or ¼ ton increments), the recordation must show, for each material component (aggregate, mineral filler, and RAP, if used) and asphalt binder, the target weight and the calculated over and under weights, or, the calculated over and under weights and the theoretical batch total. The Department requires this heading to be printed once for each load, regardless of the number of batches per load. If loading storage silos, consider each full ticket as a load.

10. **Mixer Unit.** The plant shall include a batch mixer of an approved pugmill type capable of producing a uniform mixture within the permissible job mix tolerances. The mixer shall have a capacity of not less than one ton. The blades of the mixer shall have a clearance not more than ¾” (20 mm) from all fixed and moving parts. Paddle blades which are worn more than 25 percent in face area from their new condition shall be replaced. If not enclosed, the mixer shall be equipped with a dust hood to prevent loss of dust. The mixer shall be constructed to prevent leakage of the contents and must not cause significant segregation during the mixture discharge.

11. **Control of Mixing Time.** The mixer shall be equipped with an accurate time lock properly coordinated with the automation of batching equipment to control the operations of a complete mixing cycle. It shall lock the aggregate weigh hopper after charging of the mixer until the closing of the mixer gate at the completion of the cycle, lock the asphalt binder delivery system throughout the dry mixing period, and lock the mixer gate throughout the complete mixing period. The following are terms related to the timing of the mixing cycle:

- **Cycle Time** - the interval of time between successive openings of the mixer discharge gate for succeeding batches.
- **Mixing Time** - the interval of time between the opening of the aggregate weigh box gate and the opening of the mixer discharge gate.
- **Dry Mixing Time** - the interval of time between the opening of the aggregate weigh box gate and the beginning of application of asphalt binder.
- **Wet Mixing Time** - the interval of time between the beginning of application of asphalt binder and the opening of the mixer discharge gate.
- **Finish Mixing Time** - the interval of time between the termination of application of asphalt binder and the opening of the mixer discharge gate.

The control of the timing must be flexible and capable of being set at intervals of five seconds or less throughout the total cycle time. Once the cycle times are set, manipulation of the set times is not allowed.

**C. Requirements for Drum Mix Plants**

1. **Aggregate Feed Bins.** Aggregate feed bins shall have adequate separation to keep aggregates from overflowing from one bin to another. Configure the feed bins so that material more than 4 inches (100 mm) cannot be placed into the bin. Clearly label all feed bins to identify the aggregate size used.

Each feed bin shall proportion aggregate accurately and uniformly. The section of the bin that controls the feed rate flow must be adjustable and have a method to identify the opening. Interlock each feed bin so that HMA production is interrupted within five seconds if any feed bin becomes empty or the flow is obstructed.
2. **Mineral Filler System.** Mineral filler shall be delivered to the mixing plant independently from the aggregates. The filler system shall proportion the mineral filler at adjustable rates accurately and uniformly. The filler system must be accurate to 0.25 percent based on the total weight of the HMA mixture. Interlock the filler system so that HMA production is interrupted within five seconds if the system becomes empty or the flow is obstructed.

3. **Aggregate Weigh System.** The plant shall weigh the aggregates continuously with a system meeting the requirements of National Institute of Standards and Technology Handbook 44. The weigh system will be tested as outlined in Section II. D. 3. Scales, Continuous Weigh Systems and Meters. Provide means for diverting the aggregate after passing over the weigh system and prior to entry into the drum. The weigh system must be readable to the nearest 0.01 ton during testing.

The Director, Materials Bureau will consider other weighing systems different from conventional designs. The following tolerances apply to all continuous weigh systems:

   a. **Acceptance Tolerance.** Acceptance tolerance is 0.5% of the test load and applies to initial installation of the weigh system, annual approval prior to production, and whenever the equipment is tested because it fails to meet the maintenance tolerance during production.

   b. **Maintenance Tolerance.** Maintenance tolerance is 1.0% of the test load and applies during all times other than those where acceptance tolerance applies.

4. **PG Binder System.** The plant shall continuously proportion PG Binder at adjustable rates accurately and uniformly. The binder system must be accurate to 0.1 percent based on the total weight of the HMA mixture. The binder system will be tested as outlined in Section II. D. 3. Scales, Continuous Weigh Systems and Meters. The binder system must be interlocked so that production is interrupted within five seconds if the PG Binder flow to the mixer unit ceases. A temperature compensating device shall be installed in conjunction with the meter to correct the quantity of asphalt binder at 60°F (15°C).

5. **Proportioning Control.** All drum mix plants shall proportion materials by an automatic proportioning system that will increase and decrease the production rate using a single input. The system shall be installed in a dust and weather protected area of at least 5 square yards (4.0 m²) with no internal dimensions less than 6 feet (2.0 m). The system shall accurately proportion various mixture components by mass or volume.

   a. **Aggregate Feed Rate Control.** The plant must have an adjustable feed rate control for each aggregate bin feeder and mineral filler feeder. The controls must maintain aggregate flow accuracy such that the total variation of all materials being drawn per interval of time must not exceed an amount equal to 1.5 percent of total weight of HMA mixture per interval of time. Mineral filler shall be added with a maximum variation of 0.5 percent of the total weight of HMA mixture per interval of time.

   The flow rates of aggregate and mineral filler must be continuously displayed in the control room in tons per hour. The maximum resolution will be 1 ton per hour for dry aggregate and 0.1 ton per hour for mineral filler.

   b. **Aggregate Weight Indicators.** Weight indicators in the control room must display the weights of dry aggregate and mineral filler in tons. They must continuously accumulate weights of material during the production period. The maximum resolution will be 0.1 tons for dry aggregate and 0.01 tons for mineral filler if added separately. The indicators must be resettable to zero and have provisions to prevent manipulation.

   c. **Aggregate Moisture Compensator.** A moisture compensation device must be capable of electronically converting the wet weight of aggregate to dry aggregate weight. The moisture compensation may be input based on composite or individual aggregate bin moisture. The maximum graduations on the compensator shall be 0.1 percent.
d. **PG Binder Control.** The PG Binder control must be capable of inputting the binder content as a percentage based on total weight of mixture. The maximum graduation on the binder input control is 0.1 percent. The asphalt binder delivery system must be linked with the aggregate delivery system to automatically maintain the required proportions as the aggregate flow varies. The delivery tolerance for asphalt binder is 0.1 percent based on the total HMA mixture weight. The flow rate of asphalt binder must be continuously displayed in the control room in tons per hour and have a maximum resolution of 0.1 ton per hour.

e. **PG Binder Quantity Indicator.** The PG Binder quantity indicator in the control room must display the quantity of the binder in tons and must continuously accumulate the quantity of binder during the production period in the day. The maximum resolution shall be 0.01 tons. The indicator must be resettable to zero and have provisions to prevent manipulation.

f. **Warm Mix Asphalt Technology.** Proportioning for in-line blended additives (water, zeolite, chemical, or wax) for warm mix asphalt technology shall be in accordance with Materials Procedure (MP) 14-01 *Warm Mix Asphalt Production Requirements.*

6. **Recordation of Proportions.** The mixing plant must be equipped with an automatic digital recording device approved by the Director, Materials Bureau, which simultaneously records the accumulated weights of dry aggregate, mineral filler, RAP, in-line blended additives, and PG Binder at five-minute intervals during production and on demand. The recordation must include the actual virgin PG binder content and total PG binder content (if using RAP) as a percentage of the total HMA mixture weight. The maximum resolution will be 0.1 tons for dry aggregate (including RAP), 0.01 tons for mineral filler, if added separately, 0.01 tons for PG Binder, and 0.1% for PG binder content. All recordation must show the day, month, year, and time to the nearest minute for each print. Provide a clear and legible copy of the recordation to the Department.

RAP material properties (moisture content and PG binder content) shall be recorded when producing HMA mixtures which contain RAP.

In-line blended additives (i.e. anti-strip, latex, warm mix asphalt technologies) shall be recorded according to Department directives.

Automation systems must clearly identify on the recordation when a batch is initiated without satisfying all conditions of fully automated production under these specifications. The recordation should also identify when the system is taken out of the fully automated mode during the batching sequence.

7. **Automatic Aggregate Sampling Device.** Provide an automatic aggregate sampling device which will divert a representative combined aggregate sample into a hopper or container for the purpose of gradation testing. The device shall effectively sample the full width and depth of the aggregate flow without losing any portion of the sample. The sampling point must be after the aggregate is proportioned and prior to its mixing with asphalt binder.

8. **Mixer Unit.** The plant shall include a continuous mixer of a type approved by the Director, Materials Bureau, having an automatic burner control and capable of producing a uniform mixture within the job-mix tolerances. The flights within the drum which are missing, loose, broken, bent, scalloped or worn excessively from their new condition shall be repaired or replaced to the satisfaction of the RME. The discharge of the HMA mixture into a HMA holding bin shall meet the requirements of Appendix A, Section II. Hot Mix Asphalt Holding Bins, below.

9. **Truck Scales.** Each drum mix plant site shall have a platform scale conforming to the requirements outlined in Appendix A, Section I.A.6. Truck Scales, above.
II. Hot Mix Asphalt Holding Bins.

Storage silos are designed to store HMA for extended periods of time. They must be insulated and the cone must be heated. Surge bins are temporary holding bins which provide a means for HMA drum mix facilities to hold and load out HMA during production.

A. Holding Times. Holding time is defined as the time interval beginning with the introduction of HMA mixture into the bin to the time of completion of discharge from the bin. Standard holding (storage) times are 12, 24, and 48 hours. Standard maximum surge bin holding time is six hours.

B. Holding Bin Evaluation and Approval. Prior to use on Department projects, the Director, Materials Bureau must evaluate and approve each holding bin. The scope of the evaluation conducted will depend upon the standard holding times request. The evaluation is based on sampling and testing of HMA mixtures held in the bin, according to Materials Procedure 05-01 – Procedure for Testing Holding Bins for Hot Mix Asphalt. The HMA mixture, after storage, must meet the criteria outlined in Table A2 - HMA Holding Bin Acceptance Criteria. The Department reserves the right to evaluate any approved bin at any time.

<table>
<thead>
<tr>
<th>TABLE A2 - HMA HOLDING BIN ACCEPTANCE CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property</td>
</tr>
<tr>
<td>Mix Temperature</td>
</tr>
<tr>
<td>Aggregate Gradation</td>
</tr>
<tr>
<td>PG Binder Content</td>
</tr>
<tr>
<td>PG Binder Recovered from Mixtures</td>
</tr>
<tr>
<td>Dynamic Shear (AASHTO T315)</td>
</tr>
</tbody>
</table>

C. Quantity Documentation. The quantity of the mixture drawn from holding bins and delivered to Department projects shall be measured and recorded by one of the following:

1. Truck Scale. A truck scale conforming to the requirements in Appendix A, Section I. A. 6. Truck Scales, above.

2. Weight Box or Hopper. A weight box or hopper suspended beneath the holding bin. The Director, Materials Bureau must approve all scale systems or other weighing devices prior to Department use. Scales must be load cell type scales which indicate the load at all stages of the weighing operation from zero to full capacity. The scale shall measure the actual weight to within an accuracy of 0.1 percent of full scale or one graduation, whichever is less. The minimum graduation will have a value not exceeding 20 lbs (10 kg) or 0.01 tons. The minimum resolution of digital displays will be equivalent to or less than the minimum graduations on the primary scale. There must be an interlock cutoff circuit to prevent the commencement operation if the scale is outside of the zero-return tolerance. The zero-return tolerance will be from 0 to a maximum of plus 150 pounds (70 kg) or 0.07 tons, whichever is applicable.

Each installation shall be equipped with a recording device approved by the Director, Materials Bureau. The recorder shall produce a ticket with a time-date print. Each weighing cycle and the total amount of mixture discharged into the truck shall be recorded. The minimum resolution of the recorder must be equivalent to or less than the minimum graduations on the scale or digital display. Manual manipulation of the scales during weighing and printing process is not allowed. In addition, the system must be interlocked to allow printing only when the scale has come to a complete rest.
APPENDIX B – ADDITIONAL TESTING INFORMATION

A. Aggregate and RAP

1. Gradation. QC and QA aggregate and RAP gradation samples must be taken and tested at the frequency shown in Section IV. Table 4 – Sampling and Testing. The aggregate gradation analysis shall be performed using the procedures outlined in AASHTO T-27, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregate. An ignition furnace can be used to prepare samples for an aggregate gradation analysis using the procedures outlined in Test Method NY 400-13C.

   a. Automation Input. The QAT will verify that the moisture test results input into the automation system accurately represent the aggregate and RAP moisture.
   b. Aggregate. The aggregate moisture must be routinely monitored at a drum mix plant. The QCT is required to perform a minimum of one aggregate moisture test before production and one again later at the QCT’s chosen time per day, following AASHTO T-255, on a composite sample. Moisture testing on individual aggregate bins is allowed and will be accepted as a test. The QAT may verify by either testing moisture of individual aggregate bins or testing a composite sample. The RME may increase the QAT’s testing frequency if conditions warrant, i.e., based on QC results, change in weather conditions, heavy rains the previous night, etc.
   c. RAP. Follow the procedure referenced in Table 4 – Sampling and Testing.

3. RAP Binder Content. The RAP binder content may be determined following the procedure referenced in Table 4 – Sampling and Testing or Test Method NY 400-13C.

B. Mix Sampling. Required QC and QA mix samples for volumetric testing will be taken at the frequency shown in Section IV. Table 4 – Sampling and Testing. Sampling will be performed per AASHTO T168.

1. Determination of PG Binder Content - The QCT will determine the PG binder content using the procedures referenced in Section IV. Table 4 – Sampling and Testing, AASHTO T-164, or Test Method NY 400-13C for Ignition Oven.

2. Mixture Temperature. The QCT shall monitor and transmit the mix temperatures to the project paving site according to the frequency shown in Section IV. Table 4 – Sampling and Testing, at a minimum. The QCT will take temperatures of the mix in the delivery trucks and indicate it on the delivery ticket. The mix temperatures must be routinely monitored to verify specification conformance. The mix temperature should not exceed the temperatures specified in the Standard Specification, which is between 250°F (120°C) and 325°F (165°C), unless other temperatures are recommended by the PG binder supplier. The mix temperatures for Permeable Base mixtures shall be between 225°F (110°C) and 300°F (150°C) as specified in the Standard Specification. The QAT, if present, should witness at least one of the QCT’s temperature measurements per day as a QA procedure for specification compliance.

3. Mix Moisture Content. The QCT will determine mix moisture content using procedures outlined in AASHTO T-329. The QCT is required to perform the minimum number of HMA moisture content tests, listed in Section IV. Table 4 – Sampling and Testing, for drum mix plants. The frequency may be increased by the RME. In addition, the RME may request moisture testing of HMA at a batch plant. The QAT may perform moisture tests as a QA procedure. The total moisture content of the HMA mixture must be 0.5% or less.

4. Dust to Binder Ratio. The QCT will perform the test and verify the dust to binder ratio for all volumetrically designed mixes to assure the ratio is between 0.8 to 1.6%. Testing shall be done
according to AASHTO T11. If the ratio is outside the specified limit, the QCT shall modify the mix to bring the ratio within the specified limits. After 2 consecutive tests which are out of specification, the RME may rescind the mix design.

**Estimating Dust to Binder (D/B) Ratio:**

To calculate an estimated dust to binder ratio by the dry method, the following procedure may be followed instead of using the wet method:

1. **Dust** (Minus 200) – perform a dry sieve analysis and determine the % passing #200 sieve. Add 2% to this value to get an estimated wet sieve value without doing the wet analysis.

2. **Binder** (Effective AC) – use the formula in MM 5.16 on page Appendix 1-8.

Based on these two values, the D/B ratio will be calculated. If the calculated estimated D/B ratio is outside the limits or very close to the limits, then the wet sieve analysis must be performed according to AASHTO T11 to determine the true dust value. Note that the D/B ratio for 6.3 Top Course may be very close to the lower limit. In that case, a wet analysis will be performed.
APPENDIX C – FLOW CHARTS

NOTE: The following flow charts are provided for illustrative purposes only. If there are any discrepancies between the flow charts and information in the body of the document, the information in the body of the document will be enforced.

Flow Chart 1 – All Certified Production ................................................................. 40
Flow Chart 2 – Production > 500 Tons ................................................................. 41
FLOW CHART 1 - ALL CERTIFIED PRODUCTION

NOTES:
1. Production ≤ 500 tons and any production of non-volumetric mixes regardless of quantity is certifiable without testing.
2. If QC test results are not available for certified production, proceed to "Pay Based on (original) QA Test Results"
FLOW CHART 2 - PRODUCTION > 500 TONS
(Non-Certified Production of Volumetric Mixes)

PRODUCTION > 500 TONS¹

QC and QA Testing Required According to Table 4.

Are QC and QA test results within the ΔQC/QA Values?
- Table 8 for QAF Based on Air Voids

No

QAT tests QA sample representing same subplot as QC results.

Do QC and QA test results represent samples from the same subplot?

Yes

Pay Based on QC Test Results
Calculate QAF according to:
- Table 10 for QAF Based on Air Voids

Note: Gradation and binder content according to Table 11-Prequalification for Incentive Based on Air Voids must be within production tolerances to be eligible for QAF > 1.00.

No

Region tests the Dispute (QA Split) Sample for each test property/properties that exceeded the ΔQC/QA Values. Testing may be done at the Region Lab or Producer Lab.

Are QC and Dispute Sample test results within the applicable ΔQC/QA Value from Table 8?

Yes

Pay Based on (original) QA Sublot Test Results
Calculate QAF according to:
- Table 10 for QAF Based on Air Voids

Note: Gradation and binder content according to Table 11-Prequalification for Incentive Based on Air Voids must be within production tolerances to be eligible for QAF > 1.00.

No

NOTES:
1. Production > 500 tons of non-volumetric HMA mixes may be certified – follow Flow Chart 1 for certified production.
APPENDIX D – EXAMPLES

NOTE: The following examples are provided for illustrative purposes only. If there are any discrepancies between the examples and information in the body of the document, the information in the body of the document will be enforced. The examples were developed to illustrate various processes and scenarios that could occur during validation and are not considered to represent typical production days.

Example 1 – QC and QA Calculations for QAF Based on Air Voids .............................................. 43
a. Determine the Number of Sublots ................................................................. 43
b. Determine the Tonnage for each Sublot.......................................................... 43
c. Determine the QC Sample Point for Each Sublot......................................... 43
d. Determine the QA Sample Window for Each Sublot..................................... 43
e. ΔQC/QA Test Result Validation..................................................................... 44
   - QC Results Validate for Sublot A
   - Cross-sublot Validation for Sublot B (validates QC)
   - Cross-sublot Validation for Sublot C (does not validate QC results)
   - Dispute Sample Testing for Sublot C
f. Determine Sublot QAFs .................................................................................. 45
g. Determine Daily QAF .................................................................................... 46

Example 2 – QC and QA Calculations for QAF Based on Air Voids with 0.85 QAF .............. 47
a. Determine the Number of Sublots ................................................................. 47
b. Determine the Tonnage for Each Sublot.......................................................... 47
c. Determine the QC Sample Point for Each Sublot......................................... 47
d. Determine the QA Sample Window for Each Sublot..................................... 47
e. Re-determine the Number of Sublots ............................................................. 47
f. Re-determine the Tonnage for Each Sublot .................................................... 47
g. Re-determine the QC Sample Point for Each Sublot..................................... 47
h. Re-Determine the QA Sample Window for Each Sublot................................ 47
i. ΔQC/QA Test Result Validation..................................................................... 48
   - QC Results Validate for Sublot A
   - Cross-sublot Validation for Sublot B (validates QC)
   - Cross-sublot Validation for Sublot C (validates QC)
j. Determine Sublot QAFs .................................................................................. 48
k. Determine Daily QAF .................................................................................... 49
Example 1 - QC and QA Calculations for QAF Based on Air Voids

12.5 Top course mixture
Estimated production is 2500 Tons.

a. Determine the Number of Sublots to be Tested.

\[ \frac{2500}{1000} = 3 \text{ sublots} \]

b. Determine the Tonnage for Each Sublot.

Sublot A = 1000 Tons  
Sublot B = 1000 Tons  
Sublot C = 500 Tons

c. Determine the QC Sample Point for Each Sublot.

Sublot A:  
Sample Point = Random Number x 1000  
Random Number for Sublot A is 0.067  
Sample Point = 0.067 x 1000  
Sample Point = 67  
\text{Sample point for Sublot A falls in an untestable portion of the sublot. Sample point will be 75 tons}\

Sublot B:  
Sample Point = Random Number x 1000  
Random Number for Sublot B is 0.241  
Sample Point = 0.241 x 1000  
Sample Point = 241  
\text{Sample point for Sublot B is at 1241 tons (241 tons + Sublot A)}\

Sublot C:  
Sample Point = Random Number x 500  
Random Number for Sublot B is 0.759  
Sample Point = 0.759 x 500  
Sample Point = 380  
\text{Sample point for Sublot C is at 2380 tons (380 tons + Sublot A + Sublot B)}\

d. Determine the QA Sample Window for Each Sublot.

Sublot A:  
Random Point = Random Number x 1000  
Random Number for Sublot A is 0.810  
Random Sample Point = 0.810 x 1000  
Sample Point = 810 tons  
\text{The random sample window will be 660 to 960 tons. (810 - 150 tons = 660; 810 + 150 tons = 960)}\

Sublot B:  
Random Point = Random Number x 1000  
Random Number for Sublot A is 0.892  
Random Sample Point = 0.892 x 1000  
Sample Point = 892 tons  
\text{The random sample window will be 1742 to 2000 tons. (1892 - 150 tons = 1742; 1892 + 150 = 2042, tonnage 2000-2042 is in Sublot C, and cannot be used to represent Sublot B.)}\

Sublot C:  
Random Point = Random Number x 500  
Random Number for Sublot A is 0.500  
Random Sample Point = 0.500 x 500  
Sample Point = 250 tons  
\text{The random sample window will be 2100 to 2400 tons. (2250 - 150 tons = 2100; 2250 + 150 tons = 2400)}
e. **△QC/QA Test Result Validation.**

Sublot A:  
- QCT value for Maximum Specific Gravity 2.450  
- QCT value for Bulk Specific Gravity 2.355

- QAT value for Maximum Specific Gravity 2.445  
- QAT value for Bulk Specific Gravity 2.315

Determine the difference between QCT & QAT test values for sublot A.

- Maximum Specific Gravity QCT – QAT = 2.450 – 2.445 = 0.005  
  \(0.005 < 0.025\), Therefore QAT validates Max S.G.

- Bulk Specific Gravity QCT – QAT = 2.355 – 2.315 = 0.040  
  \(0.040 < 0.050\), Therefore QAT validates Bulk S.G.

As QAT testing validates the QCT results for Bulk and Maximum Specific Gravity testing, the QCT generated value of 3.87% Air Voids will be used for determining the QAF of Sublot A.

Sublot B:  
- QCT value for Maximum Specific Gravity 2.446  
- QCT value for Bulk Specific Gravity 2.347

QAT determines to perform a cross-sublot validation using the results from sublot A

- QAT value for Maximum Specific Gravity 2.445  
- QAT value for Bulk Specific Gravity 2.315

Determine the difference between QCT & QAT test values for sublot B.

- Maximum Specific Gravity QCT – QAT = 2.446 – 2.445 = 0.001  
  \(0.001 < 0.025\), Therefore QAT validates Max S.G.

- Bulk Specific Gravity QCT – QAT = 2.347 – 2.315 = 0.032  
  \(0.032 < 0.050\), Therefore QAT validates Bulk S.G.

As QAT testing validates the QCT results for Bulk and Maximum Specific Gravity testing, the QCT generated value of 4.05 % Air Voids will be used for determining the QAF of Sublot B.

Sublot C:  
- QCT value for Maximum Specific Gravity 2.413  
- QCT value for Bulk Specific Gravity 2.366

QAT determines to perform a cross-sublot validation using the results from sublot A (No QAT test results were generated for sublot B.)

- QAT value for Maximum Specific Gravity 2.445  
- QAT value for Bulk Specific Gravity 2.315

Determine the difference between QCT & QAT test values for sublot C.

- Maximum Specific Gravity QCT – QAT = 2.413 – 2.445 = 0.032  
  \(0.032 > 0.025\), Therefore QAT does not validate Max S.G.

- Bulk Specific Gravity QCT – QAT = 2.366 – 2.315 = 0.040  
  \(0.051 < 0.050\), Therefore QAT validates Bulk S.G.
Therefore, the QA tests the retained sample for Sublot C to determine if Sublot C validates.

QAT value for Maximum Specific Gravity 2.444
QAT value for Bulk Specific Gravity 2.330

Determine the difference between QCT & QAT test values for sublot C.

Maximum Specific Gravity QCT – QAT = 2.413 – 2.444 = 0.031
0.031 > 0.025, Therefore QAT does not validate Max S.G.

Bulk Specific Gravity QCT – QAT = 2.366 – 2.330 = 0.036
0.036 < 0.050, Therefore QAT validates Bulk S.G.

Therefore, a split of the QAT’s sample is sent for dispute testing.

The dispute sample is tested to determine Max S.G.

Dispute Value for Max S.G. 2.446

Dispute testing does not validate the QCT’s Max Specific Gravity results. Therefore, the original QAT generated value for the sublot of 4.66% Air Voids will be used for determining the QAF of Sublot C.

f. Determine Sublot QAFs.

Sublot A: QCT generated value of 3.87% Air Voids.
Absolute difference from design target air voids.
Absolute difference = 3.87 - 3.50 = 0.37
The QAF for Sublot A is 1.03. A check of the gradation and PG binder contents must be made.

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Allowable difference from target value</th>
<th>QC difference from target value</th>
<th>QA difference from target value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gradation - Sieve #200</td>
<td>± 3.0%</td>
<td>+1.2</td>
<td>+ 0.9</td>
</tr>
<tr>
<td>Gradation - Sieve #8</td>
<td>± 8.0%</td>
<td>- 5.6</td>
<td>- 3.2</td>
</tr>
<tr>
<td>Gradation - Sieve #4</td>
<td>± 8.0%</td>
<td>+ 3.7</td>
<td>+5.1</td>
</tr>
<tr>
<td>PG Binder Content</td>
<td>± 0.2%</td>
<td>+ 0.1</td>
<td>+ 0.1</td>
</tr>
</tbody>
</table>

Since all test results are within the allowable tolerances, the final QAF for Sublot A will remain 1.03.

Sublot B: QCT generated value of 4.05 % Air Voids.
Absolute difference from design target air voids.
Absolute difference = 4.05 - 3.50 = 0.55
The QAF for Sublot B is 1.02. A check of the gradation and binder contents must be made.

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Allowable difference from target value</th>
<th>QC difference from target value</th>
<th>QA difference from target value</th>
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</thead>
<tbody>
<tr>
<td>Gradation - Sieve #200</td>
<td>± 3.0%</td>
<td>+1.2</td>
<td>+ 0.9</td>
</tr>
<tr>
<td>Gradation - Sieve #8</td>
<td>± 8.0%</td>
<td>- 5.6</td>
<td>- 3.2</td>
</tr>
<tr>
<td>Gradation - Sieve #4</td>
<td>± 8.0%</td>
<td>+ 3.7</td>
<td>+5.1</td>
</tr>
<tr>
<td>PG Binder Content</td>
<td>± 0.2%</td>
<td>+ 0.0</td>
<td>- 0.1</td>
</tr>
</tbody>
</table>

* Gradation results from sublot A were used.
Since all test results are within the allowable tolerances, the final QAF for Sublot B will remain 1.02.

Sublot C: QAT generated value of 4.46 % Air Voids.  
Absolute difference from design target air voids.  
Absolute difference = 4.66 - 3.50 = 1.16  
The QAF for Sublot C is 0.98.

g. Determine Daily QAF.

\[
\text{Daily QAF} = \frac{\text{Tonnage} \times \text{QAF}_{\text{Sublot A}} + \text{Tonnage} \times \text{QAF}_{\text{Sublot B}} + \text{etc.}}{\text{Total Tonnage Produced}}
\]

Daily QAF = \frac{(1000 \times 1.03) + (1000 \times 1.02) + (500 \times 0.98)}{2500}

\text{Daily QAF} = 1.02
Example 2 - QAF Based on Air Voids and one sublot with 0.85 QAF

LOT 20
12.5 Top course mixture
Estimated production is 2500 Tons.

a. Determine the Number of Sublots to be Tested.

\[ \frac{2500}{1000} = 3 \text{ sublots} \]

b. Determine the Tonnage for Each Sublot.

Sublot A = 1000 Tons
Sublot B = 1000 Tons
Sublot C = 500 Tons

c. Determine the QC Sample Point for Each Sublot. See Example 1.

d. Determine the QA Sample Window for Each Sublot. See Example 1

During a Pre-Test, Sublot A was cut-off at 400 tons due to low voids and final test results shows the QAF is 0.85. This Sublot will be evaluated as a separate LOT 21.

e. Re-determine the Number of Sublots to be Tested in LOT 20.

\[ \frac{2100}{1000} = 2 \text{ sublots} \]

f. Re-determine the Tonnage for Each Sublot.

Sublot A = 1000 Tons
Sublot B = 1100 Tons

g. Re-determine the QC Sample Point for Each Sublot.

Sublot A: Sample Point = Random Number x 1000
Random Number for Sublot A is 0.456
Sample Point = 0.456 x 1000
Sample Point = 456

Sublot B: Sample Point = Random Number x 1100
Random Number for Sublot B is 0.741
Sample Point = 0.741 x 1100
Sample Point = 815
Sample point for Sublot B is at 1815 tons (815 tons + Sublot A)

h. Re-determine the QA Sample Window for Each Sublot.

Sublot A: Random Point = Random Number x 1000
Random Number for Sublot A is 0.810
Random Sample Point = 0.810 x 1000
Sample Point = 810 tons
The random sample window will be 810 ± 150

Sublot B: Random Point = Random Number x 1100
Random Number for Sublot A is 0.892
Random Sample Point = 0.892 x 1100
Sample Point = 981 tons
The random sample window will be 1981 ± 150
i. ΔQC/QA Test Result Validation.

Sublot A: QCT value for Maximum Specific Gravity 2.450  
QCT value for Bulk Specific Gravity 2.355

QAT value for Maximum Specific Gravity 2.445  
QAT value for Bulk Specific Gravity 2.315

Determine the difference between QCT & QAT test values for sublot A.

Maximum Specific Gravity QCT – QAT = 2.450 – 2.445 = 0.005  
0.005 < 0.025, Therefore QAT validates Max S.G.

Bulk Specific Gravity QCT – QAT = 2.355 – 2.315 = 0.040  
0.040 < 0.050, Therefore QAT validates Bulk S.G.

As QAT testing validates the QCT results for Bulk and Maximum Specific Gravity testing, the QCT generated value of 3.87% Air Voids will be used for determining the QAF of Sublot A.

Sublot B: QCT value for Maximum Specific Gravity 2.446  
QCT value for Bulk Specific Gravity 2.347

QAT determines to perform a cross-sublot validation using the results from sublot A

QAT value for Maximum Specific Gravity 2.445  
QAT value for Bulk Specific Gravity 2.315

Determine the difference between QCT & QAT test values for sublot B.

Maximum Specific Gravity QCT – QAT = 2.446 – 2.445 = 0.001  
0.001 < 0.025, Therefore QAT validates Max S.G.

Bulk Specific Gravity QCT – QAT = 2.347 – 2.315 = 0.032  
0.032 < 0.050, Therefore QAT validates Bulk S.G.

As QAT testing validates the QCT results for Bulk and Maximum Specific Gravity testing, the QCT generated value of 4.05 % Air Voids will be used for determining the QAF of Sublot B.

j. Determine Sublot QAFs.

LOT 21 = 0.85 and will be evaluated separately

LOT 20 - The remainder sublots for that day will determined as follows:

Sublot A: QCT generated value of 3.87% Air Voids.  
Absolute difference from design target air voids.  
Absolute difference = 3.87 - 3.50 = 0.37  
The QAF for Sublot A is 1.03. A check of the gradation and binder contents must be made.

All gradation test results are determined to be within the allowable tolerances. The final QAF for Sublot A will remain 1.03.

Sublot B: QCT generated value of 4.05 % Air Voids.
Absolute difference from design target air voids.
Absolute difference = 4.05 - 3.50 = 0.55

The QAF for Sublot B is 1.02. A check of the gradation and binder contents must be made.

All gradation test results are determined to be within the allowable tolerances. The final QAF for Sublot B will remain 1.02.

k. Determine Daily QAF Factor.

\[
\text{Daily QAF} = \frac{\left(\text{Tonnage} \times \text{QAF}\right)_{\text{Sublot A}} + \left(\text{Tonnage} \times \text{QAF}\right)_{\text{Sublot B}}}{\text{Total Lot Tonnage}}
\]

\[
\text{Daily QAF} = \frac{(1000 \times 1.03)_{A} + (1100 \times 1.02)_{B}}{2100}
\]

Daily QAF = 1.02

LOT 20 = 1.02

BR 343 will be sent to the Project Engineer for the production represented by Lots 20 and 21 for payment.

A remark should be made to the Project Engineer that the section represented by Lot 21 will be evaluated in accordance with §401-3.10 Evaluation of Lots Represented by 0.85 QAF, prior to payment.
## APPENDIX E – TEST METHODS

<table>
<thead>
<tr>
<th>Test Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sampling of Performance Graded (PG) Binder</td>
</tr>
<tr>
<td>2</td>
<td>Reclaimed Asphalt Pavement (RAP) and Reclaimed Asphalt Shingles (RAS) Moisture Test</td>
</tr>
<tr>
<td>3</td>
<td>Sampling of Aggregates</td>
</tr>
</tbody>
</table>
TEST METHOD 1 – SAMPLING OF PERFORMANCE GRADED (PG) BINDER

The Quality Control Technician (QCT) shall verify that the received shipment of PG binder is from a Primary Source supplier and location appearing on the Department’s Approved List.

Each day of HMA production, the QCT will take a one-quart PG binder sample from each plant producing material for the Department. The sample taken shall be representative of the day’s production.

Note: Samples should be taken randomly at different times of the production day and never taken at the same time every day.

The PG binder sample shall be obtained from a sampling valve approved by the Department. The sample container shall be a new clean one-quart metal can with a double-friction top supplied by the Regional Materials Engineer.

Prior to obtaining the sample, at least one gallon of asphalt must be drawn off through the sampling valve. This material shall be discarded and not used for the sample.

Note: The drawing off (wasting) of at least one gallon of asphalt binder from the sampling valve before filling the sample container is absolutely essential. This ensures that the sampling valve is cleaned out and that a truly representative sample from the storage tank is obtained.

The sample container should be filled at least three-quarters full directly from the sampling valve. Each sample container shall be identified with the following minimum information:

1. Plant name and location
2. Plant number
3. Grade of asphalt cement
4. Date and time of sampling
5. Name and location of Primary Source*
6. Lot number*

*The identification of the Lot Number and Primary Source Name and Location shall be as detailed on the approved Bill of Lading Form representing the most recent delivery to the storage tank prior to the time of sampling.

The Quality Assurance Technician (QAT) shall follow Department procedure for PG binder samples as directed by the RME.
TEST METHOD 2 – RECLAIMED ASPHALT PAVEMENT (RAP) AND RECLAIMED ASPHALT SHINGLES (RAS) MOISTURE TEST

The sample shall be obtained and reduced to testing size in accordance with Section IV. Table 4 – Sampling and Testing. The minimum sample size for RAP/RAS moisture testing is 2,500 grams.

The following equipment is required for the composite aggregate moisture content test:

1. Oven or hot plate
2. Large capacity scale
3. Pan, brush and stirring spoon

TEST PROCEDURE

1. Weigh the sample to the nearest 0.1 g.
2. Dry the sample to a constant weight. The sample is thoroughly dry when further heating causes, or would cause, less than 0.1% additional loss in mass.
3. Cool the sample and reweigh.

CALCULATIONS:

The moisture content of the RAP/RAS composite aggregate is computed by using the following formula:

$$\% \text{ Moisture} = \frac{W_{\text{wet}} - W_{\text{dry}}}{W_{\text{dry}}} \times 100$$

Where:

$W_{\text{wet}}$ = Weight of sample containing moisture
$W_{\text{dry}}$ = Weight of sample dried to a constant weight

Note: As the sample is normally dried on a hot plate, the sample shall be stirred while drying so that no overheating or burning of the asphalt occurs during testing.

The RAP/RAS moisture content test results shall be reported to the nearest tenth of a percent.
TEST METHOD 3 – SAMPLING OF AGGREGATES

The following describes the procedures for obtaining and preparing samples of aggregate that represent material being used in hot mix asphalt. Equipment, such as pails, square shovel, brush, and sample splitter with pans, are generally used for sampling.

SAMPLING PROCEDURES

1. Stockpile Sampling
   a. Small Conical Stockpiles – The sample shall be composed of material sampled from at least nine (9) points in the stockpile. Samples shall be taken at one-third (1/3) points around the pile and at three (3) levels (base, middle, and top). At each point, the face shall be exposed to a minimum depth of one (1) foot before sampling. Care shall be taken so that aggregate adjacent to the sampling point does not fall into the sampling area.
   b. Other Stockpiles – The details for conical stockpiles shall apply except that the sample shall be composed of material sampled from at least six (6) points in the area of the stockpile being used for production. Samples shall be taken from two (2) locations and at three (3) levels (base, middle, and top).

2. Belt Sampling (Drum Mix Plants) – A composite aggregate sample shall be obtained by using an automatic aggregate sampling device which diverts a representative combined aggregate sample into a hopper or container. The device shall sample the full width and depth of the aggregate flow without losing any portion of the sample. The sampling point shall be after all the aggregate is proportioned and prior to its mixing with PG Binder.

3. Hot Bin Sampling – Samples shall be obtained with a sampling device that allows gathering of representative samples from the full width and depth of the discharge area from each aggregate hot bin while the plant is in operation. The device shall consist of a sampling tray of adequate capacity which is structurally supported during the sampling operation. A shovel is not satisfactory for this purpose.

4. Ignition Oven Sample – A mixture sample shall be obtained from the truck and processed through the ignition oven in accordance with NY 400-13C.

SAMPLE SIZE

The amount of aggregate required for a representative sample and the size of sample for testing are given in AASHTO R 90. When a non-standard aggregate size is used, the sample size shall be that of the closest standard primary size.

SAMPLE PREPARATION

In order to obtain a convenient sample size for sieving, or for other tests, a large sample may be reduced by a sample splitter or by quartering. When using a sample splitter, the original sample shall be split into two (2) fractions. If one of these fractions is too large for testing, a fraction can be split again. This splitting procedure can be used until the proper size sample for testing is achieved.

If a sample splitter is not available, the sample shall be reduced by quartering using the following method:

1. Distribute a scoopful of the aggregate as uniformly as possible over a wide, flat area on a tight weave canvas, or other smooth surface. Continue to distribute scoopfuls of aggregate in layers until all of the aggregate is used to make a wide, flat pile that is reasonably uniform in thickness and distribution of aggregate sizes. Do not permit coning of the aggregates.
2. Divide the sample into equal quarters with a square end shovel, trowel or straight piece of sheet metal. Discard two (2) opposite quarters and combine the remaining quarters taking care to include the dust and fines with each quarter. If necessary, this procedure is repeated until the sample size has been reduced sufficiently.
### APPENDIX F – EXAMPLE OF RANDOM NUMBERS TABLE

#### RANDOM NUMBERS

<table>
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<th>SUBLOT DESIGNATION</th>
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</tbody>
</table>
APPENDIX G – QUALITY CONTROL PLAN GUIDELINES

Follow the following format:

1. Title Page
   a. Insert the heading, “Hot Mix Asphalt (HMA) QC/QA Control Plan for the State of New York”
   b. List appropriate Region
   c. Company name and address
   d. Plant location and address
   e. Include signature and date lines for both the Plan Administrator and the Regional Materials Engineer

2. Facility Description
   a. Insert heading showing company name and plant name
   b. List type of facility (drum or batch), facility number, manufacturer, capacity, and automation type
   c. Insert the following statement: “This Control Plan outlines the process for the production of HMA for the State of New York. All work, including sampling and testing procedures, will be performed in accordance with Sections 401 and 402 of the Standard Specifications and addenda, latest Materials Procedure (MP) 401, and any latest applicable Materials Methods, Materials Procedures, and other relevant procedures included in this Control Plan.”

3. Organization Chart (including contact numbers)
   a. List the Plan Administrator
   b. List the Assistant Plan Administrator
   c. List all QC Technicians who may work at the location
   d. Include the QC/QA certification number for each QC Technician
   e. List fax number for the lab
   f. List Regional Materials Office contact

4. Additional Miscellaneous Statements
   a. Include the following statements in the Control Plans:
      “The Producer will
      • Verify that the correct Job Mix Formulas are used during HMA production.
      • Monitor HMA haul vehicles for compliance with §402-3.03, Hauling Equipment, of the Standard Specifications.”
   b. Testing 150 tons or less. Include a statement indicating whether testing quantities of 150 tons or less for all mixtures will be performed or not. The following could be used as a guide to develop the statements:
      • Whether testing will be performed all the time on all mixes, or
      • Whether testing will be performed occasionally when circumstances dictate to test sample because the anticipated production may go beyond 150 tons.
For this case, add the following statement: “Occasionally, testing may be performed for scheduled production of 150 tons or less and it will be documented in BR 303, QC Plant Diary, including the time, sample point, and the reason for testing.”
APPENDIX H – NEW ASSIGNED JMF NUMBER

Any one of the following will require a new JMF number:

- A change in the Performance-Graded (PG) Asphalt Binder grade.
- A change in the Aggregate Source.
- Adding a Warm Mix Additive to an existing Hot Mix Asphalt (HMA).
- Gradation targets are changed by more than 5% from the current mix design targets.
- Any change in the amount of Recycled Asphalt Pavement (RAP) other than up to the 5% decrease allowed in the mix from the original design.
- Mixture produced does not perform in the field.
APPENDIX I – CROSS-SUBLLOT VALIDATION CHARTS

The following charts are different scenarios for QA sample testing and appropriate cross-sublot validation:

<table>
<thead>
<tr>
<th>SUBLOT</th>
<th>QUALITY CONTROL (QC) SAMPLE</th>
<th>QUALITY ASSURANCE (QA) SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>TEST</td>
<td>TEST</td>
</tr>
<tr>
<td>B</td>
<td>TEST</td>
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<tr>
<td>C</td>
<td>TEST</td>
<td>TEST</td>
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</tbody>
</table>

Note: QA sample test results for sublots A, B, & C validate QC sample test results for sublots A, B, & C respectively.

<table>
<thead>
<tr>
<th>SUBLOT</th>
<th>QUALITY CONTROL (QC) SAMPLE</th>
<th>QUALITY ASSURANCE (QA) SAMPLE</th>
</tr>
</thead>
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<tr>
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</tr>
<tr>
<td>C</td>
<td>TEST</td>
<td>TEST</td>
</tr>
</tbody>
</table>

Note: QA sample test results for sublot A validate QC sample test results for sublot A and cross-validate QC sample test results for sublot B. QA sample test results for sublot C validate QC sample test results for sublot C.
<table>
<thead>
<tr>
<th>SUBLOT</th>
<th>QUALITY CONTROL (QC) SAMPLE</th>
<th>QUALITY ASSURANCE (QA) SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
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</tr>
<tr>
<td>B</td>
<td>TEST</td>
<td>TEST</td>
</tr>
<tr>
<td>C</td>
<td>TEST</td>
<td></td>
</tr>
</tbody>
</table>

Note: QA sample test results for sublot A validate QC sample test results for sublot A. QA sample test results for sublot B validate QC sample test results for sublot B and cross-validate QC sample test results for sublot C.

<table>
<thead>
<tr>
<th>SUBLOT</th>
<th>QUALITY CONTROL (QC) SAMPLE</th>
<th>QUALITY ASSURANCE (QA) SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
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<td>C</td>
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</tbody>
</table>

Note: QA sample test results for sublot B validate QC sample test results for sublot B and cross-validate QC sample test results for sublots A & C.
<table>
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<th>SUBLOT</th>
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<th>QUALITY ASSURANCE (QA) SAMPLE</th>
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<td>TEST ←</td>
<td>TEST</td>
</tr>
<tr>
<td>D</td>
<td>TEST ←</td>
<td>TEST</td>
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</table>

Note: QA sample test results for sublots A, B, C, & D validate QC sample test results for sublots A, B, C, & D respectively.

<table>
<thead>
<tr>
<th>SUBLOT</th>
<th>QUALITY CONTROL (QC) SAMPLE</th>
<th>QUALITY ASSURANCE (QA) SAMPLE</th>
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<tbody>
<tr>
<td>A</td>
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<tr>
<td>B</td>
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<tr>
<td>C</td>
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<td>TEST</td>
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<tr>
<td>D</td>
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</table>

Note: QA sample test results for subplot A validate QC sample test results for subplot A and cross-validate QC sample test results for subplot B. QA sample test results for subplot C validate QC sample test results for subplot C and cross-validate QC sample test results for subplot D.
<table>
<thead>
<tr>
<th>SUBLOT</th>
<th>QUALITY CONTROL (QC) SAMPLE</th>
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</tr>
<tr>
<td>D</td>
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</table>

Note: QA sample test results for sublot A validate QC sample test results for sublot A. QA sample test results for sublot B validate QC sample test results for sublot B and cross-validate QC sample test results for sublot C. QA sample test results for sublot D validate QC sample test results for sublot D.
<table>
<thead>
<tr>
<th>SUBLOT</th>
<th>QUALITY CONTROL (QC) SAMPLE</th>
<th>QUALITY ASSURANCE (QA) SAMPLE</th>
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<td>A</td>
<td>TEST</td>
<td>TEST</td>
</tr>
<tr>
<td>B</td>
<td>TEST</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>TEST</td>
<td>TEST</td>
</tr>
<tr>
<td>D</td>
<td>TEST</td>
<td>TEST</td>
</tr>
</tbody>
</table>

Note: QA sample test results for sublot A validate QC sample test results for sublot A and cross-validate QC sample test results for sublot B. QA sample test results for sublot C validate QC sample test results for sublot C. QA sample test results for sublot D validate QC sample test results for sublot D.