



To: <p style="text-align: center;">SUPERSEDED BY EI 11-005 EFFECTIVE 11/21/12</p>		<p style="text-align: center;">New York State Department of Transportation ENGINEERING INSTRUCTION</p>	<p style="text-align: center;">EI 09-006</p>
Title: REVISION TO HOT MIX ASPHALT SECTION 401 – PLANT PRODUCTION			
Distribution: <input checked="" type="checkbox"/> Manufacturers (18) <input checked="" type="checkbox"/> Local Govt. (31) <input checked="" type="checkbox"/> Agencies (32)	<input checked="" type="checkbox"/> Surveyors (33) <input checked="" type="checkbox"/> Consultants (34) <input checked="" type="checkbox"/> Contractors (39) _____ ()	Approved:  Robert L. Sack, PE Deputy Chief Engineer (Technical Services)	

11 Feb 09
Date

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the Letting of May 7, 2009.
- This EI supersedes EI 02-001 and EI 06-012.
- The revisions issued with this EI will be incorporated into a future update of the Standard Specifications.

PURPOSE: The purpose of this EI is to revise Standard Specifications Section 401 to be consistent with revisions to the Hot Mix Asphalt (HMA) Quality Control/Quality Assurance (QC/QA) Program.

TECHNICAL INFORMATION: The revisions included in this document are required to be consistent with significant changes made to the Hot Mix Asphalt (HMA) Quality Control and Quality Assurance practices issued by EB 09-005.

A considerable amount of information which was formerly found in Section 401 is now located in Materials Procedure 401. The information moved, primarily deals with HMA plant requirements and HMA Producer and Department responsibilities for production of HMA. Material removed from the specification includes:

- Control Plan organization
- Plant Lot and Sublot definitions
- Quality Control sampling and testing
- Acceptable tolerance ranges of testing samples
- Test result reporting
- Plant requirements

Additionally, wording under Method of Measurement has been updated to reflect changes resulting from EB 09-005.

IMPLEMENTATION:

- **Projects Scheduled for Lettings Before May 7, 2009** - Designers shall submit an amendment with the revised Section 401 Special Note if the amendment deadline has not passed.
- **Beginning with Projects Submitted for the Letting of May 7, 2009** - Main Office Design Quality Assurance Bureau will insert the Standard Specification as a Shelf Note into contract proposals.

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- The following special specifications are disapproved due to inappropriate references to Section 401.

Metric Specifications

02302.01 M – Bituminous Course Using recycled Bituminous Concrete
04502.4597 M – Asphalt Concrete Joint in Existing Pavement
05410.201199 M – Quick-Set Slurry, Type II
05410.201299 M – Quick-Set Slurry, Type III
15502.4511 M – Cement Concrete Pavement Pressure Relief Joints
15502.4598 M – Pressure Relief Joints in Existing Cement Concrete Pavement
18303.0182 M – Superpave Optional Flexible Shoulders
18502.03 M – Cement Treated Permeable Base Course
18502.6596 M – Cracking and Seating Existing PCC Pavement
18502.7596 M – Rubblizing Existing Portland Cement Concrete Pavement
51405.0201 M – Cold In-Place Recycling Asphalt Concrete
51618.34 M – Bituminous Material
51623.05 M – Aggregate
51407.01 M – Tack Coat

US Customary Specifications

502.65960018 – Cracking and Seating Existing PCC Pavement
502.75960018 – Rubblizing Existing Portland Cement Concrete Pavement
680.57000001 – Furnish and Install 3 NPS PVC Conduit for Magnetic Detectors
685.02000010 – Removing Plowable Pavement Markers

- Regional Special Specification Coordinators should continue to review their asphalt related special specifications for references to Section 401 and amend accordingly.

TRANSMITTED MATERIALS: US Customary and Metric shelf notes, Section 401 – Plant Production, are transmitted by this EI.

BACKGROUND: Revisions to New York State Department of Transportation's (NYSDOT) HMA Quality Control and Quality Assurance practices were required based on a Federal Highway Administration Quality Assurance Stewardship Review. Additional background information is available in EB 09-005.

CONTACT: Questions regarding this EB should be addressed to the Materials Bureau. Contact Russell Thielke at (518) 457-4585, rthielke@dot.state.ny.us, or Zoeb Zavery at (518) 485-5277, zzavery@dot.state.ny.us.

SECTION 401 - PLANT PRODUCTION

Make the following changes to the Standard Specifications dated May 1, 2008:
Delete Section 401 – Plant Production entirely and replace it with the following:

SECTION 401 - PLANT PRODUCTION

401-1 DESCRIPTION. The contractor is responsible for Quality Control (QC). QC is defined as all activities required to produce HMA that meets all specification requirements. The contractor will incorporate a Quality Control system for all plant production of hot mix asphalt (HMA) and assume responsibilities for all QC activities at the production facilities.

The contractor shall produce the HMA according to the specifications herein and provide production documentation. Quality Adjustment Factors (QAFs) will be used to assess HMA production quality and these factors will be applied to calculate a quality payment adjustment.

The State is responsible for Quality Assurance (QA). QA is defined as all activities performed by the State to assure that HMA production meets the specification requirements. The State will determine quality payment adjustments for each day's production using a daily QAF obtained from the calculations of the average absolute values for volumetric and non-volumetric mixes in accordance with Materials Procedure (MP) 401, Quality Control and Quality Assurance Procedures for Quality Control Hot Mix Asphalt Production. The daily QAFs measure production variation from the mean of the specification limits.

401-2 MATERIALS. The provisions of §402-2, Materials, apply and are as modified herein. Produce HMA in accordance with the requirements outlined in this specification, including all applicable Test Methods and Materials Procedures. HMA mixture designs must be acceptable to the State prior to any HMA production.

The State reserves the right to suspend any mixture design when the mixture demonstrates unacceptable paving quality or exhibits properties that will affect the anticipated pavement performance.

401-2.01 Hot Mix Asphalt Designs. Produce HMA in accordance with the procedures outlined in NYSDOT's Materials Method (MM) 5.16, Superpave Hot Mix Asphalt Mixture Design and Mixture Verification Procedures.

Formulate and submit a HMA design to the Regional Materials Engineer (RME) that satisfies all design criteria outlined in MM 5.16. When the submitted HMA design is assigned verification status, the design must be verified during production as outlined in MM 5.16. Notify the RME at least 24 hours prior to the start of verification status production. When producing under Verification Status, make necessary adjustments to control the process. Apply daily QAFs to both verification and production status mix designs. Mixtures produced under Verification Status, as outlined in MM 5.16, are allowed for use on State projects.

For any HMA permeable base and shim mixtures required by the contract documents, formulate and submit to the RME a job mix formula that satisfies the General Limits imposed by Table 401-1, Composition of Hot Mix Asphalt Mixtures.

401-2.02 Aggregates. Aggregate must be from a source approved by the State. Use fine aggregate that consists of materials conforming to the requirements of §703-01, Fine Aggregate. In addition, fine aggregate may consist of screenings, free from deleterious materials and manufactured from sources of stone, gravel, or slag meeting the requirements of §703-02, Coarse Aggregate.

Use coarse aggregate that consists either of crushed stone, crushed gravel, or crushed slag conforming to the requirements of §703-02, Coarse Aggregate and the requirements outlined in MM 5.16.

Use slag aggregate on State projects only when an alternate pay item which takes the mix yield differential into account is included on the plans or in the itemized proposal.

When coarse aggregates for the mixture are from more than one source or of more than one type of material, proportion and blend them to provide a uniform mixture.

SECTION 401 - PLANT PRODUCTION

TABLE 401-1 COMPOSITION OF HOT MIX ASPHALT MIXTURES						
Mixture Requirements	Permeable Base				Shim	
	Type 1		Type 2		Type 5	
Screen Sizes	General Limits % Passing ¹	Job Mix Tolerance %	General Limits % Passing ¹	Job Mix Tolerance %	General Limits % Passing ¹	Job Mix Tolerance %
2 in	100	-	100	-	-	-
1 1/2 in	95-100	-	75-100	±7	-	-
1 in	80- 95	±6	55- 80	±8	-	-
1/2 in	30- 60	±6	23- 42	±7	-	-
1/4 in	10- 25	±6	5- 20	±6	100	-
1/8 in	3- 15	±6	2- 15	±4	80-100	±6
No. 20	-	-	-	-	32- 72	±7
No. 40	-	-	-	-	18- 52	±7
No. 80	-	-	-	-	7- 26	±4
No. 200	0- 4	±2	-	-	2- 12	±2
Asphalt Content, % ^{2,3}	2.0-4.0	NA	2.5-4.5	NA	7.0-9.5	NA
Mixing and Placing Temperature Range °F	225-300		225-300		250-325	

NOTES:

1. All aggregate percentages are based on the total weight of the aggregate.
2. The asphalt content is based on the total weight of the mix. When using slag aggregates in the mix, the asphalt content shall be increased accordingly, a minimum of 25 percent for an all slag mix.
3. Use the PG binder listed in the proposal or as designated by the Region Materials Engineer following the guidance specified in the Comprehensive Pavement Design Manual, Chapter 6, Section 6.2.5 – Performance Graded Binder Selection.

A. Coarse Aggregate Type F1 Conditions

1. Limestone, dolomite or a blend of the two having an acid-insoluble residue content of not less than 20.0%.
2. Sandstone, granite, chert, traprock, ore tailings, slag or other similar noncarbonate materials.
3. Gravel, or a natural or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag or other similar materials, meeting the following requirements:

- a. 12.5 Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 1/8 inch particles must comprise a minimum of 30.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 95.0% of plus 3/8 inch particles must be non-carbonate.
- b. 9.5 Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 1/8 inch particles must comprise a minimum of 30.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 95.0% of plus No. 4 particles must be non-carbonate.

B. Coarse Aggregate Type F2 Conditions

1. Limestone, dolomite, or a blend of the two having an acid-insoluble residue content of not less

SECTION 401 - PLANT PRODUCTION

than 20.0%.

2. Sandstone, granite, chert, traprock, ore tailings, slag or other similar noncarbonate materials.
3. Gravel, or a natural or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag or other similar materials, meeting the following requirements:

a. 12.5 Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 1/8 inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 3/8 inch particles must be noncarbonate.

b. 9.5 Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 1/8 inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus No. 4 particles must be noncarbonate.

C. Coarse Aggregate Type F3 Conditions

1. Limestone or a blend of limestone and dolomite having an acid-insoluble residue content of not less than 20.0%.
2. Dolomite.
3. Sandstone, granite, chert, traprock, ore tailings, slag or other similar noncarbonate materials.
4. Gravel, or a natural or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag or other similar materials, meeting the following requirements:

a. 12.5 Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 1/8 inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 3/8 inch particles must be noncarbonate.

b. 9.5 Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 1/8 inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus No. 4 particles must be noncarbonate.

D. Coarse Aggregate Type F9 Conditions. Use coarse aggregate meeting the requirements of §703-02, Coarse Aggregate.

401-2.03 Mineral Filler. Mineral filler will conform to the requirements of §703-08, Mineral Filler.

401-2.04 Performance-Graded Binder. Use the Performance-Graded Binder (PG Binder) in the production of these mixtures that meets Section 702 – Bituminous Materials.

Initial acceptance of the PG Binder is based on the primary source appearing on the State's Approved List for Bituminous Material Primary Sources, A. Performance-Graded Binders for Paving. Acceptance of the PG Binder is contingent upon satisfactory test results from samples taken, as required by the State's procedural directives, at the location where the material is incorporated into the work. A primary source is defined as a firm that samples, tests, and certifies by Production Lot that the PG Binder is in conformance with the specifications. The procedural directives for sampling, testing, and certifying the PG Binder, and for achieving and maintaining approved list status, are available from the Materials Bureau.

The temperature of PG Binder delivered to the HMA Production Facility will not exceed 350°F, unless the PG Binder supplier recommends it.

401-2.05 Reclaimed Asphalt Pavement. Reclaimed Asphalt Pavement (RAP) will meet the requirements as written in MM 5.16.

SECTION 401 - PLANT PRODUCTION

401-3 CONSTRUCTION DETAILS.

401-3.01 Quality Control. Perform all sampling and testing in accordance with Materials Procedure 401. Document all QC test results and records in a legible manner and provide them to the State at the end of each production season or when requested by the RME. HMA produced without the required sampling, testing and documentation may be rejected.

401-3.02 Production Facility Laboratory. Maintain an approved production facility site laboratory to perform all required HMA sampling and testing according to MP 401.

401-3.03 Plant Lots and Sublots. Determine plant lots and sublots on a daily basis in accordance with MP 401.

401-3.04 Quality Control Sampling and Testing. Obtain and test QC samples as outlined in MP 401.

401-3.05 Production Control. Produce HMA according to MP 401. Make necessary process control adjustments during production according to MP 401.

401-3.06 Production Quantities. Whenever production is made for the State, notify the Regional Materials office by 3:00 p.m. the day before the day of production.

Maintain a record of each day's production quantity for each mix design supplied to the project site daily. Retain these records at the production facility. These records must be available to the State's representative for review. Ship all production quantities to the project site as outlined in §401-4 Method of Measurement.

401-3.07 Documentation. Record all QC test data for each plant on the appropriate forms provided by the State according to MP 401. Also, keep a copy of the plant automation printout at the plant facility for each mix type produced and make them available for review at all times. Transmit a summary of all test data weekly to the RME.

401-3.08 HMA Mixing Plant. HMA mixing plants must meet the requirements in MP 401.

401-3.09 Hot Mix Asphalt Holding Bins. HMA mixtures may be held in holding bins which meet the requirements in MP 401.

401-4 METHOD OF MEASUREMENT. Determine the quantities daily for each plant. The quantity is the number of actual tons determined from the automated proportioning system, the delivery vehicle weigh system, or the HMA holding bin weigh system. Measure or calculate the quantity based on the measured amount and report to the nearest 0.01 of a ton.

A delivery ticket indicating the total quantity in tons being delivered must accompany each delivery vehicle supplying HMA. The method of determining the delivered quantity is subject to the approval of the RME. Make one legible copy of the delivery ticket available to the State's paving inspector prior to the placement of the mixture. The delivery ticket shall show the following minimum information:

- Ticket number
- Plant identification
- Contract number
- SiteManager Mix ID (as outlined in MP 401)
- Mix Code (as outlined in MP 401)
- Quantity of material in vehicle
- Date and Time

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The quality assurance technician (QAT) will determine the quality adjustment factor (QAF) for each day's production in accordance with MP 401 and this section.

The Engineer will use the Daily QAF to calculate the quality payment adjustment for each day's production according to 402-4 Method of Measurement.

401-4.01 Certified Production, Production Less Than 500 Tons, and Highway Permit Production. Production meeting the specification requirements will be assigned a QAF of 1.00. Production failing to meet the specification requirements will be subject to evaluation according to 401-4.03 Evaluation of Sublots Represented by 0.85 QAF.

401-4.02 Production Greater Than 500 Tons. The QAT will determine each Sublot QAF according to MP 401 and this section. Sublots represented by a 0.85 QAF will be subject to evaluation according to 401-4.03 Evaluation of Sublots Represented by 0.85 QAF.

The Daily QAF will be calculated according to the following formula:

$$\text{Daily QAF} = [(\text{Tonnage} * \text{QAF})_{\text{Sublot A}} + (\text{Tonnage} * \text{QAF})_{\text{Sublot B}} + \text{etc.}] / \text{Total Tonnage Produced}$$

The Daily QAF applies to all production quantity deemed acceptable by the Engineer. A sublot represented by a 0.85 QAF will only be included in the Daily QAF calculation if determined that it will be left in place.

A. Sublot QAF Based on Air Voids (volumetric top and binder course mix designs).

The QAT will determine each Sublot QAF based on Table 401-2, Sublot QAF Based on Air Voids and Table 401-3, Pre-Qualification for Incentive Based on Air Voids.

Absolute Difference Value (Test Value - 3.5) ¹	Quality Adjustment Factor (QAF)
0.00 - 0.17	1.05 ²
0.18 - 0.33	1.04 ²
0.34 - 0.50	1.03 ²
0.51 - 0.67	1.02 ²
0.68 - 0.83	1.01 ²
0.84 - 1.00	1.00
1.01 - 1.10	0.99
1.11 - 1.20	0.98
1.21 - 1.30	0.97
1.31 - 1.40	0.96
1.41 - 1.50	0.95
1.51 - 1.60	0.94
1.61 - 1.70	0.93
1.71 - 1.80	0.92
1.81 - 1.90	0.91
1.91 - 2.00	0.90
over 2.00	0.85

1. For 6.3 mm mix - Absolute Difference Value is (Test Value - 4.0).
2. A sublot QAF of 1.00 will be assigned if any of the QC or QA gradation or asphalt content test results for the sublot exceed the maximum tolerances listed in Table 401-3 - Pre-Qualification for Incentive Based on Air Voids. When there are not any QC or QA gradation results for a sublot, use the nearest results, in terms of tonnage, to determine the sublot's eligibility for incentive payment.

SECTION 401 - PLANT PRODUCTION

Test Property	Difference From Target Value
Gradation – Sieve # 200 (% passing)	± 3.0 %
Gradation – Sieve # 8 (% passing)	± 8.0 %
Gradation – Sieve # 4 (% passing)	± 8.0 %
Asphalt Binder Content (%)	± 0.2% ¹

1. Asphalt 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. 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.

B. Sublot QAF Based on Gradation (37.5 mix and non-volumetric mix designs). For each job mix formula sieve having a design target value less than 90 percent passing, the QAT will determine the Sieve QAF based on Table 401-4, Sieve QAF and Table 401-5, Pre-Qualification for Incentive Based on Gradation. The Sublot QAF will be the same as the lowest Sieve QAF for the subplot if any Sieve QAF is less than 1.00. If all Sieve QAFs for the subplot are equal to or greater than 1.00, the Sublot QAF will be the same as the highest Sieve QAF.

PERCENT PASSING			
Absolute Difference Value (Test Value - JMF Target Value)			Quality Adjustment Factor (QAF)
Sieve Size #50 and Larger	Sieve Size #80 and #100	Sieve Size #200	
0.0 - 0.8	0.0 - 0.5	0.0 - 0.3	1.05 ¹
0.9 - 1.5	0.6 - 1.0	0.4 - 0.5	1.04 ¹
1.6 - 2.3	1.1 - 1.5	0.6 - 0.8	1.03 ¹
2.4 - 3.0	1.6 - 2.0	0.9 - 1.0	1.02 ¹
3.1 - 4.5	2.1 - 3.0	1.1 - 1.5	1.01 ¹
4.6 - 6.0	3.1 - 4.0	1.6 - 2.0	1.00
6.1 - 6.2	4.1 - 4.2	2.1	0.99
6.3 - 6.4	4.3 - 4.4	2.2	0.98
6.5 - 6.6	4.5 - 4.6	2.3	0.97
6.7 - 6.8	4.7 - 4.8	2.4	0.96
6.9 - 7.0	4.9 - 5.0	2.5	0.95
7.1 - 7.2	5.1 - 5.2	2.6	0.94
7.3 - 7.4	5.3 - 5.4	2.7	0.93
7.5 - 7.6	5.5 - 5.6	2.8	0.92
7.7 - 7.8	5.7 - 5.8	2.9	0.91
7.9 - 8.0	5.9 - 6.0	3.0	0.90
over 8.0	over 6.0	over 3.0	0.85

1. A subplot sieve QAF of 1.00 will be assigned if any of the QC or QA asphalt content test results for the subplot exceed the maximum tolerance listed in the Table 401-5 - Pre-Qualification for Incentive Based on Gradation, below.

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TABLE 401-5 PRE-QUALIFICATION FOR INCENTIVE BASED ON GRADATION	
Test Property	Difference From Target Value
Asphalt Binder Content (%)	± 0.2 ¹

1. Asphalt 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. 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.

401-4.03 Evaluation of Sublots Represented by 0.85 QAF. When any material results in a QAF of 0.85, the Engineer will evaluate the subject material to determine if it will be left in place. The Engineer may require the Contractor to core the pavement to determine if the in-place density is acceptable. When cores are required, the Engineer will divide the pavement area being evaluated into 4 sublots. Follow the requirements of Section 402-3.08, Pavement Density Samples, at no cost to the State. The material will be left in-place when either of the following sets of conditions is met.

- The calculated plant air voids used for payment are greater than 5.5% and less than or equal to 7.0%, the asphalt content, based on automation, is within 0.2% of the production target, the contractor achieved field density of 92% to 97%, and there are no defects such as, but not limited to, cracking, raveling, rutting, shoving, or bleeding.
- The calculated plant air voids used for payment are greater than or equal to 1% and less than 1.5%, the validated QC and QA plant air void test results, according to MP 401, average 1.5% to 5.5%, the asphalt content, based on automation, is within 0.2% of the production target, the contractor achieved field density of 92% to 97%, and there are no defects such as, but not limited to, cracking, raveling, rutting, shoving, or bleeding.

If the material does not meet the above conditions or it is unknown, such as for mixes accepted based on gradation or if QA testing was not required, the Engineer will determine if the material in question may remain in-place considering, but not limited to, the following:

- Type of material produced
- The layer in which the material was placed
- The location and traffic volume
- Laboratory test results
- Field test results, such as density

If the subject material is left in-place, it will be assigned a Sublot QAF of 0.85 and be included in the Daily QAF calculation. If determined the subject material will not be left in-place, the Contractor shall remove and replace the material at no cost to the State and the material will not be included in the Daily QAF calculation.

SECTION 401 - PLANT PRODUCTION

Make the following changes to the Standard Specifications dated May 4, 2006:
Delete Section 401 – Plant Production entirely and replace it with the following:

SECTION 401 - PLANT PRODUCTION

401-1 DESCRIPTION. The contractor is responsible for Quality Control (QC). QC is defined as all activities required to produce HMA that meets all specification requirements. The contractor will incorporate a Quality Control system for all plant production of hot mix asphalt (HMA) and assume responsibilities for all QC activities at the production facilities.

The contractor shall produce the HMA according to the specifications herein and provide production documentation. Quality Adjustment Factors (QAFs) will be used to assess HMA production quality and these factors will be applied to calculate a quality payment adjustment.

The State is responsible for Quality Assurance (QA). QA is defined as all activities performed by the State to assure that HMA production meets the specification requirements. The State will determine quality payment adjustments for each day's production using a daily QAF obtained from the calculations of the average absolute values for volumetric and non-volumetric mixes in accordance with Materials Procedure (MP) 401, Quality Control and Quality Assurance Procedures for Quality Control Hot Mix Asphalt Production. The daily QAFs measure production variation from the mean of the specification limits.

401-2 MATERIALS. The provisions of §402-2, Materials, apply and are as modified herein. Produce HMA in accordance with the requirements outlined in this specification, including all applicable Test Methods and Materials Procedures. HMA mixture designs must be acceptable to the State prior to any HMA production.

The State reserves the right to suspend any mixture design when the mixture demonstrates unacceptable paving quality or exhibits properties that will affect the anticipated pavement performance.

401-2.01 Hot Mix Asphalt Designs. Produce HMA in accordance with the procedures outlined in NYSDOT's Materials Method (MM) 5.16, Superpave Hot Mix Asphalt Mixture Design and Mixture Verification Procedures.

Formulate and submit a HMA design to the Regional Materials Engineer (RME) that satisfies all design criteria outlined in MM 5.16. When the submitted HMA design is assigned verification status, the design must be verified during production as outlined in MM 5.16. Notify the RME at least 24 hours prior to the start of verification status production. When producing under Verification Status, make necessary adjustments to control the process. Apply daily QAFs to both verification and production status mix designs. Mixtures produced under Verification Status, as outlined in MM 5.16, are allowed for use on State projects.

For any HMA permeable base and shim mixtures required by the contract documents, formulate and submit to the RME a job mix formula that satisfies the General Limits imposed by Table 401-1, Composition of Hot Mix Asphalt Mixtures.

401-2.02 Aggregates. Aggregate must be from a source approved by the State. Use fine aggregate that consists of materials conforming to the requirements of §703-01, Fine Aggregate. In addition, fine aggregate may consist of screenings, free from deleterious materials and manufactured from sources of stone, gravel, or slag meeting the requirements of §703-02, Coarse Aggregate.

Use coarse aggregate that consists either of crushed stone, crushed gravel, or crushed slag conforming to the requirements of §703-02, Coarse Aggregate and the requirements outlined in MM 5.16.

Use slag aggregate on State projects only when an alternate pay item which takes the mix yield differential into account is included on the plans or in the itemized proposal.

When coarse aggregates for the mixture are from more than one source or of more than one type of material, proportion and blend them to provide a uniform mixture.

SECTION 401 - PLANT PRODUCTION

Mixture Requirements	Permeable Base				Shim	
	Type 1		Type 2		Type 5	
Screen Sizes	General Limits % Passing ¹	Job Mix Tolerance %	General Limits % Passing ¹	Job Mix Tolerance %	General Limits % Passing ¹	Job Mix Tolerance %
50.0 mm	100	-	100	-	-	-
37.5 mm	95-100	-	75-100	±7	-	-
25.0 mm	80- 95	±6	55- 80	±8	-	-
12.5 mm	30- 60	±6	23- 42	±7	-	-
6.3 mm	10- 25	±6	5- 20	±6	100	-
3.2 mm	3- 15	±6	2- 15	±4	80-100	±6
850 µm	-	-	-	-	32- 72	±7
425 µm	-	-	-	-	18- 52	±7
180 µm	-	-	-	-	7- 26	±4
75 µm	0- 4	±2	-	-	2- 12	±2
Asphalt Content, % ^{2,3}	2.0-4.0	NA	2.5-4.5	NA	7.0-9.5	NA
Mixing and Placing Temperature Range °C	110-150		110-150		120-165	

NOTES:

1. All aggregate percentages are based on the total weight of the aggregate.
2. The asphalt content is based on the total weight of the mix. When using slag aggregates in the mix, the asphalt content shall be increased accordingly, a minimum of 25 percent for an all slag mix.
3. Use the PG binder listed in the proposal or as designated by the Region Materials Engineer following the guidance specified in the Comprehensive Pavement Design Manual, Chapter 6, Section 6.2.5 – Performance Graded Binder Selection.

A. Coarse Aggregate Type F1 Conditions

1. Limestone, dolomite or a blend of the two having an acid-insoluble residue content of not less than 20.0%.
2. Sandstone, granite, chert, traprock, ore tailings, slag or other similar noncarbonate materials.
3. Gravel, or a natural or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag or other similar materials, meeting the following requirements:
 - a. 12.5 mm Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 30.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 95.0% of plus 9.5 mm particles must be non-carbonate.
 - b. 9.5 mm Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 30.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 95.0% of plus 4.75 mm particles must be non-carbonate.

B. Coarse Aggregate Type F2 Conditions

1. Limestone, dolomite, or a blend of the two having an acid-insoluble residue content of not less

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than 20.0%.

2. Sandstone, granite, chert, traprock, ore tailings, slag or other similar noncarbonate materials.
3. Gravel, or a natural or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag or other similar materials, meeting the following requirements:

- a. 12.5 mm Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 9.5 mm particles must be noncarbonate.
- b. 9.5 mm Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 4.75 mm particles must be noncarbonate.

C. Coarse Aggregate Type F3 Conditions

1. Limestone or a blend of limestone and dolomite having an acid-insoluble residue content of not less than 20.0%.
2. Dolomite.
3. Sandstone, granite, chert, traprock, ore tailings, slag or other similar noncarbonate materials.
4. Gravel, or a natural or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag or other similar materials, meeting the following requirements:

- a. 12.5 mm Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 9.5 mm particles must be noncarbonate.
- b. 9.5 mm Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 4.75 mm particles must be noncarbonate.

D. Coarse Aggregate Type F9 Conditions. Use coarse aggregate meeting the requirements of §703-02, Coarse Aggregate.

401-2.03 Mineral Filler. Mineral filler will conform to the requirements of §703-08, Mineral Filler.

401-2.04 Performance-Graded Binder. Use the Performance-Graded Binder (PG Binder) in the production of these mixtures that meets Section 702 – Bituminous Materials.

Initial acceptance of the PG Binder is based on the primary source appearing on the State's Approved List for Bituminous Material Primary Sources, A. Performance-Graded Binders for Paving. Acceptance of the PG Binder is contingent upon satisfactory test results from samples taken, as required by the State's procedural directives, at the location where the material is incorporated into the work. A primary source is defined as a firm that samples, tests, and certifies by Production Lot that the PG Binder is in conformance with the specifications. The procedural directives for sampling, testing, and certifying the PG Binder, and for achieving and maintaining approved list status, are available from the Materials Bureau.

The temperature of PG Binder delivered to the HMA Production Facility will not exceed 175°C, unless the PG Binder supplier recommends it.

401-2.05 Reclaimed Asphalt Pavement. Reclaimed Asphalt Pavement (RAP) will meet the requirements as written in MM 5.16.

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401-3 CONSTRUCTION DETAILS.

401-3.01 Quality Control. Perform all sampling and testing in accordance with Materials Procedure 401. Document all QC test results and records in a legible manner and provide them to the State at the end of each production season or when requested by the RME. HMA produced without the required sampling, testing and documentation may be rejected.

401-3.02 Production Facility Laboratory. Maintain an approved production facility site laboratory to perform all required HMA sampling and testing according to MP 401.

401-3.03 Plant Lots and Sublots. Determine plant lots and sublots on a daily basis in accordance with MP 401.

401-3.04 Quality Control Sampling and Testing. Obtain and test QC samples as outlined in MP 401.

401-3.05 Production Control. Produce HMA according to MP 401. Make necessary process control adjustments during production according to MP 401.

401-3.06 Production Quantities. Whenever production is made for the State, notify the Regional Materials office by 3:00 p.m. the day before the day of production.

Maintain a record of each day's production quantity for each mix design supplied to the project site daily. Retain these records at the production facility. These records must be available to the State's representative for review. Ship all production quantities to the project site as outlined in §401-4 Method of Measurement.

401-3.07 Documentation. Record all QC test data for each plant on the appropriate forms provided by the State according to MP 401. Also, keep a copy of the plant automation printout at the plant facility for each mix type produced and make them available for review at all times. Transmit a summary of all test data weekly to the RME.

401-3.08 HMA Mixing Plant. HMA mixing plants must meet the requirements in MP 401.

401-3.09 Hot Mix Asphalt Holding Bins. HMA mixtures may be held in holding bins which meet the requirements in MP 401.

401-4 METHOD OF MEASUREMENT. Determine the quantities daily for each plant. The quantity is the number of actual metric tons determined from the automated proportioning system, the delivery vehicle weigh system, or the HMA holding bin weigh system. Measure or calculate the quantity based on the measured amount and report to the nearest 0.01 of a metric ton.

A delivery ticket indicating the total quantity in metric tons being delivered must accompany each delivery vehicle supplying HMA. The method of determining the delivered quantity is subject to the approval of the RME. Make one legible copy of the delivery ticket available to the State's paving inspector prior to the placement of the mixture. The delivery ticket shall show the following minimum information:

- Ticket number
- Plant identification
- Contract number
- SiteManager Mix ID (as outlined in MP 401)
- Mix Code (as outlined in MP 401)
- Quantity of material in vehicle
- Date and Time

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The quality assurance technician (QAT) will determine the quality adjustment factor (QAF) for each day's production in accordance with MP 401 and this section.

The Engineer will use the Daily QAF to calculate the quality payment adjustment for each day's production according to 402-4 Method of Measurement.

401-4.01 Certified Production, Production Less Than 500 Tons, and Highway Permit Production. Production meeting the specification requirements will be assigned a QAF of 1.00. Production failing to meet the specification requirements will be subject to evaluation according to 401-4.03 Evaluation of Sublots Represented by 0.85 QAF.

401-4.02 Production Greater Than 500 Tons. The QAT will determine each Sublot QAF according to MP 401 and this section. Sublots represented by a 0.85 QAF will be subject to evaluation according to 401-4.03 Evaluation of Sublots Represented by 0.85 QAF.

The Daily QAF will be calculated according to the following formula:

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

The Daily QAF applies to all production quantity deemed acceptable by the Engineer. A sublot represented by a 0.85 QAF will only be included in the Daily QAF calculation if determined that it will be left in place.

A. Sublot QAF Based on Air Voids (volumetric top and binder course mix designs). The QAT will determine each Sublot QAF based on Table 401-2, Sublot QAF Based on Air Voids and Table 401-3, Pre-Qualification for Incentive Based on Air Voids.

TABLE 401-2 SUBLLOT QAF BASED ON AIR VOIDS	
Absolute Difference Value (Test Value - 3.5) ¹	Quality Adjustment Factor (QAF)
0.00 - 0.17	1.05 ²
0.18 - 0.33	1.04 ²
0.34 - 0.50	1.03 ²
0.51 - 0.67	1.02 ²
0.68 - 0.83	1.01 ²
0.84 - 1.00	1.00
1.01 - 1.10	0.99
1.11 - 1.20	0.98
1.21 - 1.30	0.97
1.31 - 1.40	0.96
1.41 - 1.50	0.95
1.51 - 1.60	0.94
1.61 - 1.70	0.93
1.71 - 1.80	0.92
1.81 - 1.90	0.91
1.91 - 2.00	0.90
over 2.00	0.85

1. For 6.3 mm mix - Absolute Difference Value is (Test Value - 4.0).
2. A sublot QAF of 1.00 will be assigned if any of the QC or QA gradation or asphalt content test results for the sublot exceed the maximum tolerances listed in Table 401-3 - Pre-Qualification for Incentive Based on Air Voids. When there are not any QC or QA gradation results for a sublot, use the nearest results, in terms of tonnage, to determine the sublot's eligibility for incentive payment.

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Test Property	Difference From Target Value
Gradation – 75 µm Sieve (% passing)	± 3.0 %
Gradation – 2.36 mm Sieve (% passing)	± 8.0 %
Gradation – 4.75 mm Sieve (% passing)	± 8.0 %
Asphalt Binder Content (%)	± 0.2% ¹

1. Asphalt 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. 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.

B. Sublot QAF Based on Gradation (37.5 mm and non-volumetric mix designs). For each job mix formula sieve having a design target value less than 90 percent passing, the QAT will determine the Sieve QAF based on Table 401-4, Sieve QAF and Table 401-5, Pre-Qualification for Incentive Based on Gradation. The Sublot QAF will be the same as the lowest Sieve QAF for the subplot if any Sieve QAF is less than 1.00. If all Sieve QAFs for the subplot are equal to or greater than 1.00, the Sublot QAF will be the same as the highest Sieve QAF.

PERCENT PASSING			
Absolute Difference Value (Test Value - JMF Target Value)			Quality Adjustment Factor (QAF)
Sieve Size 300 µm and Larger	Sieve Size 180 µm and 150 µm	Sieve Size 75 µm	
0.0 - 0.8	0.0 - 0.5	0.0 - 0.3	1.05 ¹
0.9 - 1.5	0.6 - 1.0	0.4 - 0.5	1.04 ¹
1.6 - 2.3	1.1 - 1.5	0.6 - 0.8	1.03 ¹
2.4 - 3.0	1.6 - 2.0	0.9 - 1.0	1.02 ¹
3.1 - 4.5	2.1 - 3.0	1.1 - 1.5	1.01 ¹
4.6 - 6.0	3.1 - 4.0	1.6 - 2.0	1.00
6.1 - 6.2	4.1 - 4.2	2.1	0.99
6.3 - 6.4	4.3 - 4.4	2.2	0.98
6.5 - 6.6	4.5 - 4.6	2.3	0.97
6.7 - 6.8	4.7 - 4.8	2.4	0.96
6.9 - 7.0	4.9 - 5.0	2.5	0.95
7.1 - 7.2	5.1 - 5.2	2.6	0.94
7.3 - 7.4	5.3 - 5.4	2.7	0.93
7.5 - 7.6	5.5 - 5.6	2.8	0.92
7.7 - 7.8	5.7 - 5.8	2.9	0.91
7.9 - 8.0	5.9 - 6.0	3.0	0.90
over 8.0	over 6.0	over 3.0	0.85

1. A subplot sieve QAF of 1.00 will be assigned if any of the QC or QA asphalt content test results for the subplot exceed the maximum tolerance listed in the Table 401-5 - Pre-Qualification for Incentive Based on Gradation, below.

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TABLE 401-5 PRE-QUALIFICATION FOR INCENTIVE BASED ON GRADATION	
Test Property	Difference From Target Value
Asphalt Binder Content (%)	± 0.2 ¹

1. Asphalt 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. 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.

401-4.03 Evaluation of Sublots Represented by 0.85 QAF. When any material results in a QAF of 0.85, the Engineer will evaluate the subject material to determine if it will be left in place. The Engineer may require the Contractor to core the pavement to determine if the in-place density is acceptable. When cores are required, the Engineer will divide the pavement area being evaluated into 4 sublots. Follow the requirements of Section 402-3.08, Pavement Density Samples, at no cost to the State. The material will be left in-place when either of the following sets of conditions is met.

- The calculated plant air voids used for payment are greater than 5.5% and less than or equal to 7.0%, the asphalt content, based on automation, is within 0.2% of the production target, the contractor achieved field density of 92% to 97%, and there are no defects such as, but not limited to, cracking, raveling, rutting, shoving, or bleeding.
- The calculated plant air voids used for payment are greater than or equal to 1% and less than 1.5%, the validated QC and QA plant air void test results, according to MP 401, average 1.5% to 5.5%, the asphalt content, based on automation, is within 0.2% of the production target, the contractor achieved field density of 92% to 97%, and there are no defects such as, but not limited to, cracking, raveling, rutting, shoving, or bleeding.

If the material does not meet the above conditions or it is unknown, such as for mixes accepted based on gradation or if QA testing was not required, the Engineer will determine if the material in question may remain in-place considering, but not limited to, the following:

- Type of material produced
- The layer in which the material was placed
- The location and traffic volume
- Laboratory test results
- Field test results, such as density

If the subject material is left in-place, it will be assigned a Sublot QAF of 0.85 and be included in the Daily QAF calculation. If determined the subject material will not be left in-place, the Contractor shall remove and replace the material at no cost to the State and the material will not be included in the Daily QAF calculation.