To:				
SUPERSEDED BY EI 09-006 EFFECTIVE 5/7/09	MODIFIED BY EB 02-021 EFFECTIVE 5/9/02		*New York State Department of Transportation* **ENGINEERING INSTRUCTION**	**EI 02-001**

Title: **SPECIFICATION REVISIONS: SECTIONS 401, 402, AND 403-HOT MIX ASPHALT**

Distribution:

- ☐ Manufacturers (18)
- ☒ Main Office (30)
- ☒ Local Govt. (31)
- ☒ Regions/Agencies (32)
- ☐ Surveyors (33)
- ☒ Consultants (34)
- ☒ Contractors (39)
- ☐ _____( )

Approved:

Robert L. Sack — 21 DEC 01

Robert L. Sack, Director (Acting), Technical Services Division — Date

ADMINISTRATIVE INFORMATION: This Engineering Instruction (EI) is effective with contracts submitted for the letting of July 11, 2002, coinciding with the planned effective date for the proposed *2002 Standard Specifications*. It supersedes EI 98-041, ED 99-001, and partially supersedes EI 00-031. It also supersedes the Standard Specifications Sections 401, 402, 403, special specifications relating to "root" number 403, and portions of Chapter 6 of the Comprehensive Pavement Design Manual (CPDM). The materials transmitted herewith will be included in the next revision of the Standard Specifications and the CPDM.

PURPOSE: The purpose of issuing this EI is as follows:

1. To authorize the issuance of the revised Sections 401, 402, and 403 under the 2002 Standard Specifications
2. Disapprove existing Standard Specifications Sections 401, 402, and 403 issued under 1995 Standard Specifications and revised by Addendum 2, EI 98-041, ED 99-001, EI 00-031
3. Change other sections of the Standard Specifications affected by the reorganization and issuance of the revised Sections 401, 402 and 403
4. Disapprove existing Special Specifications with "root" number 403 (xx403.xxxxxxM)
5. Disapprove all other existing Special Specifications which include references to the disapproved Sections 401, 402, and 403.

TECHNICAL INFORMATION

Policy: The Department adopted the Superpave mixture design system for Hot Mix Asphalt (HMA) mixtures in 1996 by issuing Special Specifications. The adoption of Superpave as the Department's standard HMA mixture design system has created a need for revising the HMA section of the NYS Standard Specification book.

Changes:

- The revised sections were reorganized and renumbered to place the requirements of mix production (Section 401) ahead of the requirements for construction (Section 402) including the pay items.
- The revised Section 401 now include all the requirements for HMA production including Quality Control/Quality Assurance (QC/QA) specifications which were previously in the Addendum 2.
- The revised Section 402 include the previously issued special specifications used for implementing the Superpave mixture design system for Department projects and all the pay items associated with these specifications. In addition, §402-3.12, Paver and Equipment Cleaning, was added to the specification due to environmental concerns with the use of petroleum products used for cleaning paving equipment.
- The revised Section 403 includes all the Marshall designed HMA mixtures and the pay items associated

with these specifications. The items in this section will not be available for Department projects. They are only available to the municipalities such as Towns, Counties, etc.

- Other sections of the 2002 Standard Specifications which had references to the old Sections 401, 402, and 403 were revised to reference the new sections.
- Chapter 6 of the CPDM is being revised to include the new items and the new Performance Graded Binder selection guide affected by the revisions to Sections 401, 402, and 403.

The full text of these Sections 401, 402, and 403 will be made available to the users on the Design Quality Assurance Bureau's Specifications and Standards page on the IntraDOT site.

Cost Impact: The implementation of the revised specifications will have no impact on costs.

IMPLEMENTATION

Guidance to Designers: Once the revisions to Chapter 6 of the Comprehensive Pavement Design Manual (CPDM) are completed, the revised chapter will be transmitted to all designers. Designers should design all projects for lettings on or after July 11, 2002 using the revised sections of the Standard Specifications and the revised Chapter 6. Designers will not be permitted to use those Hot Mix Asphalt items available in Section 403. These items are strictly for use by the municipalities only. The revised sections will be contained in the advance copies of the 2002 Standard Specifications and will be made available to designers.

Disapproved Specifications: All existing special specification items with the "root" number 403 (xx403.xxxxxxM).

New Specifications: Below are new Superpave and Marshall item numbers. Only the Superpave item numbers will be used on Department projects effective with the letting date of July 11, 2001.

402.010901	Type 1 F9, Asphalt-Treated Permeable Base Course	Metric Ton
402.010911	Plant Production Quality Adjustment to 402.010901	Quality Unit
402.011901	Type 2 F9, Asphalt-Treated Permeable Base Course	Metric Ton
402.011911	Plant Production Quality Adjustment to 402.011901	Quality Unit
402.017901	True & Leveling F9, Superpave HMA, 70 Series Compaction	Metric Ton
402.017911	Plant Production Quality Adjustment to 402.017901	Quality Unit
402.018901	True & Leveling F9, Superpave HMA, 80 Series Compaction	Metric Ton
402.018911	Plant Production Quality Adjustment to 402.018901	Quality Unit
402.058901	Shim Course F9, Hot Mix Asphalt	Metric Ton
402.058911	Plant Production Quality Adjustment to 402.058901	Quality Unit
402.095101	9.5 mm F1 Superpave HMA, 50 Series Compaction	Metric Ton
402.095111	Plant Production Quality Adjustment to 402.095101	Quality Unit
402.095121	Pavement Density Quality Adjustment to 402.095101	Quality Unit
402.095201	9.5 mm F2 Superpave HMA, 50 Series Compaction	Metric Ton
402.095211	Plant Production Quality Adjustment to 402.095201	Quality Unit
402.095221	Pavement Density Quality Adjustment to 402.095201	Quality Unit
402.096101	9.5 mm F1 Superpave HMA, 60 Series Compaction	Metric Ton

402.096111	Plant Production Quality Adjustment to 403.096101	Quality Unit
402.096201	9.5 mm F2 Superpave HMA, 60 Series Compaction	Metric Ton
402.096211	Plant Production Quality Adjustment to 402.096201	Quality Unit
402.096301	9.5 mm F3 Superpave HMA, 60 Series Compaction	Metric Ton
402.096311	Plant Production Quality Adjustment to 402.096301	Quality Unit
402.097101	9.5 mm F1 Superpave HMA, 70 Series Compaction	Metric Ton
402.097111	Plant Production Quality Adjustment to 402.097101	Quality Unit
402.097201	9.5 mm F2 Superpave HMA, 70 Series Compaction	Metric Ton
402.097211	Plant Production Quality Adjustment to 402.097201	Quality Unit
402.097301	9.5 mm F3 Superpave HMA, 70 Series Compaction	Metric Ton
402.097311	Plant Production Quality Adjustment to 402.097301	Quality Unit
402.098101	9.5 mm F1 Superpave HMA, 80 Series Compaction	Metric Ton
402.098111	Plant Production Quality Adjustment to 402.098101	Quality Unit
402.098201	9.5 mm F2 Superpave HMA, 80 Series Compaction	Metric Ton
402.098211	Plant Production Quality Adjustment to 402.098201	Quality Unit
402.098301	9.5 mm F3 Superpave HMA, 80 Series Compaction	Metric Ton
402.098311	Plant Production Quality Adjustment to 402.098301	Quality Unit
402.098901	9.5 mm F9 Superpave HMA, Shoulder Course, 80 Series Compaction	Metric Ton
402.098911	Plant Production Quality Adjustment to 402.098901	Quality Unit
402.125101	12.5 mm F1 Superpave HMA, 50 Series Compaction	Metric Ton
402.125111	Plant Production Quality Adjustment to 402.125101	Quality Unit
402.125121	Pavement Density Quality Adjustment to 402.125101	Quality Unit
402.125201	12.5 mm F2 Superpave HMA, 50 Series Compaction	Metric Ton
402.125211	Plant Production Quality Adjustment to 402.125201	Quality Unit
402.125221	Pavement Density Quality Adjustment to 402.125201	Quality Unit
402.126101	12.5 mm F1 Superpave HMA, 60 Series Compaction	Metric Ton
402.126111	Plant Production Quality Adjustment to 402.126101	Quality Unit
402.126201	12.5 mm F2 Superpave HMA, 60 Series Compaction	Metric Ton
402.126211	Plant Production Quality Adjustment to 403.126201	Quality Unit
402.126301	12.5 mm F3 Superpave HMA, 60 Series Compaction	Metric Ton
402.126311	Plant Production Quality Adjustment to 402.126301	Quality Unit
402.127101	12.5 mm F1 Superpave HMA, 70 Series Compaction	Metric Ton
402.127111	Plant Production Quality Adjustment to 402.127101	Quality Unit
402.127201	12.5 mm F2 Superpave HMA, 70 Series Compaction	Metric Ton
402.127211	Plant Production Quality Adjustment to 402.127201	Quality Unit
402.127301	12.5 mm F3 Superpave HMA, 70 Series Compaction	Metric Ton
402.127311	Plant Production Quality Adjustment to 402.127301	Quality Unit
402.128101	12.5 mm F1 Superpave HMA, 80 Series Compaction	Metric Ton
402.128111	Plant Production Quality Adjustment to 402.128101	Quality Unit
402.128201	12.5 mm F2 Superpave HMA, 80 Series Compaction	Metric Ton
402.128211	Plant Production Quality Adjustment to 402.128201	Quality Unit
402.128301	12.5 mm F3 Superpave HMA, 80 Series Compaction	Metric Ton
402.128311	Plant Production Quality Adjustment to 402.128301	Quality Unit
402.128901	12.5 mm F9 Superpave HMA, Shoulder Course, 80 Series Compaction	Metric Ton
402.128911	Plant Production Quality Adjustment to 402.128901	Quality Unit

402.195901	19 mm F9 Superpave HMA, 50 Series Compaction	Metric Ton
402.195911	Pavement Density Quality Adjustment to 402.195901	Quality Unit
402.195921	Plant Production Quality Adjustment to 402.195901	Quality Unit
402.196901	19 mm F9 Superpave HMA, 60 Series Compaction	Metric Ton
402.196911	Plant Production Quality Adjustment to 402.196901	Quality Unit
402.197901	19 mm F9 Superpave HMA, 70 Series Compaction	Metric Ton
402.197911	Plant Production Quality Adjustment to 402.197901	Quality Unit
402.198901	19 mm F9 Superpave HMA, 80 Series Compaction	Metric Ton
402.198911	Plant Production Quality Adjustment to 402.198901	Quality Unit
402.255901	25 mm F9 Superpave HMA, 50 Series Compaction	Metric Ton
402.255911	Plant Production Quality Adjustment to 402.255901	Quality Unit
402.255921	Pavement Density Quality Adjustment to 402.255901	Quality Unit
402.256901	25 mm F9 Superpave HMA, 60 Series Compaction	Metric Ton
402.256911	Plant Production Quality Adjustment to 402.256901	Quality Unit
402.257901	25 mm F9 Superpave HMA, 70 Series Compaction	Metric Ton
402.257911	Plant Production Quality Adjustment to 402.257901	Quality Unit
402.258901	25 mm F9 Superpave HMA, 80 Series Compaction	Metric Ton
402.258911	Plant Production Quality Adjustment to 402.258901	Quality Unit
402.376901	37.5 mm F9 Superpave HMA, 60 Series Compaction	Metric Ton
402.376911	Plant Production Quality Adjustment to 402.376901	Quality Unit
402.377901	37.5 mm F9 Superpave HMA, 70 Series Compaction	Metric Ton
402.377911	Plant Production Quality Adjustment to 402.377901	Quality Unit
402.378901	37.5 mm F9 Superpave HMA, 80 Series Compaction	Metric Ton
402.378911	Plant Production Quality Adjustment to 402.378901	Quality Unit

TRANSMITTED MATERIALS: Attached is the list of all the changes made to other section of the 2002 Standard Specifications due to the revisions of Sections 401, 402, and 403. In addition, Sections 401, 402, and 403 are not transmitted under this Engineering Instruction to save printing expenses. Full text of these sections will be contained in the next printing of the 2002 Standard Specifications.

CONTACT: Direct questions regarding these specifications to Zoeb Zavery (zzavery@gw.dot.state.ny.us) or Sigrid Rantanen (srantanen@gw.dot.state.ny.us) of the Field Engineering II Section of the Materials Bureau at (518) 457-4582.

Make the following changes to the Standard Specifications of January 2, 1995 and Addendum No. 2 to the Standard Specifications:

Page 1-38, lines 7 and 9 .

Under §102-21, delete "Item No. 403.11 M" and replace it with "402.255901"

Page 1-44, lines 19 and 21

Under §102-22, delete "Item No. 403.11 M" and replace it with "402.255901"

Page 3-1, lines 18-19

Under §302-2.01 Option B, delete "§401, PLANT MIX PAVEMENTS GENERAL" and replace it with "Section 402 - Hot Mix Asphalt (HMA) Pavements".

Page 3-1, line 23

Under §302-2.01 Option C, delete "§401" and replace it with "Section 402"

Page 3-4, line 15

Under §302-3.05, delete "§401-3.12" and replace it with "§402-3.07"

Page 3-5, lines 15, 19, and 21

Under §303-2 Table 303-1, delete "§401-2" and replace it with "§403-2"

Page 3-5, line 28

Under §303-2, delete "401" and replace it with "403"

Page 3-5, line 31

Under §303-3, delete "401-3" and replace it with "403-3"

Page 6-44, lines 38-43 and page 6-45, lines 1-3

Under §608-2.02, delete the entire subsection and replace it with the following:

"**608-2.02 Asphalt Concrete Sidewalks, Driveways, and Bicycle Paths.** The mixture requirements for these items shall either be 9.5 mm or 19.0 mm mixtures. These mixtures shall be designed for <0.3 million ESALs and produced in accordance to Section 401 using coarse aggregate Type F9. The number of courses and course thicknesses shall be as given in Table 608 - 1, Hot Mix Asphalt Composition.

TABLE 608-1
HOT MIX ASPHALT COMPOSITION

Total Paved Thickness	9.5 mm Mix	19.0 mm Mix	Number of Courses
40 mm	40 mm		1
50 mm	50 mm		1
80+ mm	40 mm	40+ mm	2+

Notes:
1. For the 19.0 mm mixture, the maximum thickness that can be placed in one pass is 75 mm.
2. A course shall consist of one or more separate lifts of hot mix asphalt, as directed by the Engineer, to attain the indicated thickness.

Page 6-46, line 33

Under §608-3.02, delete "401-3 Construction Details for Plant Mix Pavements–General" and replace it with "§402-3 Construction Details for Hot Mix Asphalt (HMA) Pavements".

Page 6-48, line 26 (added sentence as per Addendum 2, page VI-12, line 22)

Under §608-4.02 delete §403-4 and replace it with §402-4.

Page 6-53, line 10

Under §609-3.07 delete §401-3 and replace it with §402-3.

Page 6-79, lines 26 and 27

Under §619-2.03 delete "Section 401 Bituminous Pavements" and replace it with "Section 402 - Hot Mix Asphalt (HMA) Pavements".

Page 6-103, line 20

Under §619-5.12 delete §401-3.01 and replace it with §402-3.01.

Page 6-110, lines 18-20

Under §624-2.01 delete the entire subsection and replace it with the following:

"**624-2.01 Asphalt Concrete Gutters.** The materials for hot mix asphalt gutters shall meet the requirements specified for a 9.5 mm mixture designed for <0.3 million ESALs using coarse aggregate Type F9."

Page 6-110, line 33

Under §624-3.01 delete "401-3, Plant Mix Pavements–Construction Requirements" and replace it with "§402-3 Construction Details for Hot Mix Asphalt (HMA) Pavements".

Page 6-111, line 33 (added sentence as per the Addendum 2, page VI-23, line 38)

Under §624-4.01, delete "§403-4" and replace it with "§402-4."

Page 6-117, line 18

Under §633-2, delete "Bituminous Concrete 401" and replace it with "Hot Mix Asphalt (HMA) Pavements 402."

Page 6-132, line 3

Under §638-2.05, delete "§401-2.02, Composition of Mixtures" and replace it with "§401-2.01 Hot Mix Asphalt Designs."

Page 6-132, line 25

Under §638-3, delete "§401-3, Plant Mix Pavement - Construction requirements" and replace it with "§402-3, Hot Mix Asphalt (HMA) Pavements - Construction Details."

Page 6-132, line 26

Under §638-3.01 delete, "§401-3.01" and replace it with "§402-3.01"

Page 6-132, line 28

Under §638-3.02, delete "§401-3.02" and replace it with "§401-3.08"

Page 6-133, line 32

Under §638-3.05, delete "§401-3.12" and replace it with "§402-3.07"

Page 6-203, line 4

Under §688-3.03, delete "§401-3.01" and replace it with "§402-3.01"

Page 6-203, line 33

Under §688-3.05, delete "§401-3.06" and replace it with "§402-3.04"

Page 7-149, line 15

Under §714-06, delete "§401, Hot Plant Mix Pavements - General" and replace with "Section 401 - Hot Mix Asphalt Production".

Section 400
HOT MIX ASPHALT
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) 96-02, 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.

TABLE 401-1
COMPOSITION OF HOT MIX ASPHALT MIXTURES

Mixture Requirements	Permeable Base				Shim	
	Type 1		Type 2			
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]	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.

A. Coarse Aggregate Type F1 Conditions

1. Limestone having an acid insoluble residue content of not less than 20.0%, excluding particles of chert and similar siliceous rocks.

2. Dolomite having an acid insoluble residue content of not less than 17.0%, excluding particles of chert and similar siliceous rocks.

3. Sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate 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. Non-carbonate 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. Non-carbonate 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 having an acid insoluble residue content of not less than 20.0%, excluding particles

of chert and similar siliceous rocks.

2. Dolomite having an acid insoluble residue content of not less than 17.0%, excluding particles of chert and similar siliceous rocks.

3. Sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate 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. Non-carbonate 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 non-carbonate.

b. 9.5 mm Nominal Maximum Size Aggregate Mixes. Non-carbonate 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 non-carbonate.

C. Coarse Aggregate Type F3 Conditions

1. Limestone having an acid insoluble residue content of not less than 20.0%, excluding particles of chert and similar siliceous rocks.

2. Dolomite

3. Sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate 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. Non-carbonate 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 non-carbonate.

b. 9.5 mm Nominal Maximum Size Aggregate Mixes. Non-carbonate 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 non-carbonate.

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 the AASHTO MP1 - Standard Specification for Performance-Graded Asphalt Binder.

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.

401-3 CONSTRUCTION DETAILS.

401-3.01 Quality Control. Perform all sampling and testing in accordance with procedures supplied by or approved by the State. 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.

A. Control Plan. Provide a control plan for each HMA mixing plant. Only one control plan is needed when more than one plant is located at the same site. Identify all plants at the site in the control plan.

List the personnel associated with HMA production, including the names and their functions necessary to implement the QC program. Include in the list, the control plan administrator, designated assistant, QC personnel, and phone numbers. Assume the responsibility of administration of the control plan.

Submit the control plan to the RME for initial approval at least 15 working days prior to HMA production for the State from the facility. After the control plan has been assigned initial approval, submit a statement outlining the control plan status to the RME each subsequent year at least 15 working days prior to any HMA production. Also, submit amendments to the control plan, or personnel changes for approval annually prior to production and as changes occur during the construction season. The State reserves the right to suspend production in the event the control plan is not followed. Control plan guidelines are available from the RME.

B. Quality Control Organization

1. Plan Administrator. The plan administrator is a representative of the HMA manufacturer and will have full authority to institute all operations of the control plan. The plan administrator is responsible to ensure all requirements are in conformance with the specification. The plan administrator's signature will be legally binding. One plan administrator is allowed to 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 must be available to communicate with the State personnel at all times. The State reserves the right to stop production when the plan administrator or designee is not available. In addition, the plan administrator is responsible for the following:

a. Location and control of friction aggregate stockpiles.

b. Outlining testing frequencies, testing procedures, and documentation procedures.

c. Periodic verification during production that the proper friction aggregate and the correct amount of friction aggregate is being included into the State mixes as outlined in NYSDOT's Materials Method (MM) 28, Friction Aggregate Control and Test Procedures.

d. 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 NYSDOT form BR 303 Quality Control Daily Diary.

2. Quality Control Technician (QCT). The QCT must possess a current New York Construction Materials Association Certification or its equivalent, as determined by the Director, Materials Bureau. The production facility must have a sufficient number of QCTs to perform QC sampling and testing, but at least one certified QCT at each production facility site. Non-certified technicians may be utilized to augment the certified QCT. HMA production is not acceptable unless the certified QCT is present during production. A certified QCT is not required to be present for HMA production of 150 metric tons or less, if approved by the RME. Technicians associated with private testing organizations must meet the requirements specified above.

The State reserves the right to stop plant production in the event unacceptable technician

performance is noted. The RME or representative will immediately inform the plan administrator regarding the reasons for stopping production operations.

The State may require the HMA manufacturer to replace unacceptable technicians before HMA production is allowed to continue.

401-3.02 Production Facility Laboratory. Maintain an approved production facility site laboratory to perform all required HMA sampling and testing. All sampling and testing equipment must meet the requirements pertaining to test procedures detailed in this specification. Unless otherwise outlined in the MM 5.16, calibrate all testing equipment requiring calibration annually and certify that all testing equipment meets the required operational tolerances. The State will perform verification of the production facility site laboratory and testing equipment annually. Additional verification will be performed when deemed necessary. Make laboratory sampling and testing equipment available to the State's QA personnel. The requirements specified in §401-3.08 A.13. Inspection Facilities, apply.

401-3.03 Plant Lots and Sublots. Determine plant lots and sublots on a daily basis in accordance with MP 96-02.

A plant lot is defined as the quantity in metric tons of HMA produced per plant for each mix design in one day. When different mix designs are produced on the same day, then each mix design represents a separate plant lot. For each mix design produced, number the plant lots consecutively (1-200) 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 for each day's production.

Plant lots are subdivided into sublots and are based on anticipated daily production. A sublot is defined as a portion of a plant lot not to exceed 1250 metric tons. When production exceeds 1250 metric tons and the excess is not greater than 150 metric tons, incorporate the excess into the previous sublot. Sublots are assigned a consecutive letter (A-E) and begins with "A" each production day.

QC testing is allowed on any portion of a plant lot, including any production less than 150 tons, as documented in the Control Plans, when an option of testing quantities less than 150 metric tons is selected.

QC testing is not required on the first or last 150 metric ton portion of a lot. This testing exclusion does not apply for lots greater than 150 but less than 300 metric tons, retest samples, or any sample obtained when production is terminated before the anticipated production for that plant lot. When a lot is greater than 150 but less than 300 metric tons, obtain a sample from the portion greater than 150 metric tons.

When production stops before a sublot sample is obtained, incorporate the untested sublot quantity into the previous sublot of the same day. If there is no previous sublot to incorporate it into, the untested sublot quantity is considered a plant lot and the QAF for that amount will be 1.00. Do not incorporate untested sublot quantities into any subsequent or previous day's plant lot production. When production stops after a sublot sample is obtained and the quantity is less than 1250 metric tons, it is still considered a sublot.

A retest may be performed on any portion of a plant sublot providing the retest sample is obtained after the required random sample. The retest sample does not have to be obtained randomly. When a sublot is retested, average the absolute difference test value from the retest sample with the required random sample's absolute difference test value. This average represents the sublot's test value in the calculation of the daily QAF. When a retest is performed, document all actions on NYSDOT form BR 303, Quality Control Plant Diary.

When the daily plant lot quantity is between 150 metric tons and 500 metric tons, report the daily QAF as 1.00 providing the required QC sample yields a QAF between 0.90 and 1.00. If the required test result yields a QAF greater than 1.00, report the actual QAF. If the required test result yields a QAF less than 0.90, the State will evaluate the subject production in accordance with procedures outlined in §401-4, Method of Measurement.

A. Certified Lot Production. HMA production without the required QC testing is allowed to be certified for plant lot quantities of 150 metric tons or less. Certified plant lots have a QAF of 1.00. All certified production must meet the requirements outlined in this specification. Obtain friction aggregate samples as outlined in MM 28 for all certified production placed in pavement courses requiring friction aggregate. Transmit BR-307, Quality Control HMA Certification, to the Project Engineer on a daily basis for the quantity of certified production.

B. Volumetric Mixture Storage. When volumetric mixtures are stored prior to delivery, incorporate the stored quantity 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.

C. Non-Volumetric Mixture Storage. 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.

D. Night Production. During night production, associate the plant lots as specified in this subsection. If continuously producing for a calendar day or more, the plant lot will be defined when the plant's employee shift change occurs. Notify the RME which option will be used at least one day prior to any production of this type.

E. Highway Permit Production. HMA production supplied to highway permit projects will meet all requirements outlined in this specification. Quality payment adjustments are not applicable. However, all HMA production placed is subject to rejection as outlined in §401-2 Materials.

401-3.04 Quality Control Sampling and Testing. Obtain QC samples as outlined in MP 96-02. The QCT will perform QC sampling and testing meeting the requirements outlined in §401-3.01 B. 2, Quality Control Technician. The State will determine Daily QAFs using the QCT's test results as outlined in §401-3.03 and §401-3.04.

QC test procedures are verified by the Quality Assurance Technician (QAT), a State's representative, on a random basis by split sample testing. The QC sample is split into two representative samples and individually tested by the QCT and the QAT. The QAT's test results are compared to the QCT's test results.

The QCT/QAT test results must be within the allowable tolerances outlined in Table 401-2, Allowable Split Sample Testing Tolerances.

TABLE 401-2
ALLOWABLE SPLIT SAMPLE TESTING TOLERANCES

Test Property	Tolerance	
	Within Lab	Lab to Lab
Gradation ≥ 425 µm Sieve	± 5.0 %	± 7.0 %
Gradation < 425 µm Sieve	± 2.0 %	± 3.0 %
Bulk Specific Gravity	± 0.020	± 0.028
Maximum Specific Gravity	± 0.011	± 0.019

When the test results exceed the allowable tolerance, perform a split sample retest on the test property that exceeded the allowable tolerance. The retest must be performed on the day the material is produced or delivered. When the retest exceeds the allowable tolerance, the State will terminate the production and all QC test results up to this point will be used to determine the daily QAF. Production is not allowed until the RME is satisfied that the cause for the excessive deviation in the split sample verification is resolved.

Obtain all required HMA samples, including the maximum specific gravity and a composite aggregate (hot bin) split sample. Obtain a minimum of one aggregate split sample per day for each mix type produced. Prepare the HMA specimens and reduce the aggregate split sample to testing size in accordance with MM 5.16. Dry the composite aggregate samples and air dry the compacted specimens and the maximum specific gravity samples prior to packaging. Package hot bin aggregate samples separately by hot bins and retain all samples together. Identify and retain all the samples at the production site for a minimum of ten (10) business days. The identification of the retained samples will include the facility number, production date, plant lot, sublot, and mix description.

Unless directed by the RME, discard all retained specimens and samples at the end of the specified time

period. The State reserves the right to witness any or all QC sampling and testing, and test any or all retained samples.

Perform all sampling and testing using test procedures and frequencies outlined in Table 401-3, Quality Control Sampling and Testing.

A. Random Sampling. Obtain QC samples for aggregate and HMA randomly using the procedures outlined in MP 96-02. Random sample numbers may be re-selected to accommodate changes in anticipated production quantity. Obtain other required QC samples as outlined in B. Quality Control Testing, and Table 401-3, Quality Control Sampling and Testing.

B. Quality Control Testing

1. Aggregate Gradation. Perform the aggregate gradation analysis 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 gradations analysis using the procedures outlined in Test Method NY 400-13C.

a. Volumetric Design Mixes. Perform an aggregate gradation analysis on every other sublot produced. Perform a minimum of one gradation analysis per day for each HMA mix design used for production. Determine aggregate consensus properties and specific gravities at the beginning of each production season and subsequently at the midpoint of the production season using test methods outlined in MM 5.16. Coarse aggregate specific gravity may be determined on a composite aggregate blend in-lieu of testing each aggregate size designation (i.e., 1A's, 1's, and 2's).

TABLE 401-3
QUALITY CONTROL SAMPLING AND TESTING

Plant Test Property	Sample Location	Test Method	Quality Control Frequency
Aggregate Gradation	NYSDOT MM 5.0	AASHTO T27	Note 1
Aggregate Moisture[6]	NYSDOT MM 5.0	NYSDOT MM 5.0	1 every other sublot Minimum 2 per day
Air Voids [3]	NYSDOT MM 5.0	AASHTO T166 & T209 MM 5.16M	1 per sublot
Mix Moisture[2, 4]	NYSDOT MM 5.0	NYSDOT MM 5.0	1 minimum per day
Mix Temperature	Plant and Haul Vehicle	N/A	Routinely, minimum 4 per day
Asphalt Binder Content	NYSDOT MM 5.0	NYSDOT MM 5.0	Routinely, minimum 4 per day/mix
RAP Binder Content	NYSDOT MM 5.0	NYSDOT MM 5.0 NY400-13C	2 per week
RAP Gradation	NYSDOT MM 5.0	AASHTO T 27	2 per week
RAP Moisture	NYSDOT MM 5.0	NYSDOT MM 5.0	1 per day
Asphalt Binder Sampling [5]	NYSDOT MM 8.1	NYSDOT MM 8.1	1 per day
Friction Aggregate	NYSDOT MM 28	NYSDOT MM 28	As outlined in MM 28

Notes:
1. Volumetric design mixes - one test every other sublot, minimum one per day.
   Non -Volumetric design mixes - one test every sublot.
2. Required for drum mix plants, or as requested by the RME for batch plants.
3. Required for volumetric design mixes.
4. Required for batch and drum mix plants when producing recycled mixes.
5. The State is responsible for sample submission.
6. Required for drum mix plants only.

b. Non-Volumetric Design Mixes. Perform an aggregate gradation analysis on every sublot for each HMA mix design used for production.

2. Air Void Analysis - Volumetric Design Mixes. Perform an air void analysis for each sublot of volumetric HMA mix design used for production. Use HMA samples obtained from the delivery vehicle. When holding bins are used for storage, perform the air void analysis on HMA samples taken after storage. Perform the air void analysis using procedures outlined in MM 5.16.

When performing the air void analysis, use Table 401-4, Allowable Specimen Tolerance Range, to determine if sample specimens are valid for analysis. The Allowable Specimen Tolerance Range listed in Table 401-4 is applicable to all QC and retest samples. The difference between the specimen test results should not exceed the tolerance range values in Table 401-4. If the results

exceed the allowable tolerance range, the specimens are not valid and the test results will not be used in the calculation of the daily QAF.

Table 401-4
Allowable Specimen Tolerance Range

Mix Types	All Mix Types except the 37.5 mm Maximum Sp.Gr		37.5 mm
Number of Specimens	Bulk Sp.Gr.	Maximum Sp.Gr.	Maximum Sp.Gr.
2	.020	.011	.019
3	.023	------	------
4	.025	------	------

When a plant lot consists of one sublot and the test specimen value exceeds the allowable tolerance, perform a retest. If production is terminated before a retest sample can be obtained, the QAF for that plant lot will be reported as 1.00. When a plant lot consists of multiple sublots and the test specimen value for a sublot exceeds the allowable tolerance, perform a retest on the material within that sublot. If a retest is not or cannot be performed, use an absolute difference value of 0.92 for that sublot to calculate the plant lot daily QAF in accordance with MP 96-02.

3. Determination of Asphalt Binder Content. Determine the asphalt binder content using the procedures outlined in Materials Method (MM) 5, Plant Inspector's Manual for Bituminous Concrete Production. Calculate the asphalt binder content during initial production and then routinely throughout production for a minimum of four times per day per HMA mix design used for production.

4. Mixture Temperature. Determine the mix temperature for each mix type at the beginning of each production day starting with the first or second delivery vehicle and then routinely throughout the production day. Determine a minimum of four temperatures per day independent of HMA mix design used for production. Record the temperature on the delivery ticket and transmit to the project paving site with the delivery vehicle. When holding bins are loaded for storage, determine the mix temperature routinely throughout the loading time.

5. Aggregate and Mix Moisture Content. Determine moisture content of the aggregate, the recycled mixtures, and the HMA mixture in accordance with procedures outlined in MM 5.0. Aggregate moisture testing of individual components is allowed. Determine the aggregate moisture content daily in accordance with the frequency detailed in Table 401-3. Perform one test during the initial production and at least one test per day on a composite aggregate sample. The frequency for determining the moisture content in the HMA and HMA with RAP mixtures is a minimum once per day. If excessive mix moisture results are obtained, the testing frequency may be increased as directed by the RME. The moisture content of the mixtures upon discharge from the mixing unit will not exceed 0.5 percent.

6. Asphalt Binder Sampling. Obtain asphalt binder samples in accordance with procedures outlined in Materials Method (MM) 8.1, Quality Assurance Procedure for Paving Asphalt Cement. Obtain a minimum of one sample for each production day. The frequency may be increased at the discretion of the RME. Asphalt binder samples are not required when production is 150 metric tons or less. Identify all samples as determined by the RME and store them at the facility site. The State will supply sample containers, document and submit these samples for testing.

7. Friction Aggregate. The friction aggregate will meet the requirements outlined in §401-2.02, Aggregates. Perform sampling and testing of friction aggregate at the production facility using procedures outlined in MM 28.

8. Recycled Mixes. Perform sampling and testing of HMA containing reclaimed asphalt pavement (RAP) using procedures outlined in MM 5.0. The frequency of sampling and testing is outlined in §401-3.04, Quality Control Sampling and Testing, except perform the following tests at frequencies outlined in MM 5.0 and Table 401-3.

a. RAP Moisture Test

b. RAP Binder Content

c. Recycled Mix Moisture Test

C. Air void and Gradation Reporting. Report the air void test values to the nearest 0.01 of a percent and aggregate gradation test values to the nearest 0.1 of a percent. When determining test result acceptability, the air void test value is referenced to the mix design median of 4.00 percent and the gradation test value is referenced to the Job Mix Formula (JMF) target value.

D. Significant Decimals. For reporting the results, use the following rules for rounding off for all calculations:

1. When the digit to be dropped (1 digit beyond the significant digit) is less than 5, the preceding digit will not change.
2. When the digit to be dropped (1 digit beyond the significant digit) is 5 or greater, the preceding digit will be increased by 1.

E. Volumetric Plant Production Tolerances. Determine the volumetric properties outlined in Table 401-5, Volumetric Plant Production Tolerance, for every sublot of HMA volumetric design produced. When any mix design test property consistently falls outside any tolerance value, the design may be rescinded as outlined in MM 5.16.

Table 401-5
Volumetric Plant Production Tolerances

Test Property [1]	Tolerance [2]
Voids in the Mineral Aggregate, VMA	- 1.0 %
Voids Filled with Binder, VFB	± 5.0 %

Notes:
1. Compact all gyratory specimens to N_{design}
2. Tolerances are referenced to the specification value.

F. Sampling and Testing Disputes. The State will perform referee sampling and testing to settle all disputes. Referee samples will be obtained randomly and independently from the QC samples and tested at the Regional or Central Office laboratory. If production is terminated, the State will test the samples retained at the production facility. The State's independent referee test results are final, and will be used to determine the daily QAF for the disputed quantity and the acceptance of the in-place production material.

401-3.05 Production Control. Make necessary process control adjustments during production as long as the target values do not exceed the specification general limits. However, strive for the mix design target values when making necessary process control adjustments. Only the aggregate gradation production tolerance is allowed to exceed the general limits. Also, when adjustments are made to any volumetric mixture design during production, all specified properties must remain within the specified production limits. Record all adjustments, including new target values, on BR-303 QC Daily Diary. When any test value consistently falls outside the allowable production tolerance, take corrective actions. In addition, notify the RME prior to production of any subsequent adjusted sublot.

Production may be terminated at any time, in which case, notify the RME immediately. When production is terminated, the HMA quantity produced up to that point is considered a plant lot and the daily QAF is

determined using all required and all additional QC test values. HMA in storage from any terminated plant lot having a QAF less than 0.90, or any required testing not in conformance with the specification requirements, will be considered unacceptable.

When the daily QAF is less than 0.90 for two consecutive production days, terminate production. When production is terminated due to unacceptable production quality, demonstrate by trial production that the production process yields a QAF of 0.90 or greater before resuming production for the State. Also, notify the RME when any sublot yields a QAF of less than 0.90.

The State may rescind a "Production Status" of a mix design if the design consistently produces a mixture that yields a daily QAF less than 1.00 and/or has volumetric properties outside the plant production tolerances.

During production of any HMA design assigned "Verification Status" as outlined in MM 5.16 or the first production day of the construction season for any HMA design assigned "Production Status", the State will report a daily QAF of 1.00 provided the required test results yield a daily QAF between and including 0.90 and 1.00. When the required test results yield a daily QAF greater than 1.00, the State will report the actual daily QAF. When the required test results yield a daily QAF less than 0.90, the State will evaluate the subject production in accordance with procedures outlined in §401-4, Method of Measurement.

A. Mixing Plant Control. All mix production must be in the automatic mode. If any material is produced and shipped to State projects in a non-automatic mode, notify the RME immediately. Do not ship any material produced in the automatic mode that exceeds twice the production tolerance. Material produced in the automatic mode that is between the single and double production tolerance may be shipped. However, the RME will determine if the material is acceptable to the State.

B. Friction Aggregate Control. Use the following friction aggregate criteria:

1. If the friction aggregate test results are greater than the JMF requirements, continue friction aggregate controls.

2. If the friction aggregate test results are greater than the State's minimum specifications, but less than the JMF requirements, perform aggregate adjustments and retest.

3. If the friction aggregate test results are less than the State's minimum specifications, stop production, notify the RME, correct the problem and retest before resuming production.

401-3.06 Production Quantities. Whenever production is made for the State, notify the Regional Materials office by 3:00 p.m. 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. Update the QC test data within 24 hours following each plant lot production and retain these records at the plant site laboratory. 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 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. All HMA mixing plants must be approved for metric production by January 2, 2003.

A. Requirements for All Plants

1. Acceptance. Each HMA mixing plant requires initial and annual approval by the Director, Materials Bureau. The RME may disapprove use of a previously approved mixing plant at any time for non-conformance with specifications. Once disapproved, production for State projects will not be allowed until corrective measures have been implemented satisfactory to the RME.

2. Friction Aggregate Management. 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 midway through 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 State's representative. As a minimum the following personnel must be thoroughly familiar with all friction aggregate control procedures.

a. Plant Superintendent

b. Quality Control Technician

c. HMA Plant Operator

d. Loader Operator/Truck Driver feeding HMA plant

3. Failure of Equipment

a. Printer Breakdown. When the automated proportioning system or delivery weigh system printer is not properly working, the producer must notify the QAT at the plant site. However, when a QAT is not present, the producer must 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.

b. 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:

1. HMA samples (enough for at least 2 specimens) will be taken at the normal specified required frequency, retained until the gyratory compactor is repaired, then tested for informational purposes.
2. Aggregate gradations will be performed and recorded for each sublot produced during the breakdown period.
3. The final QAF shall be 1.00 for all mix accepted by the Project Engineer during the breakdown period.

4. Scales, Continuous Weigh Systems and Meters. Perform tests on scales, continuous weigh systems, and meters for accuracy, at no cost to the State. These tests must be performed by a qualified technician using procedures outlined in Materials Method (MM) 27, Plant Equipment Inspection Manual. Perform the test as follows:

a. Annually, prior to use for State work.

b. At intervals of not more than 90 calendar days.

c. Whenever the plant changes location.

d. At any time directed by the RME.

Provide standard test weight and a platform, cradle or hanger approved by the RME or the authorized representative for testing each scale. Provide at least 10 standard 25 kg test weights for testing the springless dial or load cell type scales. Provide a sufficient number of test weights to test belt scales within production range.

5. 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 ±15°C of the temperature for which the meter is calibrated. Provide separate tanks and pipe lines when asphalt binder and other liquid asphaltic materials are

mixed in the same mixer.

Equip all mixing plants with a sampling valve designed to be non-clogging, safe and completely divorced from any solvent clean-out operations. For plants having multiple tanks, locate the sample valve in the line between the tanks and the mixing plant or in the return line. When plants have only one tank, locate the sample valve directly on the tank. Clearly label "Sample Valve". The type and location of the valve requires the RME's approval.

6. Aggregate Cold Feed Bins. Use 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.

7. PG Binder Control Unit. Provide a satisfactory means to add the proper amount of PG Binder to the mixture. 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, provide a by-pass so that the binder quantity and flow rate can be checked in accordance with MM 27.

8. 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 ±3°C.

9. Dust Collector. Equip all plants with adequate dust collectors constructed to remove or return uniformly all or portions of the collected dust to the system.

10. 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 §401-3.08 A.4. Scales, Continuous Weigh Systems and Meters. All truck scales must have sufficient capacity and size to weigh the largest loaded vehicle in one weighing.

Equip truck scales used for determining delivered quantity at the mixing plant site with a recording device approved by the Director, Materials Bureau. The recording device must produce a ticket with a time-date print and any two of the following weights:

a. Gross weight

b. Net weight

c. Tare weight

Print tare weights by weighing each truck empty for each delivery. Do not manually manipulate truck scales 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.

11. 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.

12. RAP Delivery System. Feed RAP into the plant using equipment specifically designed for recycling. All RAP equipment requires approval of the Director, Materials Bureau. Install scalping screens, grizzlies or similar devices on RAP feed bins. These devices must be capable of removing foreign material in excess of 100 mm.

13. Inspection Facilities. At each HMA mixing plant site, 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 22 square meters with a layout providing a minimum internal width

of 2.1 meters and a ceiling height of not less than 2.3 meters. The laboratory must have tables, work benches, shelving, and other necessary equipment required for testing HMA. Should the HMA manufacturer elect or be required to provide additional testing equipment, increase the internal area 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 time weighted average of 85 dBa. The State will have priority use when more than one inspection authority is using the inspection facility.

The inspection facility and the location requires 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 750 mm by 1500 mm with drawers and a chair. A fireproof file cabinet with at least two lockable drawers and two keys with access only to State 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. Provide a lavatory with 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 20°C ±3°.

g. Ventilation. Adequate ventilation system to remove dust and fumes from the laboratory. A 6 m^3/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 State personnel located in the laboratory office. A fax machine must be available for State 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. Maintain the inspection facility, office, and testing equipment such that they are in good operating condition. Also, keep the facility clean.

k. Fire Extinguisher. Furnish and locate a properly maintained 4.5 kg capacity multi-class ABC fire extinguisher in the laboratory area.

l. Extractor. For plants producing recycled mixtures, equip the laboratory facility with a chemical extractor or 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, fully enclose and weatherproof it.

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 TP4 calibrated at a frequency outlined in MM 5.16. When a compactor is used at a remote location during a breakdown period, outline the details in the Control Plan.

s. Specimen Mold Assembly. Mold assembly will meet the requirements of AASHTO TP4. Provide a minimum of four mold assemblies and an adequate supply of paper discs.

t. Specimen Extractor. The extractor will meet the requirements of AASHTO TP4.

u. Oven. Supply a thermostatically controlled convection type oven having a minimum capacity of 0.04 cubic meter to preheat the specimen mold assemblies and asphalt mix samples. The oven must have a controlled temperature range up to 200°C with a ±3°C accuracy throughout the range.

v. Maximum Specific Gravity Equipment. Equipment meeting the requirements of AASHTO T209.

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

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 §401-3.08 A.11. Safety Requirements.

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 installed on or after January 2, 1987 must be either the springless dial or load cell type and must indicate the load at all stages of the weighing operation from zero to full capacity. Scales installed after January 2, 2003 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 repeating dials or digital displays must be equivalent to or less than the minimum graduations on the primary scale. Repeating dials or digital displays must match the primary scale within one graduation. Locate the scales, repeating dials, or digital displays so they are easily readable from the operator's work station by direct sight. Prevent any manipulation of scale weight.

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 4.0 square meters with no internal dimension less than 2.0 meters. The system must accurately proportion various mixture components by mass or volume, and control the cycle sequence and timing during the mixing operation. All systems must operate in metric units on or before January 2, 2003, unless otherwise indicated in the contract documents. 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:

Each Aggregate Component	±1.5%	Zero Return (Aggregate)	±0.5%
Mineral Filler	±0.5%	Zero Return (Asphalt Binder)	±0.1%
Asphalt Binder	±0.1%		

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. Equip all plants with automatic digital recording devices approved by the Director, Materials Bureau, and locate these devices 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, mineral filler, asphalt binder, 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. Provide the State with a clear and legible copy of the recording for each batch.

Record asphalt binder quantities separate from aggregate and filler and record as weight. If measured in volume (liters), convert the volume to weight in kilograms at 15°C.

Record the weights as indicated on the batching scale or display 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.

Automation systems installed on or after January 2, 1987 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 Mg increments), the recordation must show for each aggregate (mineral filler and RAP, if used) and asphalt material, the target weight and the calculated over and under weights, **or**, the calculated over and under weights and the theoretical batch total. The State 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 must include a batch mixer of an approved pugmill type capable of producing a uniform mixture within the permissible job mix tolerances. The mixer must have a capacity of not less than one metric ton. The blades of the mixer shall have a clearance not in excess of 20 mm from all fixed and moving parts. Replace paddle blades which are worn in excess of 25 percent in face area from their new condition. If not enclosed, the mixer must be equipped with a dust hood to prevent loss of dust. The mixer must 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 must 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 must lock the aggregate weigh hopper after charging of the mixer until the closing of the mixer gate at the completion of the cycle. It must 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 in excess of 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 §401-3.08 A.4. 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 metric 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, to the 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 ther han those where acceptance tolerance apply.

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 §401-3.08 A.4. 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. Install a temperature compensating device in conjunction with the meter to correct the quantity of asphalt binder at 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. Install the system in a dust and weather protected area of at least 4.0 sq. meters with no internal dimensions less than 2.0 meters. The system shall accurately proportion various mixture components by mass or volume. All systems must operate in metric units on or before January 2, 2003, unless otherwise indicated in the contract documents.

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 an 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. Add mineral filler 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 metric tons per hour. The maximum resolution will be 1 metric ton per hour for dry aggregate and 0.1 metric 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 metric tons. They must continuously accumulate weights of material during the production period. The maximum resolution will be 0.1 metric tons for dry aggregate and 0.01 metric 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 metric tons per hour and have a maximum resolution of 0.1 metric 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 metric tons and must continuously accumulate the quantity

of binder during the production period in the day. The maximum resolution will be 0.01 metric tons. The indicator must be resettable to zero and have provisions to prevent manipulation.

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 and PG Binder at five minute intervals during production and on demand. The recordation must include the actual PG Binder content as a percentage of the total HMA mixture weight. The maximum resolution will be 0.1 metric tons for dry aggregate, 0.01 metric tons for mineral filler, if added separately, 0.01 metric 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 State.

Automation systems installed on or after January 2, 1992 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 being capable of producing a uniform mixture within the job-mix tolerances. Repair or replace flights within the drum which are missing, loose, broken, bent, scalloped or worn excessively from their new condition to the satisfaction of the RME. Discharge the HMA mixture into a HMA holding bin meeting the requirements of §401-3.09, Hot Mix Asphalt Holding Bins.

9. Truck Scales. Each drum mix plant site shall have a platform scale conforming to the requirements outlined in §401-3.08 A.10. Truck Scales.

401-3.09 Hot Mix Asphalt Holding Bins. 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.

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 times are 12, 24, and 48 hours. Standard surge time is six hours.

B. Acceptance Criteria. The HMA mixture, after storage, must meet the criteria outlined in Table 401-6, HMA Holding Bin Acceptance Criteria.

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

1. A truck scale conforming to the requirements of §401-3.08, A.10. Truck Scales.

2. 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 State use. Scales installed after January 2, 2003 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 10 kg or 0.01 metric tons. The minimum resolution of repeating dials or digital displays will be equivalent to or less than the minimum graduations on the primary. There must be an interlock cutoff circuit to prevent the

Table 401-6 HMA Holding Bin Acceptance Criteria	
Property	Acceptance Criteria
Mix Temperature	±10°C from pugmill discharge temperature.
Aggregate Gradation	Within Job Mix Formula tolerances (applies to pugmill discharge mean gradation).
Asphalt Binder Content	±0.4% (applies to pugmill discharge mean asphalt binder content).
Asphalt Binder Recovered from Mixtures	
Dynamic Shear (TP5)	G*/sin δ, min., 2.20 kPa

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 70 kilograms or 0.07 metric 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 and the total amount of mixture discharged into the truck. 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, interlock the system to allow printing only when the scale has come to a complete rest.

D. Holding Bin Evaluation and Approval. Prior to use on State 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.

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. The State reserves the right to evaluate any approved bin any time.

401-3.10 Preparation of PG Binder. 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.

401-3.11 Preparation of Aggregates.

A. Requirements for All Plants. Keep all State approved aggregates from different sources separate from each other unless approved by the RME. Separate all State approved aggregates from non-approved aggregates.

B. Requirements for Batch Plants. Stockpile all aggregates, including RAP, on free draining and clean bases such that the aggregates are not contaminated with foreign materials. 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 non-uniform aggregate gradation or moisture content results, this transfer of aggregate will no longer be permitted.

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, screen the aggregates into fractions and place into separate compartments.

RAP will be last in the aggregate weigh sequence and the RAP design batch weight must be

increased to compensate for moisture content. All requirements pertaining to aggregates apply to RAP, including the equipment requirements for automated proportioning and recordation stipulated for aggregates in §401-3.08, HMA Mixing Plant.

C. Requirements for Drum Mix Plants. Stockpile all aggregates, including RAP, on free draining and clean bases such that the aggregates are not contaminated with foreign materials. 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 §401-3.08 C.7. Automatic Aggregate Sampling Device.

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 §401-3.08, HMA Mixing Plant. In addition, add RAP 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.

401-3.12 Mixing. The mixer must 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 percent for base course and 95 percent for binder and surface course. The procedure for determining particle coating is available from the RME.

A. Requirements for 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. In addition, the total quantity of material mixed shall not be less than 50 percent 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.

1. Base Course Mixes. Dry mix the base course mixes 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 percent of the coarse aggregate particles are fully coated or the finish mixing time exceeds ten seconds, whichever is longer.

2. Top and Binder Course Mixes. Dry mix the top and binder course mixes 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 percent of the coarse aggregate particles are fully coated or the finish mixing time exceeds 10 seconds, whichever is longer.

B. Requirements for Drum Mix Plants and for recycle mixes in Batch Plants. The moisture content of the mixture upon discharge into the haul unit will not exceed 0.5 percent when tested in accordance with procedures outlined in MM 5.0.

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 and the HMA coded as outlined in Table 401-7, Delivery Ticket Mix Coding.

- Ticket number
- Plant identification
- Contract number
- Mix Codes
- Quantity of material in vehicle
- Date and Time

The QAT will determine a daily QAF for each day's production from either Table 401-8, Air Voids in Plant Mixture (Volumetric Designs) or Table 401-9, Percent Passing (Non-Volumetric Designs) using the calculations of the average absolute difference values in accordance with MP 96-02. The Engineer will use the daily QAF to calculate quality payment adjustment for each day's production.

A. Volumetric Designs - Quality payment adjustment for volumetric design mixtures is based on plant mixture air voids. The Engineer will obtain the daily QAF for volumetric design mixtures from Table 401-8, Air Voids in Plant Mixture. When hot mix asphalt holding bins are used for volumetric design mixtures, the Engineer will determine the daily QAF for the stored mixture on the day of delivery.

B. Non-Volumetric Designs - Quality payment adjustment for non-volumetric design mixtures is based on plant mixture aggregate gradation. The daily QAF will be calculated for non-volumetric design mixtures for all Job Mix Formula sieves having design target values less than 90 percent passing. The daily QAF for non-volumetric design mixtures will be the lowest factor obtained from Table 401-9, Percent Passing. If each individual QAF is equal to or greater than 1.00, the highest calculated QAF will be used.

When any material with plant air voids of less than 2% or greater than 6% which results in daily QAF of 0.85, the Engineer will evaluate the subject material to determine if it will be left in-place. The considerations for determining whether the material in question is left in place are, but not limited to:

- Type of material produced
- The layer in which the material was placed
- The location of the project

If the subject material is left in-place, the Engineer will use a daily QAF of 0.85 to calculate the quality payment adjustment. If the subject material is not left in-place, remove and replace the material at no cost to the State. The daily QAF for the replaced material shall be determined as outlined in this subsection. The daily QAF applies to all production quantity deemed acceptable by the Engineer.

Table 401-7
Delivery Ticket Mix Coding[3]

Mix Type	Code	Code [1]	Design ESAL	Code	Consensus Properties [2]	Code	PG Binder Type	Code
9.5 mm	09	F1	<0.3 million	1	<100 mm	Y	PG 58-34	A
12.5 mm	12	F2	<3.0 million	2	>100 mm	N	PG 64-22	B
19.0 mm	19	F3	<10 million	3			PG 64-28	C
25.0 mm	25	F9	<30 million	4			PG 70-22	D
37.5 mm	37	-----	>30 million	5			PG 76-22	E
							OTHER	G

Notes:

1. Friction Aggregate Classification Codes
2. When at least 75% of a layer is deeper than 100 mm below the pavement surface, the >100 mm aggregate consensus properties apply for that layer.
3. Delivery Ticket Mix Coding Example: 12.5 mm, <30 million design, <100 mm from surface, PG 64-28
   Mix Coding on Delivery Ticket: ***12F24YC***.

TABLE 401-8 AIR VOIDS IN PLANT MIXTURE (Volumetric Designs)	
Average Absolute Value (Test Value - 4.0)	**Quality Adjustment Factor (QAF)**
0.00 - 0.17	1.05
0.18 - 0.33	1.04
0.34 - 0.50	1.03
0.51 - 0.67	1.02
0.68 - 0.83	1.01
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

TABLE 401-9 PERCENT PASSING (Non-Volumetric Designs)			
Average Absolute Value (Test Value - JMF Target Value)			**Quality Adjustment Factor**
Sieve Size 425µm and Larger	**Sieve Size 180µm**	**Sieve Size 75µm**	
	0.0 - 0.5	0.0 - 0.3	1.05
0.9 - 1.5	0.6 - 1.0	0.4 - 0.5	1.04
1.6 - 2.3	1.1 - 1.5	0.6 - 0.8	1.03
2.4 - 3.0	1.6 - 2.0	0.9 - 1.0	1.02
3.1 - 4.5	2.1 - 3.0	1.1 - 1.5	1.01
4.6 - 6.0	3.1 - 4.0	1.6 - 2.0	1.00
6.1 - 6.3	4.1 - 4.2	2.1	0.99
6.4 - 6.6	4.3 - 4.4	2.2	0.98
6.7 - 6.9	4.5 - 4.6	2.3	0.97
7.0 - 7.2	4.7 - 4.8	2.4	0.96
7.3 - 7.5	4.9 - 5.0	2.5	0.95
7.6 - 7.8	5.1 - 5.2	2.6	0.94
7.9 - 8.1	5.3 - 5.4	2.7	0.93
8.2 - 8.4	5.5 - 5.6	2.8	0.92
8.5 - 8.7 0.0 - 0.8	5.7 - 5.8	2.9	0.91
8.8 - 9.0	5.9 - 6.0	3.0	0.90
over 9.0	over 6.0	over	0.85

SECTION 402 - HOT MIX ASPHALT (HMA) PAVEMENTS

402-1 DESCRIPTION. These specifications apply to all plant mixed Hot Mix Asphalt (HMA) produced at an approved production facility under Section 401, Plant Production, irrespective of aggregate gradation, type, and amount of HMA material or use.

This work will consist of one or more courses of HMA pavement constructed on the prepared foundation in accordance with these specifications, the specific requirements of the item under contract, and as shown in the contract documents or as directed by the Engineer.

Prior to routine paving, the Engineer will conduct a pre-paving meeting with all parties working under this specification.

402-2 MATERIALS

402-2.01 General. Obtain State approval of materials before any material is mixed at any HMA plants. Obtain approval of aggregate sources for coarse and fine mineral aggregates from the Regional Materials Engineer. Performance-Graded Binder (PG Binder), mineral filler or any other materials that are used in the mix will be accepted according to the State's written instructions. The PG Binder and the Design Estimated Traffic in 80 kN ESALs will be specified by a special note in the contract documents.

402-2.02 Composition of Mixtures. Formulate and submit, to the Regional Materials Engineer, a Superpave Mix Design that satisfies the requirements of §401-2 and the mixture design procedure as written in Materials Method (MM) 5.16, Superpave Hot Mix Asphalt Mixture Design and Mixture Verification Procedures.

Table 402-1, General Description, lists the specification types of compaction methods and their use.

Table 402-1 General Description					
Specification Types		50 Series	60 Series	70 Series	80 series
Item No.		402.XX51ZR, XX=09, 12	402.XX61ZR, XX=09, 12	402.XX71ZR, XX=09, 12	402.XX81ZR, XX=09, 12
Item No.		402.XX52ZR, XX=09, 12	402.XX62ZR, XX=09, 12	402.XX72ZR, XX=09, 12	402.XX82ZR, XX=09, 12
Coarse Agg. Type = F1 & Coarse Agg. Type = F2	Use	Mainline paving for controlled access highways, i.e., interstate, parkways.	Mainline paving other than 50 or 70 Series.	Mainline paving on low volume roadways.	Miscellaneous repairs, bridge approaches, trenches, etc.
		Density monitoring using 4 cores every day.	Density monitoring using PTD based on average of 4 cores.	Density monitoring using a nuclear gauge.	Number of passes applies.
Coarse Agg. Type = F3	Item No.		402.XX63ZR, XX=09, 12	402.XX73ZR, XX=09, 12	402.XX83ZR, XX=09, 12
	Use		Mainline paving other than 70 Series.	Mainline paving on low volume roadways.	Miscellaneous repairs, bridge approaches, trenches, etc.
			Density monitoring using PTD based on average of 4 cores.	Density monitoring using a Nuclear gauge.	Number of passes applies.
Coarse Agg. Type = F9	Item No.	402.XX59ZR, XX=19, 25	402.XX69ZR, XX=19, 25, 37	402.XX79ZR, XX=19, 21, 25, 37	402.XX89ZR, XX=09, 12, 19, 21, 25, 37
	Use	Mainline paving for controlled access highways, i.e., interstate, parkways.	Mainline paving other than 50 or 70 Series.	T&L, Mainline paving on low volume roadways.	T&L, shoulders, miscellaneous repairs, bridge approaches, trenches, etc.
		Density monitoring using 4 cores every day.	Density monitoring using PTD based on average of 4 cores.	Density Monitoring using a Nuclear gauge.	Number of passes applies.

For 50, 60, and 70 series compaction methods, notify the Engineer of a desired mix temperature to be delivered to the project. For the 80 series compaction method, the Engineer will specify the desired mix temperature. The mixtures will be produced, delivered to the work site, and incorporated into the work within

10°C of the specified temperature. The specified temperature must be within the mixing and compaction range of 120°C and 165°C, or as recommended by the PG Binder manufacturer.

402-3 CONSTRUCTION DETAILS

402-3.01 Weather and Seasonal Limitations. Do not place HMA plant mix on any wet surface or when the surface temperature is less than specified in Table 402-2, Temperature and Seasonal Requirements, or when weather conditions will prevent proper handling or finishing of the HMA mixtures.

Discontinue paving as soon as the surface temperature falls below the requirements which are shown in Table 402-2 and applies for all pavement and shoulder courses.

TABLE 402-2
TEMPERATURE AND SEASONAL REQUIREMENTS

Nominal Compacted Lift Thickness	Surface Temperature Minimum (Note 1)	Seasonal Limits
≥100 mm	5°C	None
≥50 mm but <100 mm	8°C	(Notes 2 & 3)
<50 mm	10°C	(Notes 2 & 3)

NOTES:

1. Measure all temperatures on the surface where the mixture is to be placed and the controlling temperature will be the average of three temperature readings taken at locations 8± meters apart.
2. Place Top Course only during the period of April 1st up to and including the third Saturday of November in the counties of Dutchess, Orange, Rockland, Putnam, Westchester, Nassau, Suffolk, and the City of New York.
3. Place Top Course only during the period of May 1st up to and including the third Saturday of October in all counties except as noted in Note 2.

HMA pavement for temporary detours, which are not and will not become part of the permanent pavement, will not be subject to the above requirements in regard to temperature and seasonal limitations, but must be placed as approved by the Engineer.

Place HMA paving mixtures for curbs, driveways, sidewalks, gutters, and other incidental construction on surfaces having a minimum temperature of 10°C. The Engineer may allow the placement of these mixtures below the minimum temperature to expedite the completion of the project.

Schedule the paving operations such that all paving necessary to provide safe and adequate maintenance and protection of traffic or for protection of previously laid courses is completed within the weather and seasonal limitations. Such scheduling will include expediting construction operations to permit paving within the seasonal limitations or by limiting the length of work to that which can be completed before the seasonal shut-down. The cost of scheduling and sequencing of work to conform with the seasonal limitations will be reflected in the unit bid prices for the related contract items. Should paving operations not be completed within weather and seasonal limitations, provide all temporary materials and work necessary, such as the shimming of castings and protrusions, drainage of the roadway, providing acceptable rideability, and other work needed for the adequate maintenance and protection of traffic until paving operations can be completed the following paving season, and will not be reimbursable by the State.

Repair any damage to the base and binder course which has been placed and which will be permanently incorporated into the work and left open to traffic over the winter, at no additional expense to the State. In addition, clean this pavement course in accordance with Section 633, Conditioning Existing Pavement, at no additional expense to the State, immediately prior to applying a tack coat and overlaying. Apply tack coat in accordance with Section 407, Tack Coat, immediately prior to overlaying.

The contractor may propose to place surface course HMA pavement outside seasonal and/or weather limitations by providing a limited warranty against defects in such work. Warranty information can be provided by the Engineer.

402-3.02 HMA Pavers. Provide a self-powered HMA paver with an activated screed or strike-off assembly. The machine shall be capable of spreading and finishing courses of HMA plant mix material in lane widths applicable to the specified typical section and thicknesses shown on the plans. When screed extensions are necessary for placement of mainline pavement, such extensions shall be of the same design as the main screed. Auger and tunnel extensions are required to be mounted on the paver when the screed is extended more than 0.3 meter for fixed paving widths wider than 3.6 meters. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of HMA plant material in widths shown on the plans. The paver shall have a receiving hopper with sufficient capacity for uniform spreading operation and with automatic flow controls to place the mixture uniformly in front of the screed. Heat the screed or strike-off assembly as necessary to produce a finished surface of the required smoothness and texture without tearing, shoving or gouging the mixture. When laying mixtures, the paver shall be capable of operating at forward speeds consistent with satisfactory placement of the mixtures.

HMA pavers used for placing the initial paving layer, base, binder, and surface courses shall be equipped with approved automatic transverse slope and longitudinal grade screed controls. The controls shall automatically adjust the screed and increase or decrease the mat thickness to compensate for irregularities that are in the surface being paved. The controls shall be capable of maintaining the proper transverse slope and be readily adjustable so transitions and super-elevated curves can be satisfactorily paved. The controls shall operate from suitable fixed or moving references as prescribed in §402-3.06, Spreading and Finishing. When paving width is in excess of 5.2 meters, a paver must have approved automatic transverse slope and longitudinal grade screed controls that operate from both sides of the paver.

The transverse slope and longitudinal grade screed controls of the HMA paver may be manually adjusted according to the requirements of §402-3.06, Spreading and Finishing. The HMA pavers must be at the project site prior to the start of paving operations to allow examination and approval by the Engineer. Repair or replace immediately any paver found to be worn or defective either before or during its use.

402-3.03 Hauling Equipment. Transport HMA mixtures to the work site in vehicles having clean, smooth and tight metal beds. Cover the HMA mixture with waterproof covers during transportation. If a flexible cover is used, it must overlap the vehicle's sideboards and back by a minimum of 150 mm and be securely fastened. The inside surface of the vehicle body may be lightly coated with a release agent. Release agents must meet all applicable State and Federal environmental requirements. Petroleum products or solvents having an adverse effect upon the HMA pavement will not be permitted for use as release agents. All hauling equipment is subject to the approval of the Engineer.

402-3.04 Rollers. All rollers shall be an approved vibratory, static steel wheel type, or pneumatic tire type used according to the requirements of §402-3.07, Compaction. All rollers shall be in good mechanical condition, free from excessive backlash, and capable of operating at speeds slow enough to avoid displacement of the mixture. The number and weight of rollers must be sufficient to satisfactorily compact the mixture while it is still in a workable condition. The use of equipment which results in excessive crushing of aggregate will not be permitted.

A. Vibratory rollers shall be of a type that are specifically designed for the compaction of HMA mixture. Vibratory roller models satisfying the specification requirements contained herein will be evaluated by the Materials Bureau to determine compaction capabilities. If acceptable, the roller model will be placed on the State's current Approved List for Hot Mix Asphalt Vibratory Compaction Equipment. For all State projects, use only the vibratory roller models appearing on this list. Alternate types of rollers may be approved by the Director, Materials Bureau, for 50, 60, 70, and 80 series compaction methods, if, upon reviewing the specification of the rollers and demonstration that satisfactory results can be achieved.

Vibratory rollers shall meet the following requirements:

Nominal Amplitude	1.25 mm maximum.
Vibration Frequency	1500 vpm minimum.
Drum Width (dual vibrating drums)	1.3 m, minimum
(single vibrating drum)	2.1 m, minimum

When the rollers have pneumatic drive wheels, apply release agents to the tires to prevent material pickup.

All vibratory rollers shall be equipped with a speedometer that accurately indicates roller speed in either 1 km/hr or 15 m/min increments (maximum) throughout the specified operating range. Vibratory rollers must also be equipped with a speed control device that can be set to prevent the roller from traveling in excess of 4 km/hr or 67 m/min when the roller is in vibratory mode. The type of speed control device will be subject to the approval of the Director, Materials Bureau.

B. Static steel-wheel rollers shall be self-propelled and be either 9 to 11 metric ton tandem three axle type or 7 to 9 metric ton tandem two axle type.

C. Pneumatic rubber-tired rollers shall be self-propelled and consist of two axles on which multiple pneumatic-tired wheels are mounted in such a manner that the rear wheels shall not follow in the tracks of the forward wheels and will be spaced to give essentially uniform coverage with each pass. The axles will be mounted in a rigid frame provided with means for adding ballast. The wheels shall be mounted so as to oscillate individually or in pairs. The tires must be smooth and show no tread pattern, be of equal size and diameter, and be uniformly inflated. Pneumatic rollers shall meet the following requirements unless otherwise approved:

Maximum Wheel Load	2,600 kg
Tire Compression on Pavement	550 ± 35 kPa
Maximum Axle Load	10,160 kg

402-3.05 Conditioning of Existing Surface. When specified in the contract, clean the surface of the existing pavement, fill joints and cracks, and level the surface to a uniform grade and cross slope prior to the application of a new HMA concrete course. Clean the surface and fill the joints and cracks under the provisions of Section 633, Conditioning Existing Pavement. Clean any foreign material resulting from construction operations from the pavement at no additional cost to the State. Leveling of the pavement surface prior to new HMA placement will be in conformance with the requirements stated below:

a. Apply a thin, uniform tack coat as specified in Section 407, Tack Coat, to all contact surfaces of existing HMA and Portland Cement Concrete layers including such areas as adjacent pavement edges, curbing, gutters, manholes, and other structures, immediately prior to placing the HMA mixture against them.

b. Fill depressions and wheel path ruts prior to the paving of the truing and leveling course, as directed by the Engineer. For wheel path ruts with a depth of 7 mm, but less than 20 mm, use Shim Course. For ruts greater than 20 mm, use a 9.5 mm mixture.

c. If a truing and leveling course is specified on the plans or in the itemized proposal, place the course(s) of a minimum variable thickness of proper plant mix necessary to bring the surface of the existing pavement to the same transverse slope and longitudinal grade required for the finished pavement surface. Test the surface of this course in the same manner prescribed in §402-3.10, Surface Tolerance, except that the allowable variation from the true surface after compaction must not exceed 10 mm. Unless a mixture type is specified in the plans, use Table 402-3, Mixture Selection for T&L Course, to select the appropriate mix type such that dragging of stones is minimized during placement of the mixture.

TABLE 402-3 Mixture Selection For T&L Course

Compacted Thickness Range (mm)	Mixture Type
≤ 40	9.5 mm or 12.5 mm
>40	19.0 mm or 25.0 mm

Note: 37.5mm mixture may be used when the compactive thickness is greater than or equal to 75mm.

When constructing wedges for super-elevation, select a mixture such that dragging of stones at the thin edge is minimized. If dragging is excessive in any T&L course, as determined by the Engineer, the selected mixture will be disallowed for use for the application. Pay special attention to the proper compaction of thin sections.

402-3.06 Spreading and Finishing. Apply tack coat on the contact surfaces between all HMA pavement lifts in accordance with Section 407, Tack Coat, prior to placing HMA mixture regardless of time period between lifts. The only exception to this is the surface of permeable base courses. Paving over a tack coat should not commence until the emulsion has broken (goes from brown to black) or is tacky when touched.

Lay the mixture upon an approved clean, tack coated surface. Spread and strike off to the established grade and elevation. Use HMA paver(s) to distribute the mixture either over the entire width or over such partial width as may be practicable. Upon arrival at the site, the trucks will dump the mixture into the paver. Immediately spread and strike off to the required width and appropriate loose depth to obtain the required compacted thickness at completion of the work.

When the initial pavement course is laid with automatic HMA pavers, guide the paver by a taut reference line positioned at or near the pavement centerline or edge. Erect and maintain the reference line to the satisfaction of the Engineer. Support the reference line at approximately 8 meter intervals on tangent sections and at closer intervals on curves. Tension the line sufficiently to remove any sags. The Engineer may permit a moving reference of at least 9 meters in length in lieu of a reference line. The moving reference may be a floating beam, ski, or other suitable type such that the resulting pavement layer surface is sufficiently even. A short ski or shoe may also be used for the initial course with the approval of the Engineer if a satisfactory fixed reference such as a curb, gutter, or other fixed reference is adjacent to the pavement. When the proposed floating beam or the short ski does not produce the results similar to those obtained using a taut reference line, the Engineer shall disapprove the use of these devices.

Place subsequent pavement courses over the initial course using one of the above methods. In addition, any course in an adjacent lane may be used as the reference for the use of a short ski. The Engineer has final approval of the method chosen by the Contractor.

The automatic screed controls will not be required where existing grades at roadway intersection or drainage structure must be met, for shoulders, temporary detours, behind curbs, or in other areas where its use is impractical.

If there are less than 1250 square meters in the contract, or the areas to be paved are small and scattered, the HMA mixture may be spread by hand methods. For these areas, dump and spread the mixture such that the compacted thickness meets the specified thickness in the plans.

Prior to the beginning of rolling, check the loose mat, adjust any irregularities, and remove and replace all unsatisfactory material.

When placing the Shim Course to fill wheel ruts in an existing pavement, each wheel path rut must be paved separately. The placement equipment will be a drag box configuration or approved equal having side forms. Use the equipment to spread and strike off the shim course material to a uniform width of approximately 1.2 meters. The intent of the operation is to fill the low area only and not to place the material for the pavement's full lane width. The placement equipment wheels and/or other appurtenances must not interfere with the distribution and placement of the shim course material. Deliver the placement equipment to the project site prior to the placing operation to allow sufficient time for examination and approval by the Engineer.

402-3.07 Compaction. Compact the HMA mixture using the appropriate compaction method specified in Table 402-4, Compaction Methods, associated to specific items being placed.

TABLE 402-4
Compaction Methods

Compaction Methods	Item Number[1]
A=50 series	402.XX5FZR
B=60 series	402.XX6FZR
C=70 series	402.XX7FZR
D=80 series	402.XX8FZR & other

Notes: 1. XX = Mix type (37, 25, 21, 19, 12, 09)
2. F = Friction requirement (1, 2, 3, 9)
3. Z = Quality item number
4. R = Revision number

Immediately after the HMA mixture has been spread, struck off, and surface irregularities adjusted to uniformity, compact it using rollers meeting the requirements of §402-3.04, Rollers. Roll the surface when the mixture is in the proper condition and when the rolling does not cause displacement, cracking or shoving as determined by the Engineer. Initially roll all courses with the roller traveling parallel to the centerline of the pavement beginning at each edge and working toward the center. Roll the banked curves starting at the low side edge and working toward the super-elevated edge.

Correct at once any displacement occurring as a result of reversing the direction of the roller, or from other causes, by the use of rakes and addition of fresh mixture as required. Care will be exercised in rolling not to displace the line and grade of the edges of the HMA mixture. To prevent adhesion of the mixture to the rollers, keep the wheels properly moistened with water, water mixed with small quantities of detergent or other approved material. Petroleum products or solvents having an adverse effect upon the HMA pavement will not be permitted for use on State projects.

There shall be no visible defects, such as shallow ruts, ridges, roller marks, cracking, tearing, segregation, or any other irregularities, as determined by the Engineer, in the pavement when the rolling operation is complete. If these defects are present, correct these defects to the satisfaction of the Engineer or relay the pavement at no additional cost to the State.

Along forms, curbs, headers, walls and other areas not accessible to rollers, thoroughly compact the mixture with mechanical tampers. On depressed areas, use a trench roller or a small vibratory roller with the approval by the Engineer. Cleated compression strips also may be used under the roller to transmit compression to the depressed area.

Remove and replace with fresh HMA mixture any mixture that becomes loose and broken, mixed with dirt, or is in any way defective. Compact the mixture to conform with the surrounding area. Correct any area showing an excess or deficiency of HMA material.

When Shim Course is used for filling wheel ruts, compact with a minimum of three passes of a pneumatic rubber tire roller. When Shim Course is used as a skim coat, use pneumatic rubber tire rollers unless other rollers are approved by the Engineer.

Vibratory compaction is not permitted when compacting HMA mixtures on structural bridge decks, or other structures with less than 0.6 meter cover. When using vibratory compaction, repair all damages which may occur to the highway components and adjacent property, including buried utility and service facilities, at no cost to the State.

When placing HMA mixture using either 50, 60, or 70 series compaction methods, control the operation of the rollers including the speed, the amplitude settings, the vibration frequency, and the weight of the rollers.

For 60 and 70 series compaction methods, use a nuclear density gauge to monitor the pavement density in accordance with this section and Materials Procedure (MP) 96-01, Nuclear Gauge Density Data Collection for Hot Mix Asphalt. The nuclear density gauge shall consist of a radioactive source, scaler and other basic components housed in a single backscatter unit. The gauge must be operated by personnel trained in the principles of nuclear testing and safety practices.

The following compaction methods shall be used for HMA placements on all State projects.

A. 50 Series Compaction Method. On the first day of mainline paving, select one of the following options:

> ***1. Option 1: Test Section.*** Prior to routine paving of this item, construct a test section on the project site at a location approved by the Engineer. The test section will be a maximum of 500 lane meters on the mainline. The contractor will construct the full width of the pavement if deemed necessary by the Engineer. The test section will be the same depth specified for the construction of the course which it represents. Use the first 100 linear meters of the test section to stabilize the paving operation. There is no maximum length if the test section is not on the mainline. The first 200 metric tons of quantity placed on a test section will be paid at a factor of 1.5 times the bid price. The remaining quantity will be paid at the bid price. A maximum of two test sections per item will be paid at the 1.5 adjustment. Pavement density Quality Adjustment Factors (QAFs) will not apply to the first two test sections. If more than two test sections are required, the pavement density QAF will apply when the additional test sections are located on the mainline. Only one test section per

item per day will be placed. Subsequent test sections after the initial test section will be subject to approval by the Engineer. Once the test section is completed, the Engineer will select core locations and have cores taken in accordance with §402-3.08, Pavement Density Samples. When the average of the cores is less than 88% of the maximum theoretical density, the Engineer will evaluate the test section to determine its acceptability. If found acceptable, payment will be adjusted by a factor of 0.60. If the Engineer chooses to have it removed and replaced, there will be no cost to the State and the 1.5 factor will not apply.

Routine paving operations for this item will not be permitted until the results of the cores from the test section has a minimum pavement density QAF of 1.00. If the pavement density QAF is less than 1.00, construct another test section in accordance with Option 1.

2. Option 2: Routine Paving. Begin paving operations. Test Section Adjustment of 1.5 for the first 200 metric tons will not apply. All material placed will be subject to a pavement density QAF. If the pavement density QAF on the first day of paving is less than 1.00, construct a test section in accordance with Option 1.

During the placement of HMA mixture under this method, including the test section, take cores and loose mix samples in accordance with §402-3.08, Pavement Density Samples.

A paving lot is defined as a day's production which must be a minimum of 200 metric tons. Each paving lot will be equally divided into four sublots in accordance with Materials Procedure (MP) 96-04, Asphalt Concrete Statistical Pavement Density Determination. When paving is continuous within a 24 hour period, a new lot will result when a change occurs in the paving crew. When a single plant is supplying to multiple paving operations or multiple plants are supplying to multiple paving operations, each paving operation will be evaluated separately. Multiple plants will not be allowed to supply HMA mixture to a single paver. If less than 200 metric tons are placed on any day, pavement cores will not be required and the density QAF will be reported as 1.00 for that day.

Compact the pavement sufficiently to achieve densities, expressed as a percentage of the mixtures average daily maximum theoretical density (%MADMTD), in a range of 92% to 97%. Pavement cores and loose mix samples will be tested and analyzed by the State in accordance with MP 96-04 to determine the pavement density QAF.

When consecutive lots are found to have a density QAF equal to or less than 0.85, stop paving operations and immediately construct a new test section in accordance with Option 1, described previously in this section.

The density QAF will not be applied to material placed on ramps with a uniform full width section of less than 400 m in length, shoulders, maintenance widenings and crossovers, and bridges. Payment for these areas will be based on satisfactory placement and compaction. Placement and compaction procedures will be deemed satisfactory by the Engineer when the procedures used in these areas obtain pavement density similar to that obtained on the mainline pavement sections. If the shoulder shows signs of distress at this level of compaction, decrease the compaction effort until no further damage occurs to the shoulder or subbase. Also, if a nuclear gauge(s), or an equivalent density monitoring device is used to monitor mainline paving, use the same gauge(s) to monitor density of the above referenced areas.

B. 60 Series Compaction Method. On the first day of paving, select one of the options specified below:

1. Option 1 - Test Section. The test section is for determining a Project Target Density (PTD) for this item and correlation of a nuclear density gauge. Prior to routine paving operations for this item, construct a test section on the project site at a location approved by the Engineer. Construction of the test section will not be allowed unless both a nuclear gauge and the operator are present. The test section will be a maximum of 500 lane meters on the mainline. The contractor will construct the full width of the pavement if deemed necessary by the Engineer. The test section will be the same depth specified for the construction of the course which it represents. Use the first 100 linear meters of the test section to stabilize the paving operation. The remainder of the length will be used to determine the PTD.

During construction of the test section, take samples in accordance with §402-3.08, Pavement Density Samples. These samples should represent the material placed on the test section. At the conclusion of the test section, the Engineer will randomly select four 150 mm core locations on the test section (excluding the initial 100 linear meters) in accordance with §402-3.08. Take density readings with a nuclear density gauge(s) at each core location prior to drilling the cores. A nuclear density reading is the average of the four measurements taken at 90°. Deliver the samples and the four nuclear density readings with the gauge model and serial number for each gauge to be correlated to the Regional Laboratory in accordance with §402-3.08. The Regional Materials Engineer will use the test section cores and nuclear gauge readings to establish a PTD for each gauge within one business day of the delivery of the samples and nuclear gauge density readings. When the average of the cores is less than 88% of the maximum theoretical density, the Engineer will evaluate the test section to determine its acceptability. If found acceptable, payment will be adjusted by a factor of 0.60. If the Engineer chooses to have it removed and replaced, there will be no cost to the State and the 1.5 factor will not apply.

The first 200 metric tons of quantity placed on a test section will be paid at a factor of 1.5 times the bid price. The remaining quantity will be paid at bid price. A maximum of two test sections per item will be paid at the 1.5 adjustment. Only one test section per item per day will be placed. Subsequent test sections after the initial test section will be subject to approval by the Engineer.

Routine paving will only begin after a PTD has been established by the Regional Materials Engineer based on testing of the pavement cores.

2. Option 2 - Continue Paving After Test Section. Inform the Engineer when this option is selected. Construct a test section as described in Option 1 and continue paving. Take additional loose mix samples in accordance with §402-3.08. Store these samples at the plant. The 1.5 adjustment for the test section does not apply when this option is selected. Determine an Interim PTD to monitor pavement density as described in MP 96-01. If nuclear readings over two consecutive locations fall below 96% or exceeds 103% of the Interim PTD, stop routine paving operations and immediately construct a new test section as required in Option 1 - Test Section.

At the end of the first day's paving, submit a copy of Form BR340 to the Engineer. The Engineer will determine whether the nuclear readings taken using the Interim PTD are acceptable based on the Actual PTD. If not, the Engineer will select core locations randomly over the entire first day's production excluding the test section. Prior to drilling these cores, take nuclear density readings at each core location. Deliver the core samples, nuclear gauge readings, and the loose mix samples to the Regional Laboratory in accordance with §402-3.08.

If the average density of the pavement cores is not between 92% and 97% of the mixture's maximum theoretical density, the Engineer will make a payment adjustment in accordance with Table 402-9, Density Quality Adjustment Factors, to the material placed on that day excluding the material placed on the test section.

Use only the gauge(s) correlated during the construction of the test section for monitoring pavement density during routine paving operations.

Compact the pavement sufficiently to achieve the PTD value. The minimum acceptable density reading will be 96% and no greater than 103% of the PTD at a single test location and 98% of the PTD calculated as a moving average of the last 10 test locations as determined by a nuclear density gauge. Take nuclear gauge readings at each location, randomly selected by the Engineer, every 60 meters along the length of the pavement for each pass of the paver. Record these density values on Form BR340.

Placement and compaction on shoulders, ramps, maintenance widenings and crossovers, and bridges will be deemed satisfactory by the Engineer when the procedures used in these areas obtain pavement density similar to that obtained on the mainline pavement sections. Monitor and record the density of the above referenced areas with the same nuclear gauge to insure the PTD is achieved. If the shoulder subbase is structurally insufficient to sustain the level of compaction such that the shoulder shows signs of distress, decrease the compaction effort until no damage occurs to the shoulder or subbase.

The Engineer may require additional pavement core samples for daily density verification from the

previously placed HMA. The requirement of these samples shall be based on the following situations:

- Insufficient number of density readings recorded, either at a specific location or at the required frequency.
- Paving without a nuclear density gauge on site.
- Paving completed after the only calibrated nuclear density gauge on site breaks down.
- Gauge readings do not accurately represent the HMA density.

When pavement samples are required, take cores and nuclear density readings at each core location in accordance with §402-3.08 and deliver them to the Regional Laboratory. The material placed under the above situations will be subject to a payment adjustment.

The Engineer may require pavement samples to verify PTD used on the project for the following situations:

- When the contract includes multiple paving locations.
- Changes in existing pavement condition being overlaid.
- Excessive plant mix variations.
- When accuracy of the gauge is in question.

When pavement samples are required, take cores, nuclear density readings at each core location, and loose mix samples in accordance with §402-3.08 and deliver them to the Regional Laboratory. The material placed under these situations will not be subject to payment adjustment. However, the Regional Materials Engineer will establish a new PTD, if different from the original PTD.

C. 70 Series Compaction Method. On the first day of paving, construct a test section on the project site at a location approved by the Engineer, using the same equipment and procedures to be used in the construction of the remainder of the course being laid. The test section is for the purpose of determining the PTD for this method. Routine paving operations may begin immediately following the construction of the test section once a PTD has been established to the satisfaction of the Engineer based on the evaluation of density readings. Paving operations will not be allowed unless both a nuclear density gauge and an operator are present.

Test Section. Construct a test section maximum of 500 linear meters on the mainline which has the same depth specified for the construction of the course it represents. Use the first 100 meters of the test section to stabilize the paving operation. The remainder of the length will be used to determine the Project Target Density (PTD). Once a sufficient amount of material has been placed in the remaining test section, compact the pavement initially with a breakdown roller making four vibratory passes or as recommended by the Engineer. The Engineer will select three random locations in accordance with MP 96-01, and mark these sites so that subsequent density testing can be performed at the same locations. Take density readings at the selected three sites. A nuclear density reading is defined as the average of four nuclear measurements taken at 90° at a location. Make additional machine passes using either the intermediate or the finish roller and take additional density readings at the three previously selected sites after each pass until the increase in density is less than 32.0 kg/m^3, or until the Engineer stops further compaction because the pavement shows signs of distress.

The Engineer will calculate the average of the density readings at each of the three test locations. This highest average density will be the PTD for monitoring the pavement density during routine paving operations.

Compact the pavement sufficiently to achieve the PTD value. The minimum acceptable density reading will be 96% or maximum of 103% of the PTD in a single test location and 98% of the PTD calculated as a moving average of the last 10 test locations as determined by a nuclear density gauge. Take nuclear density readings at each location, randomly selected by the Engineer, approximately every 60 meters along the length of the pavement for each pass of the paver. Record these values on Form BR340.

If nuclear density readings over two consecutive locations fall below 96% or above 103% of the PTD or if the moving average of the last 10 nuclear density readings falls below 98% of the PTD, stop

routine paving operations and immediately construct a new test section in accordance with requirements of the Test Section.

Placement and compaction on shoulders, ramps, maintenance widenings and crossovers, and bridges will be deemed satisfactory by the Engineer when the procedures used in these areas obtain pavement density similar to that obtained on the mainline pavement sections. Monitor the density of the above referenced areas with the same nuclear gauge to insure the PTD is achieved. If the shoulder subbase is structurally insufficient to sustain the level of compaction such that they show signs of distress, decrease the compaction effort until no damage occurs to the shoulder or subbase.

D. 80 Series Compaction Method. For this compaction method, use either of the compaction options listed below:

1. Option A - Three Roller Compaction Train or Modifications As Approved by the Engineer. Use this option only when the compacted thickness of the finished mat is 100 mm or less. The roller speeds shall not exceed 5 km/hr and will move at a slow and uniform speed. The roller drive wheel or drum will be nearest to the paver. When paving multiple lanes simultaneously, increase the required number of rollers proportionately for each additional full lane width unless otherwise approved by the Engineer. Under this option, initially roll all HMA mixtures with an approved steel-wheel roller operating in a static mode. Overlap the previous roller pass by one-half the width of the roller.

Immediately following the initial rolling, roll the mat with an approved pneumatic rubber-tired roller. A minimum of 3 passes of the rubber-tired roller will be required. One pass is defined as one movement of the roller over any point of the pavement in either direction.

Immediately following the pneumatic rubber-tired rolling, finish rolling the mat with a steel-wheel roller to remove all shallow ruts, ridges, roller marks, and other irregularities from the surface.

To prevent adhesion of the mixture to the drum(s) and pneumatic tires, keep the drum(s) and the pneumatic tires properly moistened with water, or water mixed with small quantities of detergent or other State approved materials.

When the compaction procedure fails to produce results acceptable to the Engineer, adjust the procedure to obtain the desired results.

2. Option B - Vibratory Compaction. Under this option, furnish a vibrating reed tachometer for the exclusive use of the Engineer. The vibrating reed tachometer must have a frequency range of 17 Hz to 67 Hz with a minimum reed interval of 1 Hz between 17 Hz and 33 Hz and a minimum reed interval of 2 Hz between 33 Hz and 67 Hz.

Operate vibratory rollers at a uniform speed not exceeding 4 km/hr (67 m/min.) on all pavement courses. Complete all turning of the compaction equipment on material which has had a minimum of one roller pass.

The number of passes listed in Table 402-5, Number of Passes, are recommended and may be increased or decreased if, in the opinion of the Engineer, adequate density can be achieved. Complete all breakdown roller passes before the mat temperature falls below 120° C. One vibratory pass is defined as one movement of one drum of the roller over any point on the pavement in either direction. One static pass is defined as one movement of the roller over any point on the pavement in either direction. Remove all ruts, ridges, roller marks or other irregularities from the surface using static rolling. The Engineer may approve alternate compaction procedures for areas where the specified procedures are not practical.

If the Engineer determines that unsatisfactory compaction is being obtained or damage to highway components and/or adjacent property is occurring using vibratory compaction equipment, then immediately cease using this equipment and proceed with the work in accordance with the conventional compaction procedures stipulated under Option A at no additional cost to the State.

TABLE 402-5 NUMBER OF PASSES				
Pavement Courses	Option A Three Roller Train (Static)		Option B Vibratory Rollers	
	Steel Wheel Rollers	Pneumatic Roller	Vibratory Passes	Static Passes
37.5 mm Base (Each Lift)	8	3	6	4
25.0 mm Binder	8	3	6	4
19.0 mm Binder	6	3	4	2
12.5 mm Top	6	3	4	2
9.5 mm Top	4	3	4	2

For the permeable base course, compact the mixture between the temperatures of 60° C and 110° C by applying two roller passes operating in the static mode, unless otherwise directed by the Engineer-in-Charge.

Vibratory compaction is not permitted when compacting HMA mixtures on structural bridge decks. If vibratory compaction equipment is elected, full responsibility is assumed for the cost of repairing all damages which may occur to highway components and adjacent property. The State is not responsible for these costs.

402-3.08 Pavement Density Samples .

A. Pavement Cores. The Engineer will select one pavement core location for each sublot in accordance with MP 96-04, to represent each paving sublot. The Engineer will define a total of four 150 mm diameter coring locations. The pavement core samples must come from within the 150 mm diameter circles outlined. Under no circumstances will the Engineer designate the coring locations before the rolling operation is completed. The rolling operation is completed when all compaction equipment has moved off the sublot designated for coring. Obtain the 150 mm diameter pavement core samples no later than a day following placement of the lot. If necessary, cool the pavement so that the core samples are not damaged during coring. Do not intentionally separate the pavement core from the underlying material if it does not debond during coring. The State will separate the pavement core required for testing from the underlying material by sawing, if necessary. Backfill the core holes with a similar HMA material before opening the lane to traffic.

B. Loose Mix Samples. On each paving day, take four loose mix samples in accordance with AASHTO T168, Standard Test Method for Sampling Bituminous Paving Mixtures. Take these samples periodically throughout the day so as to represent the entire day's production. When a low production day is anticipated, it is recommended that a minimum of three loose mix samples be obtained before production is terminated. When operational conditions cause production to be terminated before the specified number of samples have been taken, the following procedures will be used:

1. If only three samples are taken, the loose mix maximum theoretical density (MTD) will be based on the average of the three samples taken.

2. If only one or two samples are taken, the day's production will be added to the next day's production and sublots determined based on the total quantity placed during the two days. Therefore a maximum of six loose mix samples will be used to determine the loose mix MTD.

Deliver the loose mix samples to the Regional Laboratory no later than the end of the following day's placement. If, for any reason, a delay occurs in the delivery of the lot samples for three consecutive lots, paving operations for the item will not be permitted to continue until the samples are delivered and tested.

C. Security Procedure. After procuring the pavement cores, secure them in accordance with MP 96-04. Cores arriving at the Regional Laboratory for testing with a damaged or missing security seal will not be tested, and new cores will be taken within 0.3 m from the original core location at the same offset.

D. Sample Delivery. Deliver the pavement core samples to the State Regional Laboratory no later than the end of the following day's placement. If, for any reason, a delay occurs in the delivery of the lot samples for three consecutive lots, paving operations for the item will not be permitted to continue until the samples are delivered and tested.

E. Core Testing. The option of testing pavement samples taken under §402.3-08, Pavement Density Samples, for 50 and 60 series compaction methods may be selected with the approval of the Regional Materials Engineer. Under this provision, perform all sample testing as outlined in accordance with the requirements of Materials Procedure (MP) 98-01, Procedure for Testing Cores Taken from All Hot Mix Asphalt (HMA) Performance-Related Specifications. In addition, when this option is selected, the Engineer will define one additional core from two of the sublots within 0.3 m from the original core location at the same offset.

402-3.09 Joints. The finished pavement at all joints must comply with the surface smoothness requirements and exhibit the same uniformity of texture and compaction as other sections of the course. Do not pass rollers over the unprotected edges of a freshly laid mixture unless permitted by the Engineer.

In the formation of all joints, excluding the tapered wedge joint, the exposed edge of the newly placed layer that will become part of the joint shall be the full thickness of the layer and straight. If the edge of the newly placed layer is unacceptable, correct the edge by using a power driven saw or other approved tools to cut a neat line. Apply a light coat of HMA material meeting the requirements of Section 702 to the existing pavement edges in order to provide bonding with the newly laid pavement.

The pavement of successive courses will be such that all joints are offset no more than 150 mm from the joint of the lower pavement course, unless otherwise approved by the Engineer.

A. Transverse. Place the courses as continuously as possible to limit the number of transverse joints. Stagger the transverse joints in adjacent lanes a minimum of 3 meters. Form the transverse joint by cutting back on the previous run to expose the full depth of the course.

Set up the paver such that material is laid to overlap the previously placed edge by 50 mm to 75 mm. The thickness of the overlap material will be approximately 1/4 the compacted thickness of the course, so as to result in a smooth and well compacted joint after rolling. Broom the overlapped material back onto the hot mat so that the roller operator can crowd the small excess into the hot side of the joint. If the overlap is excessive, trim off the excess material so that the material along the joint is uniform. Remove and discard the coarse particles of aggregate in the overlap material if deemed necessary by the Engineer.

Compact the transverse joint in static mode with the roller parallel to the joint and perpendicular to traffic. Place boards of proper thickness at the edge of the pavement for the off pavement movement of the roller. Make the first pass with the roller operating on the previously laid material with 150 to 200 mm of its drum(s) projecting onto the non-compacted mix. Then make successive passes with the roller drum(s) moving approximately 300 mm per pass onto the hot material until half the width of the roller is on the hot mat.

If a vibratory roller with pneumatic drive wheels is used, align the first pass with one of the pneumatic wheels directly on the joint and the drum operating in static mode. Then make successive passes with the roller drum moving approximately 300 mm per pass onto the hot mat until half the width of the roller is on the hot mat.

B. Longitudinal. Carefully plan the placement of the surface course to ensure that the longitudinal joints in the surface course will correspond with the edges of the proposed traffic lanes. Other joint arrangements will require approval of the Engineer. When traffic is maintained on the roadway during paving operations, place the mixture such that no more than 30 meters of the longitudinal pavement joint will be exposed at the end of the working day unless a greater length is permitted in the contract

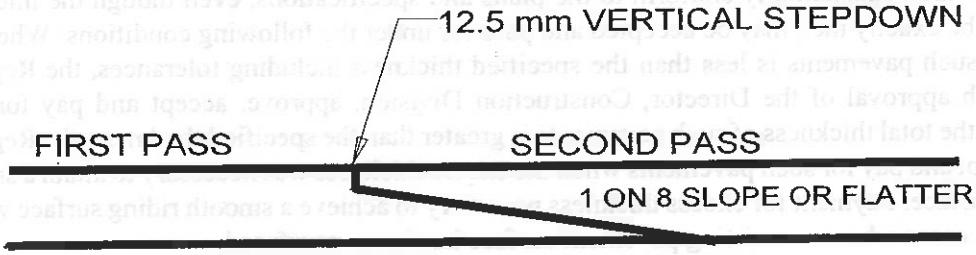
documents. An exposed joint in excess of 30 meters must be a tapered wedge joint. If an exposed joint in excess of 30 meters is allowed overnight, place warning signs at a maximum spacing of 300 meters to alert drivers of the uneven edge. Approval to leave an exposed edge must be requested in writing in advance of paving operations. If approval is granted to leave a longitudinal pavement joint exposed to traffic, plan the paving operation so that the edge is only exposed to traffic for one night and is not exposed over weekends or holidays.

If permission is granted to expose a longitudinal pavement joint overnight and the joint becomes damaged or provides an unsafe condition for motorists, the Engineer will rescind the approval to expose the longitudinal pavement joint overnight. Then, no more than 30 meters of the longitudinal pavement joint may be exposed at the end of the work day.

Use the following options when paving adjoining lanes:

1. Option A - Butt Joint. Under this option lay the asphalt concrete such that it uniformly overlaps the adjacent cold mat 50 to 75 mm. The thickness of the overlap material will be approximately one-fourth the compacted thickness of the course, so as to result in a smooth and well compacted joint after rolling. Broom or rake back the overlapped material onto the adjacent hot lane so that the roller operator can crowd the small excess into the hot side of the joint. Broadcasting of the overlap material onto the lane is not allowed. If the overlap is excessive, trim off the excess material so that the material along the joint is uniform. Remove and discard the coarse particles of aggregate in the overlap material if deemed necessary by the Engineer.

2. Option B - Tapered Wedge Joint. Under this option, place the HMA mixture for the first mat with an attachment to the paver to provide a sloping wedge with a vertical stepdown at the longitudinal pavement joint. Extend a wedge of material from the bottom of the stepdown to the existing surface at a slope of 1 on 8 or flatter. Compact the first mat such that the roller compacts up to but does not extend past the stepdown. The vertical stepdown will be 12.5 mm minimum after compaction of the mat. Place the second mat such that it uniformly overlaps the adjacent cold mat 25 to 40 mm. The thickness of the overlap material will be approximately 1/4 the compacted thickness of the HMA layer, so it result in a smooth and well compacted joint after rolling. Broom or rake back the overlapped material onto the adjacent hot lane so that the roller operator can crowd the small excess into the hot side of the joint. Broadcasting of the overlap material onto the lane is not allowed. If the overlap is excessive, trim off the excess material so that the material along the joint is uniform. Remove and discard the coarse particles of aggregate in the overlap material if deemed necessary by the Engineer.



TAPERED WEDGE JOINT

If a dual-drum vibratory roller is used during construction of a longitudinal joint using either Option A or B, operate the roller in vibratory mode and as close to the paver as practicable. Make the first pass with the roller traveling toward the paver and operating on the hot mat with 150 to 200 mm of the roller drum protruding onto the cold mat. The roller will apply a second pass to the joint as it travels back away from the paver. If a single-drum vibratory roller with pneumatic drive wheels is used, operate the roller in vibratory mode and follow the same procedure except that the roller will be aligned on the joint so

that the pneumatic drive wheels travel on the joint. All turning movements of the roller will be done on previously compacted material. After applying two roller passes on the longitudinal joint, proceed with the roller to the low side of the lane and compact as described in §402-3.07, Compaction.

402-3.10 Surface Tolerance. Construct the pavement surface to a 6 mm tolerance. If the pavement surface is not being constructed or has not been constructed to this tolerance based upon visual observation or upon riding quality, the Engineer may test the surface with a 5 meter straight edge or string line placed parallel to the centerline of the pavement and with a 3 meter straight edge or string line placed transversely to the centerline of the pavement on any portion of the pavement. Variations exceeding 6 mm will be satisfactorily corrected or the pavement relaid at no additional cost to the State.

402-3.11 Thickness Tolerance. The thickness indicated for each of the various courses of HMA pavement is the nominal thickness. Construct the pavement so that the final compacted thickness is as near to the nominal thickness as is practical, and within the tolerances specified below.

The Engineer may request cores to determine the thickness of the completed pavement layer for final acceptance and payment. Provide traffic control for safety purposes at no additional cost to the State when the pavement is cored. Fill all core holes with HMA mixture and compact the mixture in a manner satisfactory to the Engineer. The Engineer may use another acceptance method such as yield calculations to determine the final thickness for acceptance and payment.

HMA mixture, placed as a truing or leveling course as described in §402-3.05, Conditioning of Existing Surface, will not be considered in pavement thickness determinations.

A tolerance not to exceed 6 mm from the nominal thickness required for the course specified under one pay item will be acceptable where the required nominal thickness is 100 mm or less. A tolerance not to exceed 13 mm from the nominal thickness required for the course or courses specified under one pay item will be acceptable where the required nominal thickness is over 100 mm. The total thickness of all HMA mixture courses will not vary from the total of the nominal thickness indicated on the plans by more than 6 mm where the total nominal thickness is 100 mm or less; or more than 13 mm where the total nominal thickness is over 100 mm but not more than 200 mm; and by not more than 16 mm where the total nominal thickness is more than 200 mm.

When the HMA mixture is placed on newly constructed subbase material, an additional tolerance of plus 6 mm will be allowed both in the nominal thickness of the course placed directly on the subbase and the total pavement thickness.

No payment will be made for any material placed in excess of the permissible tolerance except as provided herein. Tolerances indicated for the thicknesses of individual layers of multilayer pavements (including composite pavements) are guides which should be met as closely as practical. Tolerance for the total thickness of such pavement is also a guide. In order to attain a smooth riding pavement true to line and grade, pavements which substantially conform to the plans and specifications, even though the thickness tolerance may not be exactly met, may be accepted and paid for under the following conditions: Where the total thickness of such pavements is less than the specified thickness including tolerances, the Regional Director, may with approval of the Director, Construction Division, approve, accept and pay for such pavements; where the total thickness of such pavements is greater than the specified thickness, the Regional Director may accept and pay for such pavements when the excess thickness was necessary to attain a smooth riding pavement surface. Payment for excess thickness necessary to achieve a smooth riding surface will be considered only in cases where an existing pavement surface has been resurfaced.

402-3.12 Paver and Equipment Cleaning. Cleaning tools and equipment used for HMA placement is not allowed on the pavement surface. Also, do not conduct cleaning near streams, ponds, drainage structures or other areas that are tributaries to waterways. Use an area designated by the Engineer for cleaning all paving equipment and tools. If possible, remove solid pieces of asphalt by scraping or other mechanical means prior to application of a cleaning agent. If a petroleum product is used for cleaning, contain all liquid products during cleaning operations using tarpaulins, sand pads, pails, or other collection methods to prevent spillage or accidental release. Use hand sprayers or other similar devices to minimize the amount of petroleum product applied. Properly dispose of sand and collected petroleum products as petroleum contaminated soil. Dispose solid, dry asphalt fragments as exempt construction and demolition waste. Report

any petroleum product spillage to the ground to the NYS Department of Environmental Conservation.

402-4 METHOD OF MEASUREMENT. Provisions of §401-4 Method of Measurement apply, including the following:

The HMA will be measured by the number of metric tons of compacted mixture in the accepted work. In addition, quality payment adjustments are applicable for all hot mix asphalt in accordance with these specifications herewith and the provisions outlined in the contract documents. All quality payment adjustments are measured in Quality Units. Quality Units will be determined for each day's production and placement by using the daily Quality Adjustment Factor (QAF) for plant production, pavement density, longitudinal joint density and pavement smoothness and the appropriate tons accepted by the Engineer.

Quality Units = (Quality Adjustment Factor - 1.00) x Appropriate Accepted HMA Tons

When the pavement density QAF applies, use one of the following methods of measurements in Table 402-6, Methods of Measurements, corresponding to the item used on the project:

Table 402-6 Method of Measurement

Method Type	Pay Item Number	Description
A=50 series	402.XX5FZR	QAF based on calculated PWL using four cores.
B=60 series	402.XX6FZR	QAF based on average of four core densities.

A. 50 Series Method. The Engineer will determine the paving lot's Percent Within Limits (PWL) in accordance with MP 96-4. This PWL will be used to determine the density QAF as shown in Table 402-7, Quality Schedule. The quantity of the HMA mixture subject to possible adjustment will be determined from actual quantity placed on the mainline and ramps of uniform width longer than 400 meters. When shoulders and mainline are placed together, the mainline quantity may be determined using typical sections shown in the contract documents.

The pavement density QAF from Table 402-7, Quality Schedule, will apply to the paving lot to determine the payment adjustment. The pavement density QAF will not apply to material placed on ramps with a uniform full width section of less than 400 meters in length, shoulders, maintenance widenings and crossovers, and bridges. Payment in these areas will be a QAF of 1.00 based on satisfactory placement and compaction as determined by the Engineer.

B. 60 Series Method. The State will test all pavement density samples for this item when Option 2 on the initial paving day is selected or if the Engineer requests additional cores on any day after the first day as outlined in the specifications. Full payment will be made when the average density of the four cores is between 92% and 97% of the mixture's average daily maximum theoretical density. If the average density fails to meet this limit, a payment adjustment will be made based on bid price and in accordance with Table 402-9, Density Quality Adjustment Factors, to all the material placed on the mainline for the day the cores represent, excluding the material placed on the test section.

Table 402-7 Quality Schedule	
Percent Within Limits (PWL)	**Quality Adjustment Factor (QAF)**
$PWL_{92\text{-}97} > 93$	1.05
$PWL_{92\text{-}97} \leq 93$	$\sum (PWL_{Segment} \times PayFactor_{Segment})^{1,2}$

Notes:

1. Where $PWL_{Density\ Range}$ will be calculated for each of the nine density ranges in Table 402-8, Density Segment Pay Factors, using the standard deviation and average density for the lot.
2. If the QAF is determined to be 0.60 or less, then the lot will be evaluated by the Engineer to determine if it may remain in-place. The type of material produced (i.e. binder, top), the layer in which it was used, and the location of use (i.e., mainline or a non-critical area) will be primary considerations in the determination of whether the HMA can be left in-place. If the HMA cannot be left in-place, it will be removed at no cost to the State. However, if the Engineer determines that the HMA can be left in-place, the QAF will be 0.60.

Table 402-8 Density Segment Pay Factors	
Density Segment	Segment Pay Factor
88 - 89	0.60
89 - 90	0.70
90 - 91	0.80
91 - 92	0.90
92 - 93	1.00
93 - 96	1.05
96 - 97	1.00
97 - 98	0.90
98 - 99	0.80

Table 402-9 Density Quality Adjustment Factors	
Average Core Density	**Quality Adjustment Factor**
91.0 ≤ Density < 92.0 or 97.0 < Density ≤ 98.0	0.95
90.0 ≤ Density < 91.0	0.90
88.0 ≤ Density < 90.0	0.85
Density < 88.0 or Density > 98.0	0.60*

*The lot will be evaluated by the State to determine if it may remain in-place. The type of material produced (i.e. binder, top), the layer in which it is used, and the location of use (i.e., mainline or a non-critical area) will be primary considerations in the determination of whether the HMA can be left in-place. If the HMA cannot be left in-place, it will be removed at no cost to the State. However, if the State determines that the HMA can be left in-place, the Quality Payment Adjustment will be calculated using a QAF of 0.60.

The quantity of the HMA mixture subject to possible adjustment will be determined from actual quantity placed in the accepted work on the mainline and ramps of uniform width longer than 400 meters. When shoulders and mainline are placed together, the mainline quantity may be determined using typical sections shown in the plans. The payment adjustments will be applied to material placed on mainline but not shoulders, ramps, maintenance widenings and crossovers, and bridges.

402-5 BASIS OF PAYMENT. The unit price bid per ton for all pavement courses shall include the cost of all material, labor and equipment necessary to complete the work, including any cleaning pursuant to §402-3.01; cleaning of foreign material from the pavement as a result of construction operations; all necessary repairs to highway components and/or adjacent property caused by construction operations; any necessary work to correct surface tolerances per §402-3.10; the scheduling and sequencing of work to

conform with weather and seasonal limitations, and all temporary materials and work and/or repairs associated with paving operations outside the specified weather and seasonal requirements; and any removal and replacement of HMA pursuant to §401-4 and §402-4 Method of Measurement. The unit bid price also includes the cost of all necessary traffic control, equipment, labor and materials required in obtaining the pavement cores, filling all core holes with HMA, and compacting these core holes to the satisfaction of the Engineer. In addition, Quality Units may apply to the hot mix asphalt items as calculated in §402-4. Payment of Quality Units will be made based on the Index Price listed in the contract documents. The index price shown in the itemized proposal for each Quality Unit is considered the price bid. The unit (index) price is NOT to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figure will be disregarded and the original price will be used to determine the total amount bid for the Contract.

Payment will be made under:

Item No.	Item	Pay Unit
402.010901 M	Type 1 F9, Asphalt-Treated Permeable Base Course	Metric Ton
402.010911 M	Plant Production Quality Adjustment to 402.010901 M	Quality Unit
402.011901 M	Type 2 F9, Asphalt-Treated Permeable Base Course	Metric Ton
402.011911 M	Plant Production Quality Adjustment to 402.011901 M	Quality Unit
402.017901 M	True & Leveling F9, Superpave HMA, 70 Series Compaction	Metric Ton
402.017911 M	Plant Production Quality Adjustment to 402.017901 M	Quality Unit
402.018901 M	True & Leveling F9, Superpave HMA, 80 Series Compaction	Metric Ton
402.018911 M	Plant Production Quality Adjustment to 402.018901 M	Quality Unit
402.058901 M	Shim Course F9, Hot Mix Asphalt	Metric Ton
402.058911 M	Plant Production Quality Adjustment to 402.058901 M	Quality Unit
402.095101 M	9.5 mm F1 Superpave HMA, 50 Series Compaction	Metric Ton
402.095111 M	Plant Production Quality Adjustment to 402.095101 M	Quality Unit
402.095121 M	Pavement Density Quality Adjustment to 402.095101 M	Quality Unit
402.095201 M	9.5 mm F2 Superpave HMA, 50 Series Compaction	Metric Ton
402.095211 M	Plant Production Quality Adjustment to 402.095201 M	Quality Unit
402.095221 M	Pavement Density Quality Adjustment to 402.095201 M	Quality Unit
402.096101 M	9.5 mm F1 Superpave HMA, 60 Series Compaction	Metric Ton
402.096111 M	Plant Production Quality Adjustment to 403.096101 M	Quality Unit
402.096201 M	9.5 mm F2 Superpave HMA, 60 Series Compaction	Metric Ton
402.096211 M	Plant Production Quality Adjustment to 402.096201 M	Quality Unit
402.096301 M	9.5 mm F3 Superpave HMA, 60 Series Compaction	Metric Ton
402.096311 M	Plant Production Quality Adjustment to 402.096301 M	Quality Unit
402.097101 M	9.5 mm F1 Superpave HMA, 70 Series Compaction	Metric Ton
402.097111 M	Plant Production Quality Adjustment to 402.097101 M	Quality Unit
402.097201 M	9.5 mm F2 Superpave HMA, 70 Series Compaction	Metric Ton
402.097211 M	Plant Production Quality Adjustment to 402.097201 M	Quality Unit
402.097301 M	9.5 mm F3 Superpave HMA, 70 Series Compaction	Metric Ton
402.097311 M	Plant Production Quality Adjustment to 402.097301 M	Quality Unit
402.098101 M	9.5 mm F1 Superpave HMA, 80 Series Compaction	Metric Ton
402.098111 M	Plant Production Quality Adjustment to 402.098101 M	Quality Unit
402.098201 M	9.5 mm F2 Superpave HMA, 80 Series Compaction	Metric Ton
402.098211 M	Plant Production Quality Adjustment to 402.098201 M	Quality Unit
402.098301 M	9.5 mm F3 Superpave HMA, 80 Series Compaction	Metric Ton
402.098311 M	Plant Production Quality Adjustment to 402.098301 M	Quality Unit
402.098901 M	9.5 mm F9 Superpave HMA, Shoulder Course, 80 Series Compaction	Metric Ton
402.098911 M	Plant Production Quality Adjustment to 402.098901 M	Quality Unit

402.125101 M	12.5 mm F1 Superpave HMA, 50 Series Compaction	Metric Ton
402.125111 M	Plant Production Quality Adjustment to 402.125101 M	Quality Unit
402.125121 M	Pavement Density Quality Adjustment to 402.125101 M	Quality Unit
402.125201 M	12.5 mm F2 Superpave HMA, 50 Series Compaction	Metric Ton
402.125211 M	Plant Production Quality Adjustment to 402.125201 M	Quality Unit
402.125221 M	Pavement Density Quality Adjustment to 402.125201 M	Quality Unit
402.126101 M	12.5 mm F1 Superpave HMA, 60 Series Compaction	Metric Ton
402.126111 M	Plant Production Quality Adjustment to 402.126101 M	Quality Unit
402.126201 M	12.5 mm F2 Superpave HMA, 60 Series Compaction	Metric Ton
402.126211 M	Plant Production Quality Adjustment to 403.126201 M	Quality Unit
402.126301 M	12.5 mm F3 Superpave HMA, 60 Series Compaction	Metric Ton
402.126311 M	Plant Production Quality Adjustment to 402.126301 M	Quality Unit
402.127101 M	12.5 mm F1 Superpave HMA, 70 Series Compaction	Metric Ton
402.127111 M	Plant Production Quality Adjustment to 402.127101 M	Quality Unit
402.127201 M	12.5 mm F2 Superpave HMA, 70 Series Compaction	Metric Ton
402.127211 M	Plant Production Quality Adjustment to 402.127201 M	Quality Unit
402.127301 M	12.5 mm F3 Superpave HMA, 70 Series Compaction	Metric Ton
402.127311 M	Plant Production Quality Adjustment to 402.127301 M	Quality Unit
402.128101 M	12.5 mm F1 Superpave HMA, 80 Series Compaction	Metric Ton
402.128111 M	Plant Production Quality Adjustment to 402.128101 M	Quality Unit
402.128201 M	12.5 mm F2 Superpave HMA, 80 Series Compaction	Metric Ton
402.128211 M	Plant Production Quality Adjustment to 402.128201 M	Quality Unit
402.128301 M	12.5 mm F3 Superpave HMA, 80 Series Compaction	Metric Ton
402.128311 M	Plant Production Quality Adjustment to 402.128301 M	Quality Unit
402.128901 M	12.5 mm F9 Superpave HMA, Shoulder Course, 80 Series Compaction	Metric Ton
402.128911 M	Plant Production Quality Adjustment to 402.128901 M	Quality Unit
402.195901 M	19 mm F9 Superpave HMA, 50 Series Compaction	Metric Ton
402.195911 M	Plant Production Quality Adjustment to 402.195901 M	Quality Unit
402.195921 M	Pavement Density Quality Adjustment to 402.195901 M	Quality Unit
402.196901 M	19 mm F9 Superpave HMA, 60 Series Compaction	Metric Ton
402.196911 M	Plant Production Quality Adjustment to 402.196901 M	Quality Unit
402.197901 M	19 mm F9 Superpave HMA, 70 Series Compaction	Metric Ton
402.197911 M	Plant Production Quality Adjustment to 402.197901 M	Quality Unit
402.198901 M	19 mm F9 Superpave HMA, 80 Series Compaction	Metric Ton
402.198911 M	Plant Production Quality Adjustment to 402.198901 M	Quality Unit
402.255901 M	25 mm F9 Superpave HMA, 50 Series Compaction	Metric Ton
402.255911 M	Plant Production Quality Adjustment to 402.255901 M	Quality Unit
402.255921 M	Pavement Density Quality Adjustment to 402.255901 M	Quality Unit
402.256901 M	25 mm F9 Superpave HMA, 60 Series Compaction	Metric Ton
402.256911 M	Plant Production Quality Adjustment to 402.256901 M	Quality Unit
402.257901 M	25 mm F9 Superpave HMA, 70 Series Compaction	Metric Ton
402.257911 M	Plant Production Quality Adjustment to 402.257901 M	Quality Unit
402.258901 M	25 mm F9 Superpave HMA, 80 Series Compaction	Metric Ton
402.258911 M	Plant Production Quality Adjustment to 402.258901 M	Quality Unit
402.376901 M	37.5 mm F9 Superpave HMA, 60 Series Compaction	Metric Ton
402.376911 M	Plant Production Quality Adjustment to 402.376901 M	Quality Unit
402.377901 M	37.5 mm F9 Superpave HMA, 70 Series Compaction	Metric Ton
402.377911 M	Plant Production Quality Adjustment to 402.377901 M	Quality Unit
402.378901 M	37.5 mm F9 Superpave HMA, 80 Series Compaction	Metric Ton
402.378911 M	Plant Production Quality Adjustment to 402.378901 M	Quality Unit

SECTION 403 - HOT MIX ASPHALT (HMA) PAVEMENTS FOR MUNICIPALITIES

403-1 DESCRIPTION. These general specifications apply to plant mixed Hot Mix Asphalt (HMA) for use by municipalities such as Towns, Counties, etc. Modifications of these general requirements will be indicated in the specific requirements for each item. These mixes are suitable for low to moderate traffic volumes.

This work will consist of one or more courses of HMA constructed on the prepared foundation in accordance with these specifications and the specific requirements of the item under contract, and in reasonably close conformance with the lines, grades, thickness and typical sections shown on the plans or established by the Engineer.

Appropriate mix types with corresponding friction aggregates and Performance Graded Binder (PG Binder) grades must be specified and used based on the traffic levels and the project location. When the traffic levels exceeds an AADT of 8,000 for two lanes or 13,000 for three or more lanes, then Items in Section 402 must be specified.

403-2 MATERIALS

403-2.01 General. Use all materials for HMA production such as aggregates, PG Binder, Reclaimed Asphalt Pavement (RAP), mineral filler or any other materials meeting the State's requirements.

403-2.02 Composition of Mixtures. The HMA plant mix will generally be composed of a mixture of aggregate, Reclaimed Asphalt Pavement (RAP), filler if required, and PG Binder. For any HMA required by the plans or itemized proposal, formulate, a job mix formula that satisfies the General Limits imposed by Table 403-1, Composition of Hot Mix Asphalt Mixtures. In addition, the formula will state the mineral aggregate sources, and the PG Binder used in the mixture. For Type 6F2, 6F3, 7F2, and 7F3 mixtures, determine the optimum asphalt content for the proposed gradation using the Marshall Mix Design Method (50 blows).

The resultant mixture shall meet the following Marshall Mix Properties:

Mix Property	**Type 6F2, 6F3**	**Type 7F2, 7F3**
Air Voids, %	3.0 - 5.0	3.0 - 5.0
Voids in Mineral Agg. (VMA), %, min.	14	16
Voids Filled with Binder (VFB), %	65 - 78	65 - 78

Produce, deliver to the work site, and incorporate the mixture into the work within 10°C of the temperature specified by the Engineer but within the mixing and placing temperature range imposed by Table 403-1, Composition of Marshall Designed Plant Mixtures.

The aggregates will be those noted in the job mix formulas. The PG Binder will be accepted on the basis of PG Binder supplier's certification.

Perform quality control tests during HMA production to ensure specification compliance. The plant mixed material will be accepted after blending and mixing at the plant. The pavement courses will be accepted after all paving operations are completed.

403-2.03 Aggregates. Fine aggregate will consist 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 §703-02, Coarse Aggregate. Coarse aggregate will consist of crushed stone, crushed gravel, or crushed slag conforming to the requirements of §703-02, except for gradation.

When aggregates from approved natural fine sand sources are combined with coarse aggregates in the mixture, aggregate particles will meet additional requirements as follows:

- Particles in the No. 1A and No. 1 primary sizes will meet the quality requirements of §703-02 and will have a minimum of 85 percent, by weight, of the particles with at least two fractured faces.
- Particles in the No. 2, No. 3 and No. 3A primary sizes will meet the quality requirements of §703-02 and will have a minimum of 75 percent, by weight, of the particles with at least one fractured face.

Slag aggregate may be used only when an alternate pay item which takes the mix yield differential into account is included on the plans or in the itemized proposal.

Aggregates for all mixtures specified in Table 403-1, including Type 6 or 7 (F9), shall meet the requirements of §703-02, Coarse Aggregate. In addition, the aggregate requirements for Type 6F2, 6F3, 7F2, and 7F3 mixtures shall meet one of the following requirements based on the mix type specified in the contract documents:

A. Coarse Aggregate Type F2 Conditions

1. Limestone having an acid insoluble residue content of not less than 20.0%, excluding particles of chert and similar siliceous rocks.

2. Dolomite having an acid insoluble residue content of not less than 17.0%, excluding particles of chert and similar siliceous rocks.

3. Sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate 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. Type 6F2 Mixes. Non-carbonate 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 6.3 mm particles must be non-carbonate.

b. Type 7F2 Mixes - Non-carbonate 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 3.2 mm particles must be non-carbonate.

TABLE 403-1
COMPOSITION OF HOT MIX ASPHALT MIXTURES

Mixture	Base				Binder		Shim		Top[3,4]			
Require-ments[1]	Type 1		Type 2		Type 3		Type 5		Type 6, 6F2, 6F3		Type 7, 7F2, 7F3	
Screen Sizes	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %	General limits % Passing	Job Mix Tol. %
50.0 mm	100	-	100	-	-	-	-	-	-	-	-	-
37.5 mm	90 -100	-	75 - 100	± 7	100	-	-	-	-	-	-	-
25.0 mm	78 - 95	± 5	55 - 80	± 8	95 - 100	-	-	-	100	-	-	-
12.5 mm	57 - 84	± 6	23 - 42	± 7	70 - 90	± 6	-	-	95-100	-	100	-
6.3 mm	40 - 72	± 7	5 - 20	± 6	48 - 74	± 7	100	-	65 - 85	± 7	90 -100	--
3.2 mm	26 - 57	± 7	2 - 15	± 4	32 - 62	± 7	80 - 100	± 6	36 - 65	± 7	45 - 70	± 6
850 µm	12 - 36	± 7	-	-	15 - 39	± 7	32 - 72	± 7	15 - 39	± 7	15 - 40	± 7
425 µm	8 - 25	± 7	-	-	8 - 27	± 7	18 - 52	± 7	8 - 27	± 7	8 - 27	± 7
180 µm	4 -16	± 4	-	-	4 - 16	± 4	7- 26	± 4	4 - 16	± 4	4 - 16	± 4
75 µm	2 - 8	± 2	-	-	2 - 8	± 2	2- 12	± 2	2- 6	± 2	2 - 6	± 2
PGB Content, %[2]	4.0 - 6.0	±0.4	2.5 - 4.5	±0.4	4.5 - 6.5	±0.4	7.0-9.5	±0.4	5.4- 7.0	NA	5.7 -8.0	NA
Mixing and[5] Placing Temp. Range,˚C	120-165		110-150		120-165		120-165		120-165		120-165	
Descrip-tion and Typical Uses	Dense Base: For general use		Open Base: For permeable base layer		Dense Binder: Intermediate layer for general use		Shim: Fine HMA mixture for shimming ruts and leveling		Top Course: Dense course for single course resurfacing of rural, suburban, and urban roadways			

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, increase the PGB content accordingly, a minimum of 25 percent for an all slag mix.
3. 6F2, 6F3, 7F2, 7F3 mix types require friction coarse aggregates., and are required for mainline driving surface courses.
4. For Type 6 and Type 7 (F9) aggregate requirements, Marshall design will not be required.. These mix types are suitable where the State's requirements for F9 aggregate apply.
5. Introduce the PG Binder into the pugmill between 110˚C and 175˚C, or as recommended by the PG Binder supplier.

B. Coarse Aggregate Type F3 Conditions

1. Limestone having an acid insoluble residue content of not less than 20.0%, excluding particles of chert and similar siliceous rocks.

2. Dolomite

3. Sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate 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. Type 6F3 Mixes. Non-carbonate 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 6.3 mm particles must be non-carbonate.

b. Type 7F3 Mixes Non-carbonate 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 3.2 mm particles must be non-carbonate.

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

403-2.04 Mineral Filler. Mineral filler, if required in the mix to meet gradation requirements, will conform to the requirements of §703-08, Mineral Filler.

403-2.05 Performance-Graded Binder. The PG Binder will meet the requirements of §401-2.04, Performance Graded Binder. Unless the type of PG Binder is specified in the contract documents, use PG 64-22, or a PG Binder specified in Table 6-4, Performance Graded Binder Selection, of Chapter 6 of the Comprehensive Pavement Design Manual, or other suitable PG Grade as approved by the Engineer.

403-2.06 Reclaimed Asphalt Pavement. Reclaimed Asphalt Pavement (RAP) will meet the requirements as written in Materials Method (MM) 5.16, Superpave Hot Mix Asphalt Mixture Design and Mixture Verification Procedures.

403-3 CONSTRUCTION DETAILS. 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 produce HMA in accordance with the State approved Control Plan and assume responsibilities for all QC activities at the production facilities. If specified in the contract documents, The Quality Control provisions of Section 401 shall apply.

Unless modified in the contract document, the details of §401-3, Construction Details, will apply except for the gyratory compactor, specimen mold assembly, and the extractor of §401-3.08 HMA Mixing Plant are not required. The HMA mixing plant inspection facilities shall include mixture design equipment for Marshall method as detailed below.

The details of §402-3 Construction Details will apply except for §402-3.05 Conditioning of Existing Surface and §402-3.07 Compaction, and §402-3.08 Pavement Density Samples. The requirements for conditioning of the existing surface and compaction are detailed below.

403-3.01 Equipment for Marshall Design Method

A. Marshall Compactor. A compactor will meet the requirements of AASHTO T245. Mount the compactor on a solid base. The compactor will be automatically driven, have a stroke counter, and be capable of automatically stopping after applying the desired number of strokes. The compaction hammer shall weigh 4.536 kilograms (±0.009 kg).

B. Marshall Specimen Mold Assembly. The specimen mold assembly will meet the requirements of AASHTO T245. The assembly shall consist of a compaction mold, base plate, and collar. Provide a minimum of three specimen mold assemblies and an adequate supply of 100 mm paper discs.

C. Marshall Specimen Extractor. Supply an extractor, meeting the requirements of AASHTO T245, to extract the 100 mm Marshall specimens from the compaction molds.

D. Hot Plate. Supply a hot plate suitable for heating the Marshall compaction hammer. A hot plate meeting the requirements of §401-3.08, 13. p. Sample Drying Appliance, will be acceptable.

403-3.02 Conditioning of Existing Surface. Clean the surface of the existing pavement prior to placing any HMA. When specified in the contract documents:

- Clean and fill the joints and cracks under the provisions of Section 633, Conditioning Existing Pavement.
- Apply a thin, uniform tack coat under the provisions of Section 407, Tack Coat, to all contact surfaces of existing HMA and Portland Cement Concrete layers including such areas as adjacent pavement edges, curbing, gutters, manholes and other structures, immediately prior to placing the HMA mixture against them.
- If the pavement surface is rutted, fill all depressions and wheel path ruts prior to the paving of the truing and leveling course, as directed by the Engineer. For wheel path ruts 7 mm or greater, but 20 mm or less, use Shim Course. Otherwise, for ruts greater than 20 mm, use a Type 7 mixture or other appropriate mixture.
- Place a truing and leveling course of a minimum variable thickness of proper plant mix necessary to bring the surface of the existing pavement to the same transverse slope and longitudinal grade required for the finished pavement surface. For compacted thickness up to 50 mm, use a Type 6 or Type 7 mixture. For compacted thickness in excess of 50 mm, use a Type 3 mixture. Pay special attention to the proper compaction of thin sections.

403-3.03 Compaction Immediately after the HMA mixture has been spread, struck off and surface irregularities adjusted, thoroughly and uniformly compact it by rolling. Roll the surface when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking or shoving. Initially roll all courses with the roller traveling parallel to the centerline of the pavement beginning at each edge and working toward the center. Roll the banked curves starting at the low side edge and working toward the super-elevated edge.

Correct at once any displacement occurring as a result of reversing the direction of the roller, or from other causes, by the use of rakes and addition of fresh mixture as required. Exercise care in rolling so as not to displace the line and grade of the edges of the HMA mixture. To prevent adhesion of the mixture to the drum(s) and pneumatic tires, keep the drum(s) and the pneumatic tires properly moistened with water or water mixed with small quantities of detergent or other approved material. Any petroleum products or solvents having an adverse effect upon the HMA pavement will not be permitted for use.

There shall be no visible defects, such as shallow ruts, ridges, roller marks, cracking, tearing, segregation, or any other irregularities as determined by the Engineer, in the pavement when the rolling operation is complete. If these defects are present, correct these defects to the satisfaction of the Engineer or relay the pavement at no additional cost.

Along forms, curbs, headers, walls and other areas not accessible to the rollers, thoroughly compact the mixture with mechanical tampers as directed by the Engineer. On depressed areas, use a trench roller or a small vibratory roller with the approval by the Engineer. Cleated compression strips also may be used under the roller to transmit compression to the depressed area.

Remove and replace any mixture that becomes loose and broken, mixed with dirt, or is in any way defective with fresh HMA mixture which shall be compacted to conform with the surrounding area. Correct any area showing an excess or deficiency of HMA material to the satisfaction of the Engineer.

When using vibratory compaction, assume full responsibility for the cost of repairing all damages which

may occur to the highway components and adjacent property including buried utility and service facilities.

Use either of the two compaction options listed below except that the shim course must be compacted with a minimum of three passes of a pneumatic rubber tired roller unless otherwise approved by the Engineer for variance. Option B - Vibratory Compaction is not permitted when compacting HMA concrete courses on structural bridge decks, or other structures with less than 0.60 meters of cover.

A. Option A. Three Roller Compaction Train. Under this option, initially roll all HMA mixtures with an approved steel-wheel roller operating in a static mode. Overlap the previous roller pass by one-half the width of the roller.

Immediately following the initial rolling, roll the mat with an approved pneumatic rubber-tired roller. A minimum of 3 passes of the rubber-tired roller will be required. One pass is defined as one movement of the roller over any point of the pavement in either direction.

Immediately following the intermediate rolling, finish roll the mat with a steel-wheel roller to remove all shallow ruts, ridges, roller marks, and other irregularities from the surface.

Use this option only when the compacted thickness of the finished mat is 100 mm or less. Unless approved by the Engineer, the roller speeds shall not exceed 5 kilometers per hour. When paving multiple lanes simultaneously, increase the required number of rollers proportionately for each additional full lane width unless otherwise permitted by the Engineer.

B. Option B - Vibratory Compaction. Under this option, use vibratory rollers appearing on the current Approved List - HMA Concrete Vibratory Compaction Equipment. For each project where a vibratory roller is used, furnish a vibrating reed tachometer for the exclusive use of the Engineer. The vibrating reed tachometer must have a frequency range of 17 Hz to 67 Hz with a minimum reed interval of 1 Hz between 17 Hz and 33 Hz and a minimum reed interval of 2 Hz between 33 Hz and 67 Hz.

Operate vibratory rollers at a uniform speed not exceeding 4 kilometers per hour (67 meters per minute) on all pavement courses. Complete all turning of the compaction equipment on material which has had a minimum of one roller pass.

The required number of passes listed in Table 403-2, Number of Passes, are recommended and may be increased or decreased if, in the opinion of the Engineer, adequate density can be achieved. Complete all breakdown roller passes before the mat temperature falls below 120° C. One vibratory pass is defined as one movement of one drum of the roller over any point of the pavement in either direction. One static pass is defined as one movement of the roller over any point of the pavement in either direction. Remove all ruts, ridges, roller marks or other irregularities from the surface using static rolling. The Engineer may alter the compaction procedures for small areas where the specified procedures are not practical.

If the Engineer determines that unsatisfactory compaction is being obtained or damage to highway components and/or adjacent property is occurring using vibratory compaction equipment, then immediately cease using this equipment and proceed with the work in accordance with the conventional compaction procedures stipulated under Option A at no additional cost.

When the compaction procedure being used fails to produce results acceptable to the Engineer, adjust the procedure to obtain the desired results. Rollers will move at a slow and uniform speed. The roller drive roll or wheel will be nearest the paver.

TABLE 403-2 NUMBER OF PASSES				
Pavement Courses	Option A Three Roller Train (Static)		Option B Vibratory Rollers	
	Steel Wheel Rollers	Pneumatic Roller	Vibratory Passes	Static Passes
Base (Open Graded Each Lift)	4	3	4	2
Base (Dense-Graded)	4	3	4	2
Binder (Dense-Graded)	2	3	2	2
Top (Dense-Graded All Types)	2	3	2	2

403-4 METHOD OF MEASUREMENT. The Engineer shall measure the quantity of the HMA placed and compacted in the accepted work. The quantity shall be measured in metric tons to the nearest 0.01 and determined from the delivery ticket.

Each delivery vehicle supplying HMA mixture shall be accompanied with a delivery ticket indicating the total quantity in metric tons being delivered. The quantity on the delivery ticket shall be determined from the automated proportioning system or the delivery vehicle weigh system. The delivery ticket shall contain the following minimum information:

- Ticket Number
- Plant Identification
- Contract Number
- Material Description, (including the PG-Binder Grade)
- Quantity of Material in Vehicle
- Date and Time

Make one legible copy of the delivery ticket available to the project inspector prior to the placement of the mixture.

403-5 BASIS OF PAYMENT. The unit bid price per ton for all pavement courses shall include the cost of all material, labor and equipment necessary to complete the work, including any cleaning pursuant to §403-3.02; cleaning of foreign material from the pavement as a result of construction operations; all necessary repairs to highway components and/or adjacent property caused by construction operations; any necessary work to correct surface tolerances per §402-3.10; and the scheduling and sequencing of work to conform with weather and seasonal limitations, and all temporary materials and work and/or repairs associated with paving operations outside the specified weather and seasonal requirements. Cleaning, sealing, and filling the cracks will be paid under Section 633. Tack coat will be paid under Section 407, Tack Coat.

Payment will be made under:

Item No.	Item	Pay Unit
403.118902 M	Hot Mix Asphalt, Type 1 Base Course	Metric Ton
403.128902 M	Hot Mix Asphalt, Type 2 Base Course	Metric Ton
403.138902 M	Hot Mix Asphalt, Type 3 Binder Course	Metric Ton
403.158902 M	Hot Mix Asphalt, Type 5 Shim Course	Metric Ton
403.178202 M	Hot Mix Asphalt, Type 6 F2 Top Course	Metric Ton
403.178302 M	Hot Mix Asphalt, Type 6 F3 Top Course	Metric Ton
403.178902 M	Hot Mix Asphalt Type 6 Top Course	Metric Ton
403.198202 M	Hot Mix Asphalt, Type 7 F2 Top Course	Metric Ton
403.198302 M	Hot Mix Asphalt, Type 7 F3 Top Course	Metric Ton
403.198902 M	Hot Mix Asphalt Type 7 Top Course	Metric Ton
403.218902 M	Hot Mix Asphalt, True and Leveling Course	Metric Ton