SECTION 4.06 – HOT MIX ASPHALT PAVEMENTS

DESCRIPTION

The work under this item shall consist of furnishing hot mix asphalt (HMA) composed of mineral aggregate and asphalt binder, mixed in a central mixing plant and placed on a prepared course in accordance with the Standard Specification Sections 4.06 Revised January 1, 2011 and M.04 Revised October 1, 2012, or as amended herein.

Each course shall be constructed to the depth, typical section, or elevation required by the contract and/or plans and shall be rolled, finished, and approved before the placement of the next course.

QUALITY CONTROL

Refer to Standard Section 04.06.03-9 "Contractor Quality Control of HMA Pavement" except as amended herein.

04.06.03-9

Contractor Quality Control (QC) Requirements for HMA Placement: *A Quality Control Plan (QCP) shall be required for any project that has a total of 2500 tons or more of HMA. Quality Control is defined as all those planned and specified actions or operations necessary to produce bituminous concrete that will meet contract specification requirements. The Contractor shall be responsible for quality control throughout the production and placement operations. Therefore, the Contractor must ensure that the materials, mixture and work provided by Subcontractors, Suppliers and Producers also meet contract specification requirements.*

Quality Control Plan: Prior to placement and production, the Contractor shall submit a QCP to the Engineer for approval. The QCP shall include separate sections; HMA Plant Production and HMA Placement. The sections shall describe the organization and procedures which the Contractor shall use to administer quality control. The QCP shall include the procedures used to control the HMA production and placement process, to determine when immediate changes to the processes are needed, and to implement the required changes. The QCP must address the actions, inspection, sampling and testing necessary to keep the production and placement operations in control, to determine when an operation has gone out of control and to respond to correct the situation and bring it back into control.

The QCP shall also include the name and qualifications of a Quality Control Manager. The Quality Control Manager shall be responsible for the administration of the QCP, including compliance with the plan and any plan modifications. The Quality Control Manager shall be directly responsible to the Contractor and shall have the authority to make decisions where the quality of the work or product is concerned. All sampling, inspection and test reports shall be reviewed and signed by the Quality Control Manager prior to submittal to the Engineer.

The Contractor assumes the responsibility of the quality for all materials and construction incorporated into the work and will control all the processes leading to the final result through this function. Quality Control activities should include:

Maintain a Contractor Quality Control System;

Quality Control Plan when the total project tonnage is 5000 tons or more;

Proficiency testing prior to production with Engineer;

Inspection and Testing of Hot Mix Asphalt Production;

Inspection and Testing of Hot Mix Asphalt Placement.

QUALITY ACCEPTANCE

The City of Meriden, or their authorized agent, will perform the Quality Acceptance function for this work. All material will be considered for acceptance through a sampling and testing program performed by the Engineer or their agent. Quality Acceptance activities include:

Proficiency testing prior to production with Contractor;

Inspection of HMA Production Plant and Testing Laboratory;

Production Trials of HMA Products Intended For Use in Meriden;

Inspection/Testing for Acceptance of Hot Mix Asphalt Production;

Inspection/Testing for Acceptance of Hot Mix Asphalt Placement;

HMA Quality Acceptance Daily Report of Activities;

MATERIALS

Aggregate

Refer to Standard Section M.04.01 and as noted herein.

M.04.01

Bituminous Concrete Materials and Facilities: *Each source of material, and facility or plant used to produce and test bituminous concrete must be qualified on an annual basis by the Engineer. Test Procedures and Specifications referenced herein are in accordance with the latest AASHTO and ASTM Standard Test Procedures and Specifications. Such references when noted with an (M) have been modified by the Engineer and are detailed in Table M.04.03-6.*

The Contractor shall submit to the Engineer all sources of coarse aggregate, fine aggregate, mineral filler, PG binder, and if applicable any additives such as but not limited to anti-strip, warm mix, and polymer modifiers. The Contractor shall submit a Material Safety Data Sheet (MSDS) for each grade of binder, and additive to be used on the Project. The Contractor shall not change any material sources without prior approval of the Engineer.

An adequate quantity of each size aggregate, mineral filler, bitumen, and additives, shall be maintained at the bituminous concrete plant site at all times while the plant is in operation to ensure that the plant can consistently produce bituminous concrete mixtures that meet the job mix formula (JMF) as specified in Article M.04.02. The quantity of such material shall be reviewed by the Engineer on an individual plant basis and is dependent upon the plant's daily production capacity. A total quantity of any material on site that amounts to less than one day's production capacity may be cause for the job mix formula to be rejected.

Aggregate shall consist of crushed stone, or crushed gravel, with or without sand or other inert finely divided mineral aggregate. The portion of the materials retained on the #4 sieve (4.75mm) shall be known as coarse aggregate, the portion passing the #4 sieve (4.75mm) and being retained by the #200 sieve (0.075mm) as fine aggregate, and the portion passing the #200 sieve (0.075mm) as mineral filler when tested in accordance with AASHTO T27 and AASHTO T11.

Coarse Aggregate

Refer to Standard Section M.04.01-1.

M.04.01-1

Coarse Aggregate:

a. Requirements: The coarse aggregate shall consist of clean, hard, tough, durable fragments of crushed stone or crushed gravel of uniform quality. Aggregates from multiple sources of supply must not be mixed or stored in the same stockpile.

b. Basis of Approval: The request for approval of the source of supply shall include a washed sieve analysis in accordance with AASHTO T 27. The Gsa, Gsb, and Pw_a shall be determined in accordance with AASHTO T 85. The coarse aggregate must not contain more than 1% crusher dust, sand, soft disintegrated pieces, mud, dirt, organic and other injurious materials. When tested for abrasion using AASHTO T 96, the aggregate loss must not exceed 40%. When tested for soundness using AASHTO T 104 with a magnesium sulfate solution, the coarse aggregate must not have a loss exceeding 10% at the end of 5 cycles.

For all bituminous mixtures, materials shall also meet the coarse aggregate angularity criteria as specified in Tables M.04.02-2 thru M.04.02-4 for blended aggregates retained on the #4 sieve when tested according to ASTM D 5821. The amount of aggregate particles of the coarse aggregate blend retained on the #4 sieve that are flat or elongated shall be determined in accordance with ASTM D 4791 and shall not exceed 10% by weight when tested to a 3:1 ratio, as shown in Tables M.04.02-2 thru M.04.02-4.

TABLE M.04.02–3

SUPERPAVE MASTER RANGE FOR CONSENSUS PROPERTIES OF COMBINED AGGREGATE STRUCTURES

Notes: (1) *If less than 25 % of a given layer is within 4 inches of the anticipated top surface, the layer may be considered to be below 4 inches for mixture design purposes.*

Traffic Level	Design ESALs (80 kN)	Coarse Aggregate Angularity (1) ASTM D 5821	Fine Aggregate Angularity (7) AASHTO T 304	Flat or Elongated Particles ASTM D 4791	Sand Equivalent AASHTO T 176
-----	(million)			> # 4	-----
1*	< 0.3	55/- -	40	10	40
2	0.3 to < 3.0	75/- -	40	10	40
3	≥ 3.0	95/90	45	10	45
	Design ESALs are the anticipated project traffic level expected on the design lane, projected over a 20 year period, regardless of the actual expected design life of the roadway.	Criteria presented as minimum values. 95/90 denotes that a minimum of 95% of the coarse aggregate, by mass, shall have one fractured face and that a minimum of 90% shall have two fractured faces.	Criteria presented as minimum percent air voids in loosely compacted fine aggregate passing the #8 sieve.	Criteria presented as maximum Percent by mass of flat or elongated particles of materials retained on the #4 sieve, determined at 3:1 ratio.	Criteria presented as minimum values for fine aggregate passing the #8 sieve.

**** NOTE: Level 1 for use by Towns and Municipalities ONLY.***

Fine Aggregate

Refer to Standard Section M.04.01-2 except that Marshall Mixtures shall have the combined aggregate structure conforming to TABLE M.04.02-3 "Superpave Master Range for Consensus Properties of Combined Aggregate Structures" Traffic Level 2, not Level 1 as indicated.

M.04.01-2

Fine Aggregate:

Requirements: The fine aggregate from each source quarry/pit deposit shall consist of clean, hard, tough, rough-surfaced and angular grains of natural sand; manufactured sand prepared from washed stone screenings; stone screenings, slag or gravel; or combinations thereof, after mechanical screening or manufactured by a process approved by the Engineer. The Contractor is prohibited from mixing two or more sources of fine aggregate on the ground for the purpose of feeding into a plant.

a. All fine aggregate shall meet the listed criteria shown in items #1 thru #7 of Table M.04.01-1. Table M.04.01-1 indicates the quality tests and criteria required for all fine aggregate sources. Individually approved sources of supply shall not be mixed or stored in the same stockpile. The fine aggregates must be free from injurious amounts of clay, loam, and other deleterious materials.

For Superpave mixtures, in addition to the above requirements, the fine aggregate angularity shall be determined by testing the materials passing the #8 sieve in accordance with AASHTO T 304, Method A. Qualification shall be based on the criteria listed in Tables M.04.02-2 thru M.04.02-4. The fine aggregate shall also be tested for clay content as a percentage contained in materials finer than the #8 sieve in accordance with AASHTO T 176.

Table M.04.01-1: Fine Aggregate Criteria by Pit/Quarry Source

Item	***Title***	***AASHTO Protocol(s)***	***Criteria***
1	*Grading*	*T 27 & T 11*	*100% Passing 3/8 inch 95% Passing the #4 min.*
2	*Absorption*	*T 84*	*3% maximum*
3	*Plasticity limits*	*T 90*	*0 or not detectable*
4	*L.A. Wear*	*T 96*	*50% maximum(fine agg. particle size # 8 and above)*
5	*Soundness by Magnesium Sulfate*	*T 104*	*20% maximum @ 5 cycles*
6	*Clay Lumps and Friable Particles*	*T 112*	*3% maximum*
7	*Deleterious Material*	*As determined by the Engineer*	*Organic or inorganic calcite, hematite, shale, clay or clay lumps, friable materials, coal-lignite, shells, loam, mica, clinkers, or organic matter (wood, etc). -Shall not contain more than 3% by mass of any individual listed constituent and not more than 5% by mass in total of all listed constituents.*
8	*Petrographic Analysis*	*ASTM C 295*	*Terms defined in Section M.04.01-2c.*

a. Basis of Approval: A Quality Control Plan for Fine Aggregate (QCPFA) provided by the Contractor shall be submitted for review and approval for each new source documenting how conformance to Items 1 through 7 as shown in Table M.04.01-1 is monitored. The QCPFA must be resubmitted any time the process, location or manner of how the fine aggregate (FA) is manufactured changes, or as requested by the Engineer. The QCPFA must include the locations and manufacturing processing methods. The QCPFA for any source may be suspended by the Engineer due to the production of inconsistent mixtures.

The Contractor shall submit all test results to the Engineer for review. The Contractor shall also include a washed sieve analysis in accordance with AASHTO T 27/T 11. Any fine aggregate component or final combined product shall have 100% passing the 3/8 inch sieve and a minimum of 95% passing the # 4. The Gsa, Gsb, and Pw_a shall be determined in accordance with AASHTO T 84.

The Contractor will be notified by the Engineer if any qualified source of supply fails any portion of Table M.04.01-1. One retest will be allowed for the Contractor to make corrections and/or changes to the process. If, upon retest, the material does not meet the requirements of items 1-7, additional testing will be required in accordance with item 8.

b. The Contractor may provide a Petrographic analysis of the material performed by a third party acceptable to the Engineer at its' own expense. The Contractor shall submit the results of the analysis with recommended changes to the manufacturing process to the Engineer. The Contractor shall submit fine aggregate samples for testing by the Engineer after the recommended changes have been made.

The Contractor may request the use of such fine aggregate on select project(s) for certain applications of bituminous concrete pavement. Such material will be monitored for a period no less than 48 months, at no cost to the State. Terms of any evaluation and suitable application will be determined by the Engineer.

Mineral Filler

Refer to Standard Section M.04.01-3

M.04.01-3

Mineral Filler:

a. Requirements: Mineral filler shall consist of finely divided mineral matter such as rock dust, including limestone dust, slag dust, hydrated lime, hydraulic cement, or other accepted mineral matter. At the time of use it shall be freely flowing and devoid of agglomerations. Mineral filler shall be introduced and controlled at all times during production in a manner acceptable to the Engineer.

b. Basis of Approval: The request for approval of the source of supply shall include the location, manufacturing process, handling and storage methods for the material. Mineral filler shall conform to the requirements of AASHTO M-17

Recycled Asphalt Pavement (RAP)

Refer to Standard Sections M.04.01-5 and M.04.02-3(a) except as amended herein.

Standard Section M.04.02-1(d) Marshall Mixtures with RAP shall be deleted.

M.04.01-5

Reclaimed Asphalt Pavement (RAP):

a. Requirements: RAP shall consist of asphalt pavement constructed with asphalt and aggregate reclaimed by cold milling or other removal techniques approved by the Engineer. For bituminous mixtures containing RAP, the Contractor shall submit a JMF in accordance with Article M.04.02 to the Engineer for review.

b. Basis of Approval: The RAP material will be accepted on the basis of one of the following criteria:

i. When the source of all RAP material is from pavements previously constructed on Department projects, the Contractor shall provide a materials certificate listing the detailed locations and lengths of those pavements and that the RAP is only from those locations listed.

ii. When the RAP material source or quality is not known, the Contractor shall test the material and provide the following information along with a request for approval to the Engineer at least 30 calendar days prior to the start of the paving operation. The request shall include a material certificate stating that the RAP consists of aggregates that meet the specification requirements of subarticles M.04.01-1 through 3 and that the binder in the RAP is substantially free of solvents, tars and other contaminants. The Contractor is prohibited from using unapproved material on Department projects and shall take necessary action to prevent contamination of approved RAP stockpiles. Stockpiles of unapproved material shall remain separate from all other RAP materials at all times. The request for approval shall include the following:

1. *A 50-pound sample of the RAP to be incorporated into the recycled mixture.*
2. *A 25-pound sample of the extracted aggregate from the RAP.*
3. *After recovery of binder from the RAP by AASHTO T 170(M), the viscosity test results shall be reported when tested at 140°F by AASHTO T 202 or T 316.*
4. *A statement that RAP material has been crushed to 100% passing the ½ inch sieve and remains free from contaminants such as joint compound, wood, plastic, and metals.*

M.04.02-3(a)

Superpave Design Method – S0.25, S0.375, S0.5, and S1

a. *Requirements: The Contractor or its representative shall design and submit Superpave mix designs annually for approval. The design laboratory developing the mixes shall be approved by the Engineer. The mix design shall be based on the specified Equivalent Single-Axle Loads (ESAL). Each bituminous concrete mix type must meet the requirements shown in Tables M.04.02-2 thru Table M.04.02-5 and in accordance with AASHTO M 323(M) and AASHTO R 35(M). The mix design shall include the nominal maximum aggregate size and a JMF consisting of target values for gradation and bitumen content for each bituminous concrete mix type designated for the project.*

The contractor shall provide test results with supporting documentation from an AASHTO Materials Reference Laboratory (AMRL) with the use of NETTCP Certified Technicians for the following tests;

1. *Aggregate consensus properties for each type & level, as specified in Table M.04.02-3. In addition the Gsa, Gsb, Pw_a shall also be provided for each component aggregate.*

2. *New mixes shall be tested in accordance with AASHTO T 283(M) Standard Method of Test for Resistance of Compacted Hot-Mix Asphalt (HMA) to Moisture-Induced Damage, (TSR). The compacted specimens may be fabricated at a bituminous concrete facility and then tested at an AMRL accredited facility.*

   The AASHTO T 283(M) test results, specimens, and corresponding JMF sheet (Form MAT-429s) shall be submitted by the Contractor for review.

The Contractor shall supply the Engineer with 1 gallon of the specified PG binder and 1 gallon of the same PG binder with the warm mix additive blended into it. The MSDS for the WMA additive shall be included with every submittal.

In addition, minimum binder content values apply to all types of bituminous concrete mixtures, as stated in Table M.04.02-5. For mixtures containing RAP, the virgin production and the anticipated proportion of binder contributed by the RAP cannot be less than the total permitted binder content value for that type nor the JMF minimum binder content.

i. *Superpave Mixture (virgin): For bituminous concrete mixtures that contain no recycled material, the limits prescribed in Tables M.04.02-2 thru Table M.04.02-5 apply. The Contractor shall submit a JMF, on a form provided by the Engineer, with the individual fractions of the aggregate expressed as percentages of the total weight of the mix and the source(s) of all materials to the Engineer for approval. The JMF shall indicate the corrected target binder content and applicable binder correction factor (ignition oven or extractor) for each mix type by total weight of mix. The mineral filler (dust) shall be defined as that portion of blended mix that passes the #200 sieve by weight when tested in accordance with AASHTO T 30(M). The dust-to-effective asphalt (D/Pbe) ratio shall be between 0.6 and 1.2 by weight. The dry/wet mix times and hot bin proportions (batch plants only) for each type shall be included in the JMF.*

The percentage of aggregate passing each sieve shall be plotted on a 0.45 power gradation chart and shall be submitted for all bituminous concrete mixtures. This chart shall delineate the percentage of material passing each test sieve size as defined by the JMF. The percentage of aggregate passing each standard sieve shall fall within the specified control points, but outside the restricted zone limits as shown in Tables M.04.02-2 thru Table M.04.02-5. Mixes with documented performance history which pass through the restricted zone may be permitted for use as long as all other physical and volumetric criteria meets specifications as specified in Tables M.04.02-2 thru Table M.04.02-5 and with prior approval from the Engineer. A change in the JMF requires that a new chart be submitted.

ii. *Superpave Mixtures with RAP: Use of approved RAP may be allowed with the following conditions:*

- *RAP amounts up to 15% may be used with no binder grade modification.*

- *RAP amounts up to 20% may be used provided a new JMF is approved by the Engineer. The JMF submittal shall include the grade of virgin binder added and test results that show the combined binder (recovered binder from the RAP, virgin binder at the mix design proportions and warm mix asphalt additive if used) meets the requirements of the specified binder grade.*

Unless approved by the Engineer, RAP material shall not be used with any other recycling option.

The laboratory RAP-virgin binder blend viscosity value established from the RTFO residue at 140°F (60°C) shall establish the maximum viscosity allowed for the binder after discharge from the HMA plant and/or silo storage, if applicable, when recovered by AASHTO T170 and tested in accordance with AASHTO T202 and AASHTO TP48.

For design purposes, the specific gravity of the combined aggregate blend with RAP used in a HMA mixture shall be determined in accordance with AASHTO R35.

Sampling and Testing

All aggregates samples required for testing shall be furnished by the Contractor when requested. AASHTO T2 shall be used in sampling coarse aggregate and fine aggregate, and AASHTO T127 shall be used in sampling mineral filler.

Asphalt Binder Material

The types, grades, and controlling specifications, the maximum mixing temperatures and compaction temperatures for the asphalt binder materials shall conform to the following:

Refer to Standard Section M.04.01-4 except as amended herein.

M.04.01-4
Liquid Bituminous Materials:

a. General:

i Liquid PG binders shall be uniformly mixed and blended and be free of contaminants such as fuel oils and other solvents. Binders shall be properly heated and stored to prevent damage or separation.

i. The blending at mixing plants of PG binder from different suppliers is strictly prohibited. Contractors who blend PG binders will be classified as a supplier and will be required to certify the binder in accordance with AASHTO R-26(M). The binder shall meet the requirements of AASHTO M-320(M) and AASHTO R-29(M). The Contractor shall submit a Certified Test Report and bill of lading representing each delivery in accordance with AASHTO R-26(M). The Certified Test Report must also indicate the binder specific gravity at 77°F; rotational viscosity at 275°F and 329°F and the mixing and compaction viscosity-temperature chart for each shipment.

ii. The Contractor shall submit the name(s) of personnel responsible for receipt, inspection, and record keeping of PG binder materials. Contractor plant personnel shall document specific storage tank(s) where binder will be transferred and stored until used, and provide binder samples to the Engineer upon request. The person(s) shall assure that each shipment (tanker truck) is accompanied by a statement certifying that the transport vehicle was inspected before loading and was found acceptable for the material shipped and that the binder will be free of contamination from any residual material, along with two (2) copies of the bill of lading.

iii. Basis of Approval: The request for approval of the source of supply shall list the location where the material will be manufactured, and the handling and storage methods, along with necessary certification in accordance with

AASHTO R-26(M). Only suppliers/refineries that have an approved "Quality Control Plan for Performance Graded Binders" formatted in accordance with AASHTO R-26(M) will be allowed to supply PG binders to Department projects.

b. Neat Performance Grade (PG) Binder:

i. PG binder shall be classified by the supplier as a "Neat" binder for each lot and be so labeled on each bill of lading. Neat PG binders shall be free from modification with: fillers, extenders, reinforcing agents, adhesion promoters, thermoplastic polymers, acid modification and other additives, and shall indicate such information on each bill of lading and certified test report.

ii. The asphalt binder shall be Performance Grade PG 64-22.

c. Modified Performance Grade (PG) Binder

Unless otherwise noted, the asphalt binder shall be Performance Grade PG 76-22 asphalt modified with a Styrene-Butadiene-Styrene (SBS) polymer. The polymer modifier shall be added at either the refinery or terminal and delivered to the bituminous concrete production facility as homogenous blend. The stability of the modified binder shall be verified in accordance with ASTM D7173 using the Dynamic Shear Rheometer (DSR). The DSR G/sin(δ) results from the top and bottom sections of the ASTM D7173 test shall not differ by more than 10%. The results of ASTM D7173 shall be included on the Certified Test Report. The binder shall meet the requirements of AASHTO M-320(M) and AASHTO R-29(M).*

d. Warm Mix Additive or Technology:

1. The warm mix additive or technology must be listed on the NEAUPG Qualified Warm Mix Asphalt (WMA) Technologies List at the time of bid, which may be accessed online at http://www.neaupg.uconn.edu/wma_info.html.

2. The warm mix additive shall be blended with the asphalt binder in accordance with the manufacturer's recommendations.

3. The blended binder shall meet the requirements of AASHTO M-320(M) and AASHTO R-29(M) for the specified binder grade. The Contractor shall submit a Certified Test Report showing the results of the testing demonstrating the binder grade. In addition, it must include the grade of the virgin binder, the brand name of the warm mix additive, the manufacturer's suggested rate for the WMA additive, the water injection rate (when applicable) and the WMA Technology manufacturer's recommended mixing and compaction temperature ranges.

4. Cut-backs (medium cure type):

i. Requirements: The liquid petroleum materials shall be produced by fluxing an asphalt base with appropriate petroleum distillates to produce the grade specified.

ii. Basis of Approval: The request for approval of the source of supply shall be submitted at least seven days prior to its use listing the location where the materials will be produced, and manufacturing, processing, handling and storage methods. The Contractor shall submit a Certified Test Report in accordance with Section 1.06 and a Material Safety Data Sheet (MSDS) for the grade to be used on the Project. The liquid asphalt shall be MC-250 conforming to AASHTO M-82.

e. Emulsions

i. Requirements: The emulsified asphalt shall be homogeneous and not be used if exposed to freezing temperatures.

ii. Basis of Approval: The request for approval of the source of supply must include the location where the materials will be produced, and manufacturing, processing, handling and storage methods.

1. *Emulsified asphalts shall conform to the requirements of AASHTO M-140. Materials used for tack coat shall not be diluted and meet grade RS-1. When ambient temperatures are 80˚F and rising, grade SS-1 or SS-lh may be substituted if accepted by the Engineer. Each shipment shall be accompanied with a Certified Test Report listing Saybolt viscosity, residue by evaporation, penetration of residue, and weight per gallon.*

2. *Cationic emulsified asphalt shall conform to the requirements of AASHTO M-208(M). Materials used for tack coat shall not be diluted and meet grade CRS-1. The settlement and demulsibility test will not be performed unless deemed necessary by the Engineer. When ambient temperatures are 80˚F and rising, grade CSS-1 or CSS-lh may be substituted if accepted by the Engineer. Each shipment shall be accompanied with a Certified Test Report listing Saybolt viscosity, residue by evaporation, penetration of residue, and weight per gallon.*

The City may specify that a modified binder be used under certain traffic conditions as noted below:

TABLE 2. SUPERPAVE PGAB Adjustment for Design Traffic Conditions

Traffic Loading	**Adjustment to PGAB Grade**
Standing <12mph (<20 km/h)	Increase high temperature grade by 2 grades (12° C), or 76-XX. Use low temperature grade as determined by LTTP BIND software.
Slow Transient 12 to 44mph (20 to 70 km/h)	Increase high temperature grade by 1 grade (6° C), or 70-XX. Use low temperature grade as determined by LTTP BIND software.
Traffic Level (ESALs)	**Adjustment to PGAB Grade**
1×10^7 to 3×10^7	Consideration should be given to increasing high temperature grade by 1 grade (6° C), or 70-XX. Use low temperature grade as determined by LTPP BIND software
$>3 \times 10^7$	Increase high temperature grade by 1 grade (6° C), or 70-XX. Use low temperature grade as determined by LTTP BIND software.

Asphalt Binder Anti-Stripping Additive

This specification provides for an additive to asphalt to assist in the coating of wet aggregate and to increase the resistance of the binder coating to stripping in the presence of water. The additive shall be chemically inert to asphalt (heat stable) and when blended with asphalt shall withstand storage at a temperature of 400°F (204°C) for extended periods without loss-of effectiveness.

Composition: Anti-stripping compound shall be an organic chemical compound, free from inorganic mineral salts or inorganic mineral soaps. It shall contain no ingredient harmful to the binder material or to the operator, and shall not appreciably alter the specified characteristics of the binder material.

Anti-stripping additive shall be incorporated and thoroughly dispersed in the asphalt binder material in an amount equal to the percent by weight established by the job mix formula. This percent is based on the efficiency of the additive as determined by laboratory tests.

The treated composite mixture shall have a minimum tensile strength ratio (TSR) of not less than 80, when tested in accordance with AASHTO T283 with the freeze/thaw cycle. The specimens for the

AASHTO procedure shall be 4" (100mm) in diameter, compacted with the Marshall hammer or 6" diameter molds by the Superpave gyratory compactor to the desired air void level of 7.0 ± .5%.

If the TSR ratio is less than 80, the aggregates shall be treated with an approved antistrip in sufficient quantity to produce acceptable results. The hot mix asphalt materials and asphalt binder material that require antistrip additives (either liquid or mineral) shall continue to meet all requirements specified herein for binder and HMA. The anti-strip agent shall be included in the bid price.

The contractor shall submit the results of the TSR testing prior to production as part of the JMF submittal.

COMPOSITION OF HMA MIXTURES

Hot Mix Asphalt

HMA plant mix may be composed of a homogeneous mixture of aggregate, filler if required, bitumen, and/or additives, combined to meet the composition limits by weight and other characteristics as specified. The several aggregate fractions shall be sized, uniformly graded and combined in such proportions that the resulting mixture meets the grading requirements of these specifications.

Hot Mix Asphalt Mix Design

Delete Standard Sections M.04.02-1 and M.04.02-2 Marshall Method and Cold Patch Method and refer to Standard Section M.04.02-3.

M.04.02-3
Superpave Design Method – S0.25, S0.375, S0.5, and S1

b. Requirements: The Contractor or its representative shall design and submit Superpave mix designs annually for approval. The design laboratory developing the mixes shall be approved by the Engineer. The mix design shall be based on the specified Equivalent Single-Axle Loads (ESAL). Each bituminous concrete mix type must meet the requirements shown in Tables M.04.02-2 thru Table M.04.02-5 and in accordance with AASHTO M 323(M) and AASHTO R 35(M). The mix design shall include the nominal maximum aggregate size and a JMF consisting of target values for gradation and bitumen content for each bituminous concrete mix type designated for the project.

The contractor shall provide test results with supporting documentation from an AASHTO Materials Reference Laboratory (AMRL) with the use of NETTCP Certified Technicians for the following tests;

3. Aggregate consensus properties for each type & level, as specified in Table M.04.02-3. In addition the Gsa, Gsb, Pw_a shall also be provided for each component aggregate.

4. New mixes shall be tested in accordance with AASHTO T 283(M) Standard Method of Test for Resistance of Compacted Hot-Mix Asphalt (HMA) to Moisture-Induced Damage, (TSR). The compacted specimens may be fabricated at a bituminous concrete facility and then tested at an AMRL accredited facility.

The AASHTO T 283(M) test results, specimens, and corresponding JMF sheet (Form MAT-429s) shall be submitted by the Contractor for review.

The Contractor shall supply the Engineer with 1 gallon of the specified PG binder and 1 gallon of the same PG binder with the warm mix additive blended into it. The MSDS for the WMA additive shall be included with every submittal.

In addition, minimum binder content values apply to all types of bituminous concrete mixtures, as stated in Table M.04.02-5. For mixtures containing RAP, the virgin production and the anticipated proportion of binder

contributed by the RAP cannot be less than the total permitted binder content value for that type nor the JMF minimum binder content.

iii. *Superpave Mixture (virgin): For bituminous concrete mixtures that contain no recycled material, the limits prescribed in Tables M.04.02-2 thru Table M.04.02-5 apply. The Contractor shall submit a JMF, on a form provided by the Engineer, with the individual fractions of the aggregate expressed as percentages of the total weight of the mix and the source(s) of all materials to the Engineer for approval. The JMF shall indicate the corrected target binder content and applicable binder correction factor (ignition oven or extractor) for each mix type by total weight of mix. The mineral filler (dust) shall be defined as that portion of blended mix that passes the #200 sieve by weight when tested in accordance with AASHTO T 30(M). The dust-to-effective asphalt (D/Pbe) ratio shall be between 0.6 and 1.2 by weight. The dry/wet mix times and hot bin proportions (batch plants only) for each type shall be included in the JMF.*

The percentage of aggregate passing each sieve shall be plotted on a 0.45 power gradation chart and shall be submitted for all bituminous concrete mixtures. This chart shall delineate the percentage of material passing each test sieve size as defined by the JMF. The percentage of aggregate passing each standard sieve shall fall within the specified control points, but outside the restricted zone limits as shown in Tables M.04.02-2 thru Table M.04.02-5. Mixes with documented performance history which pass through the restricted zone may be permitted for use as long as all other physical and volumetric criteria meets specifications as specified in Tables M.04.02-2 thru Table M.04.02-5 and with prior approval from the Engineer. A change in the JMF requires that a new chart be submitted.

iv. *Superpave Mixtures with RAP: Use of approved RAP may be allowed with the following conditions:*

- *RAP amounts up to 15% may be used with no binder grade modification.*
- *RAP amounts up to 20% may be used provided a new JMF is approved by the Engineer. The JMF submittal shall include the grade of virgin binder added and test results that show the combined binder (recovered binder from the RAP, virgin binder at the mix design proportions and warm mix asphalt additive if used) meets the requirements of the specified binder grade.*

Unless approved by the Engineer, RAP material shall not be used with any other recycling option.

c. *Basis of Approval: On an annual basis, the Contractor shall submit to the Engineer any bituminous concrete mix design, and JMF anticipated for use on Department projects. Prior to the start of any paving operations, the mix design and JMF must be approved by the Engineer. Bituminous concrete mixture supplied to the project without an approved mix design and JMF will be rejected. The following information must be included in the mix design submittal:*

a. Gradation, specific gravities and asphalt content of the RAP,
b. Source of RAP and percentage to be used.
c. Warm mix Technology and manufacturer's recommended additive rate and tolerances, mixing and compaction temperature ranges for the mix with and without the warm-mix technology incorporated.
d. Result of TSR testing, and if applicable Anti-strip manufacturer, and dosage rate.
e. Target Temperature at plant discharge.

Note – Testing to be performed shall be done in accordance with section M.04.03.

The JMF shall be accepted if the Plant mixture and materials meet all criteria as specified in Tables M.04.02-2 thru Table M.04.02-5. If the mixture does not meet the requirements, the contractor shall adjust the JMF within the ranges shown in Tables M.04.02-2 thru Table M.04.02-5 until an acceptable mixture is produced. All equipment, tests, and computations shall conform to the latest AASHTO R-35(M) and AASHTO M-323(M).

Any JMF, once approved, shall only be acceptable for use when it is produced by the designated plant, it utilizes the same component aggregates and binder source, and it continues to meet all criteria as specified herein, and component aggregates are maintained within the tolerances shown in Table M.04.02-2.

The Contractor shall not change any component source of supply including consensus properties after a JMF has been accepted. Before a new source of materials is used, a revised JMF shall be submitted to the Engineer for

approval. Any approved JMF applies only to the plant for which it was submitted. Only one mix with one JMF will be approved for production at any one time. Switching between approved JMF mixes with different component percentages or sources of supply is prohibited.

Superpave mixture with CRCG: In addition to subarticles M.04.02 – 3 a through c, for bituminous concrete mixtures that contain CRCG, the Contractor shall submit a materials certificate to the Engineer stating that the CRCG complies with requirements stated in Article M.04.01, as applicable. Additionally, 1% hydrated lime, or other accepted non-stripping agent, shall be added to all mixtures containing CRCG. CRCG material shall not be used with any other recycling option.

The Contractor shall submit the JMF to the City on the latest forms provided by ConnDOT along with all certifications required by this specification.

JOB MIX FORMULA (JMF)

Work shall not begin nor shall any mixture be accepted until the Engineer has reviewed and approved a job mix formula (JMF) submitted by the Contractor for each mixture.

The Engineer may approve the JMF if the production plant's current Mix Status report provided by ConnDOT, as outlined in the Standard Section M.04.02-3(c), is "A" Approved.

Delete M.04.02-3(c) "Ratings are defined as:" PPT (Pre-Production Trial) and U (No Acceptable Mix Design on File)

M.04.02-3(c)

c. Mix Status: Each facility will have each type of bituminous concrete mixture evaluated based on the previous year of production, for the next construction paving season, as determined by the Engineer. Based on the rating a type of mixture receives it will determine whether the mixture can be produced without the completion of a PPT. Ratings will be provided to each bituminous concrete producer annually prior to the beginning of the paving season.

The rating criteria are based on compliance with Air Voids and Voids in Mineral Aggregate (VMA) as indicated in Table M.04.03-3: Superpave Master Range for Bituminous Concrete Mixture Production, and are as follows:

Criteria A: Based on Air Voids. Percentage of acceptance results with passing air voids.

Criteria B: Based on Air Voids and VMA. The percentage of acceptance results with passing VMA, and the percentage of acceptance results with passing air voids, will be averaged.

The final rating assigned will be the lower of the rating obtained with Criteria A or Criteria B.

Ratings are defined as:

"A" – Approved:
A rating of "A" is assigned to each mixture type from a production facility with a current rating of 70% passing or greater.

JMF Tolerances

The job mix formula, operating with the allowable action limits for individual measurements as specified in Table 10 herein, shall be set within the design master limits specified for each mixture, as per TABLE M.04.02-2 of the Standard Specifications except that the Engineer may modify the design limits if they determine this to be necessary and in the best interest of the Engineer.

TABLE M.04.02– 2: SUPERPAVE MASTER RANGE FOR BITUMINOUS CONCRETE MIXTURE DESIGN CRITERIA

Notes:(1) Minimum Pb as specified in Table M.04.02-5. (2) Voids in Mineral Aggregates shall be computed as specified herein. (3) Control point range is also defined as the master range for that mix. (4) Dust is considered to be the percent of materials passing the #200 sieve. (5) For WMA, lower minimum aggregate temperature will require Engineer's approval. (6) For WMA and PMA, the mix temperature shall meet manufacturer's recommendations.

	S0.25				S0.375				S0.5				S1			
Sieve	CONTROL POINTS (3)		RESTRICTED ZONE		CONTROL POINTS(3)		RESTRICTED ZONE		CONTROL POINTS(3)		RESTRICTED ZONE		CONTROL POINTS(3)		RESTRICTED ZONE	
inches	Min (%)	Max (%)	Max (%)	Min (%)	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)
2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.5	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-
1.0	-	-	-	-	-	-	-	-	-	-	-	-	90	100	-	-
3/4	-	-	-	-	-	-	-	-	100	-	-	-	-	90	-	-
1/2	100	-	-	-	100	-	-	-	90	100	-	-	-	-	-	-
3/8	97	100	-	-	90	100	-	-	-	90	-	-	-	-	-	-
#4	-	90	-	-	-	90	-	-	-	-	-	-	-	-	39.5	39.5
#8	32	67	47.2	47.2	32	67	47.2	47.2	28	58	39.1	39.1	19	45	26.8	30.8
#16	-	-	31.6	37.6	-	-	31.6	37.6	-	-	25.6	31.6	-	-	18.1	24.1
#30	-	-	23.5	27.5	-	-	23.5	27.5	-	-	19.1	23.1	-	-	13.6	17.6
#50	-	-	18.7	18.7	-	-	18.7	18.7	-	-	15.5	15.5	-	-	11.4	11.4
#100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
#200	2.0	10.0	-	-	2.0	10.0	-	-	2.0	10.0	-	-	1.0	7.0	-	-
Pb (1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VMA (2) (%)	16.0 ± 1				16.0 ± 1				15.0 ± 1				13.0 ± 1			
VA (%)	4.0 ± 1				4.0 ± 1				4.0 ± 1				4.0 ± 1			
Gse	JMF value				JMF value				JMF value				JMF value			
Gmm	JMF ± 0.030				JMF ± 0.030				JMF ± 0.030				JMF ± 0.030			
Dust/Pbe(4)	0.6 – 1.2				0.6 – 1.2				0.6 – 1.2				0.6 – 1.2			
Agg. Temp(5)	280 – 350F				280 – 350F				280 – 350F				280 – 350F			
Mix Temp(6)	265 – 325 F				265 – 325 F				265 – 325 F				265 – 325 F			
Design TSR	≥ 80%				≥ 80%				≥ 80%				≥ 80%			
T-283 Stripping	Minimal, as determined by the Engineer															

EQUIPMENT

Hot Mix Asphalt Mixing Plant

Refer to Standard Sections M.04.01-8 and as noted herein.

M.04.01-8
Plant Requirements:

a. Mixing Plant and Machinery:

The mixing plant used in the preparation of the bituminous concrete shall comply with AASHTO M-156(M)/ASTM D 995 for a Batch Plant or a Drum Dryer Mixer Plant, and be approved by the Engineer.

b. Storage Silos:

For all mixes, the Contractor may use silos for short-term storage of Superpave mixtures with prior notification and approval of the Engineer. A silo must have heated cones and an unheated silo cylinder if it does not contain a separate internal heating system. Prior approval must be obtained for storage times greater than those indicated. When multiple silos are filled, the Contractor shall discharge one silo at a time. Simultaneous discharge of multiple silos is not permitted.

Type of silo cylinder	*Maximum storage time for all classes (hr)*	
	HMA	*WMA/PMA*
Open Surge	*4*	*Mfg Recommendations*
Unheated – Non-insulated	*8*	*Mfg Recommendations*
Unheated – Insulated	*18*	*Mfg Recommendations*
Heated – No inert gas	*TBD by the Engineer*	

c. Documentation System: The mixing plant documentation system shall include equipment for accurately proportioning the components of the mixture by weight and in the proper order, controlling the cycle sequence and timing the mixing operations. Recording equipment shall monitor the batching sequence of each component of the mixture and produce a printed record of these operations on each delivery ticket, as specified herein. Material feed controls shall be automatically or manually adjustable to provide proportions within the tolerances listed below for any batch size.

An asterisk (*) shall be automatically printed next to any individual batch weight(s) exceeding the tolerances in ASTM D 995 section 8.7.3. The entire batching and mixing interlock cut-off circuits shall interrupt and stop the automatic batching operations when an error exceeding the acceptable tolerance occurs in proportioning.

There must be provisions so that scales are not manually adjusted during the printing process. In addition, the system shall be interlocked to allow printing only when the scale has come to a complete rest. A unique printed character (m) shall automatically be printed on the truck and batch plant printout when the automatic batching sequence is interrupted or switched to auto-manual or full manual during proportioning. For each day's production, each project shall be provided a clear, legible copy of these recordings on each delivery ticket.

d. Aggregates: The Contractor shall ensure that aggregate stockpiles are managed to provide uniform gradation and particle shape, prevent segregation and cross contamination in a manner acceptable to the Engineer. For drum plants only, the Contractor shall determine the percent moisture content at a minimum, prior to production and half way through production.

e. Mixture: The dry and wet mix times shall be sufficient to provide proper coating (minimum 95% as determined by AASHTO T 195(M)) of all particles with bitumen and produce a uniform mixture.

The Contractor shall make necessary adjustments to ensure all types of bituminous concrete mixtures contain no more than 0.5% moisture throughout when tested in accordance with AASHTO T 329.

f. RAP: The Contractor shall indicate the percent of RAP, the moisture content (as a minimum determined twice daily – prior to production and halfway through production), and the net dry weight of RAP added to the mixture on each truck ticket. For each day of production, the production shall conform to the job mix formula and RAP percentage and no change shall be made without the prior approval of the Engineer.

g. Asphalt Binder: The last day of every month, a binder log shall be submitted when the monthly production for the Department exceeds 5000 tons. Blending of PG binders from different suppliers or grades at the bituminous concrete production facility is strictly prohibited.

h. Warm mix additive: For mechanically foamed WMA, the maximum water injection rate shall not exceed 2.0% water by total weight of binder and the water injection rate shall be constantly monitored during production.

i. Field Laboratory: The Contractor shall furnish the Engineer an acceptable field laboratory at the production facility to test bituminous concrete mixtures during production. The field laboratory shall have a minimum of 300 square feet, have a potable water source and drainage in accordance with the CT Department of Public Health Drinking Water Division, be equipped with all necessary testing equipment as well as with a PC, printer, and telephone with a dedicated hard-wired phone line. In addition, the PC shall have a high speed internet connection with a minimum upstream of 384 Kbps and a functioning web browser with unrestricted access to https://ctmail.ct.gov. This equipment shall be maintained in clean and good working order at all times and be made available for use by the Engineer.

The laboratory shall be equipped with a suitable heating system capable of maintaining a minimum temperature of 65°F. It shall be clean and free of all materials and equipment not associated with the laboratory. Windows shall be installed to provide sufficient light and ventilation. During summer months adequate cooling or ventilation must be provided so the indoor air temperature shall not exceed the ambient outdoor temperature. Light fixtures and outlets shall be installed at convenient locations, and a telephone shall be within audible range of the testing area. The laboratory shall be equipped with an adequate workbench that has a suitable length, width, and sampling tables, and be approved by the Engineer.

The field laboratory testing apparatus, supplies, and safety equipment shall be capable of performing all tests in their entirety that are referenced in AASHTO R 35(M), Standard Practice for Superpave Volumetric Design for Hot-Mix Asphalt (HMA) and AASHTO M 323, Standard Specification for Superpave Volumetric Mix Design. In addition, the quantity of all equipment and supplies necessary to perform the tests must be sufficient to initiate and complete the number of tests identified in Table M.04.03-2 for the quantity of mixture produced at the facility on a daily basis. The Contractor shall ensure that the Laboratory is adequately supplied at all times during the course of the project with all necessary testing materials and equipment.

The Contractor shall maintain a list of laboratory equipment used in the acceptance testing processes including but not limited to, balances, scales, manometer/vacuum gauge, thermometers, gyratory compactor, clearly showing calibration and/or inspection dates, in accordance with AASHTO R-18.The Contractor shall notify the Engineer if any modifications are made to the equipment within the field laboratory. The Contractor shall take immediate action to replace, repair, and/or recalibrate any piece of equipment that is out of calibration, malfunctioning, or not in operation.

Hauling Equipment

Refer to Standard Section 4.06.03-2.

4.06.03-2

Transportation of Mixture: *Trucks with loads of bituminous concrete being delivered to State projects must not exceed the statutory or permitted load limits referred to as gross vehicle weight (GVW). The Contractor shall furnish a list of all vehicles and allowable weights transporting mixture.*

The State reserves the right to check the gross and tare weight of any delivery truck. A variation of 0.4 percent or less in the gross or tare weight shown on the delivery ticket and the certified scale weight shall be considered evidence that the weight shown on the delivery ticket is correct. If the gross or tare weight varies from that shown on the delivery ticket by more than 0.4 percent, the Engineer will recalculate the net weight. The Contractor shall take action to correct discrepancy to the satisfaction of the Engineer.

If a truck delivers mixture to the project and the ticket indicates that the truck is overweight, the load will not be rejected but a "Measured Weight Adjustment" will be taken in accordance with Article 4.06.04.

The mixture shall be transported from the mixing plant in trucks that have previously been cleaned of all foreign material and that have no gaps through which mixture might inadvertently escape. The Contractor shall take care in loading trucks uniformly so that segregation is minimized. Loaded trucks shall be tightly covered with waterproof covers acceptable to the Engineer. Mesh covers are prohibited. The front and rear of the cover must be fastened to minimize air infiltration. The Contractor shall assure that all trucks are in conformance with this specification. Trucks found not to be in conformance shall not be allowed to be loaded until re-inspected to the satisfaction of the Engineer.

Truck body coating and cleaning agents must not have a deleterious effect on the transported mixture. The use of solvents or fuel oil, in any concentration, is strictly prohibited for the coating of the inside of truck bodies. When acceptable coating or agents are applied, truck bodies shall be raised immediately prior to loading to remove any excess agent in an environmentally acceptable manner.

Pavers, Rollers, Lighting and Material Transfer Vehicle

Refer to Standard Section 4.06.03-3.

4.06.03-3

Paving Equipment: *The Contractor shall have the necessary paving and compaction equipment at the project site to perform the work. All equipment shall be in good working order and any equipment that is worn, defective or inadequate for performance of the work shall be repaired or replaced by the Contractor to the satisfaction of the Engineer. During the paving operation, the use of solvents or fuel oil, in any concentration, is strictly prohibited as a release agent or cleaner on any paving equipment (i.e., rollers, pavers, transfer devices, etc.).*

Refueling of equipment is prohibited in any location on the paving project where fuel might come in contact with bituminous concrete mixtures already placed or to be placed. Solvents for use in cleaning mechanical equipment or hand tools shall be stored clear of areas paved or to be paved. Before any such equipment and tools are cleaned, they shall be moved off the paved or to be paved area; and they shall not be returned for use until after they have been allowed to dry.

Pavers: Each paver shall have a receiving hopper with sufficient capacity to provide for a uniform spreading operation and a distribution system that places the mix uniformly, without segregation. The paver shall be equipped with and use a vibratory screed system with heaters or burners. The screed system shall be capable of producing a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Pavers with extendible screed units as part of the system shall have auger extensions and tunnel extenders as necessary. Automatic screed controls for grade and slope shall be used at all times unless otherwise authorized by the Engineer. The controls shall automatically adjust the screed to compensate for irregularities in the preceding course or existing base. The controls shall maintain the proper transverse slope and be readily adjustable, and shall operate from a fixed or moving reference such as a grade wire or floating beam.

Rollers: All rollers shall be self-propelled and designed for compaction of bituminous concrete. Rollers types shall include steel-wheeled, pneumatic or a combination there of and may be capable of operating in a static or dynamic mode. Rollers that operate in a dynamic mode shall have drums that use a vibratory or oscillatory system or combination of. The vibratory system achieves compaction through vertical amplitude forces. Rollers with this system shall be equipped with indicators that provide the operator with amplitude, frequency and speed settings/readouts to measure the impacts per foot during the compaction process. The oscillatory system achieves compaction through horizontal shear forces. Rollers with this system shall be equipped with frequency indicators. Rollers can operate in the dynamic mode using the oscillatory system on concrete structures such as bridges and catch basins if at the lowest frequency setting.

Pneumatic tire rollers shall be self-propelled and equipped with wide-tread compaction tires capable of exerting an average contact pressure from 60 to 90 pounds per square inch uniformly over the surface, adjusting ballast and tire inflation pressure as required. The Contractor shall furnish evidence regarding tire size; pressure and loading to confirm that the proper contact pressure is being developed and that the loading and contact pressure are uniform for all wheels.

Lighting: For paving operations, which will be performed during hours of darkness, the paving equipment shall be equipped with lighting fixtures as described below, or with approved lighting fixtures of equivalent light output characteristics. A sufficient number of spare lamps shall be available on site as replacements in the event of failures. The Contractor shall provide brackets and hardware for mounting light fixtures and generators to suit the configuration of the rollers and pavers. Mounting brackets and hardware shall provide for secure connection of the fixtures, minimize vibration, and allow for adjustable positioning and aiming of the light fixtures. Lighting shall be aimed to maximize the illumination on each task and minimize glare to passing traffic. The Contractor shall provide generators on rollers and pavers of the type, size, and wattage, to adequately furnish 120 V AC of electric power to operate the specified lighting equipment. A sufficient amount of fuel shall be available on site. There shall be switches to control the lights. Wiring shall be weatherproof and installed to all applicable codes. The minimum lighting requirements are found in tables 4.06-1 and 4.06-2:

Table 4.06-1: Paver Lighting

Fixture	Quantity	Remarks
Type A	3	Mount over screed area
Type B (narrow) or Type C (spot)	2	Aim to auger and guideline
Type B (wide) or Type C (flood)	2	Aim 25 feet behind paving machine

Table 4.06-2: Roller Lighting

Fixture*	Quantity	Remarks
Type B (wide)	2	Aim 50 feet in front of and behind roller
Type B (narrow)	2	Aim 100 feet in front of and behind roller
OR		
Type C (flood)	2	Aim 50 feet in front of and behind roller
Type C (spot)	2	Aim 100 feet in front of and behind roller

**All fixtures shall be mounted above the roller.*

Type A: Fluorescent fixture shall be heavy-duty industrial type. It shall be enclosed and sealed to keep out dirt and dampness. It shall be UL listed as suitable for wet locations. The fixture shall contain two 4-foot long lamps - Type "F48T12CWHO". The integral ballast shall be a high power factor, cold weather ballast, and 120 volts for 800 MA HO lamps. The housing shall be aluminum, and the lens shall be acrylic with the lens frame secured to the housing by hinging latches. The fixture shall be horizontal surface mounting, and be made for continuous row installation.

Type B: The floodlight fixture shall be heavy-duty cast aluminum housing, full swivel and tilt mounting, tempered-glass lens, sealed door, reflector to provide a wide distribution or narrow distribution as required, mogul lamp socket for 250 watt Metal Halide lamp, 120 volt integral ballast, and be UL listed as suitable for wet locations.

Type C: The power beam holder shall have ribbed die cast aluminum housing and a clear tempered-glass lens to enclose the fixture. There shall be an arm fully adjustable for aiming, with a male-threaded mount with serrated teeth and lock nuts. There shall be a 120-volt heatproof socket with extended fixture wiring for an "Extended Mogul End Prong" lamp base. The fixture shall have gaskets, and shall be UL listed as suitable for wet locations. The lamps shall be 1000-watt quartz PAR64, both Q1000PAR64MFL (flood) and Q1000PARNSP (spot) will be required.

Material Transfer Vehicle (MTV): A MTV shall be used when placing a HMA surface course that is a minimum of 5,000 feet in length and on a roadway that has an overall width of 28 feet or more. A surface course is defined as the total thickness of the same HMA mix that extends up to and includes the final wearing surface whether it is placed in a single or multiple lifts, and regardless of any time delays between lifts.

The MTV must be a self-propelled vehicle specifically designed for the purpose of delivering the HMA mixture from the delivery truck to the paver. The MTV must have the capability to remix the bituminous concrete mixture.

The use of a MTV will be subject to the requirements stated in Article 1.07.05- Load Restrictions. The Engineer may limit the use of the vehicle if it is determined that the use of the MTV may damage highway components, utilities, or bridges. The Contractor shall submit to the Engineer at time of pre-construction the following information:

- *The make and model of the MTV to be used.*
- *The individual axle weights and axle spacing for each separate piece of paving equipment (haul vehicle, MTV and paver).*
- *A working drawing showing the axle spacing in combination with all three pieces of equipment that will comprise the paving echelon.*

HMA CONSTRUCTION

Refer to Standard Section 4.06.03 except as noted herein.

Weather Limitations

Refer to Standard Section 4.06.04 and as noted herein.

4.06.04

Seasonal Requirements: *Paving, including placement of temporary pavements, shall be divided into two seasons; In-Season and Extended Season. In-Season shall be from May 1 – September 30 and Extended Season shall be from October 1- April 30. The following requirements shall apply unless otherwise authorized or directed by the Engineer:*

- *The final lift of HMA shall not be placed during the Extended Season.*
- *HMA mixes shall not be placed when the air or base temperature is below 40°F.*

Additional Requirements for Extended Season:

- *The minimum mixture temperature for all HMA mixtures when discharged into the paver or transfer vehicle hopper shall be 290°F. The temperature will be taken from the initial discharge of mixture from the truck. If found to be below the minimum requirement, the truck will not be allowed to unload remaining mixture.*
- *The Contractor shall use a minimum of 3 rollers with operators for paving lengths greater than 1000 feet. Two rollers must be capable of operating in the dynamic mode.*
- *The Contractor's Quality Control Plan shall include a section on Extended Season paving and address paver speed, roller patterns and balancing mixture delivery and placement operations to meet specification requirements.*

The hot mix asphalt shall not be placed when weather conditions of fog or rain prevail or when the pavement surface or base shows signs of free moisture (film of water).

The Engineer will not permit work to continue when overtaken by sudden storms until the pavement surface shows no signs of free moisture. The material in transit at the time of shutdown will not be placed until the pavement surface shows no signs of free moisture, provided the mixture is within temperature limits as specified.

Tack Coat

Refer to Standard Section 4.06.03-7 except as amended herein.

4.06.03-7

Tack Coat Application: A thin uniform coating of tack coat shall be applied to the pavement immediately before overlaying and be allowed sufficient time to break (set). All surfaces in contact with the HMA that have been in place longer than 3 calendar days shall have an application of tack coat. The tack coat shall be applied by a non-gravity pressurized spray system that results in uniform overlapping coverage at an application rate of 0.03 to 0.05 gallons per square yard for a non-milled surface and an application rate of 0.05 to 0.07 gallons per square yard for a milled surface. For areas where both milled and un-milled surfaces occur, the tack coat shall be an application rate of 0.03 to 0.05 gallons per square yard. The Engineer must approve the equipment and the method of measurement prior to use. The material for tack coat shall not be heated in excess of 160°F and shall not be further diluted.

Contact surfaces of manholes, structures, longitudinal joints, vertical pavement edges, etc. shall be painted with a thin, uniform tack coat just before the material is placed against them.

All surfaces in contact with the HMA that have been in place over night shall have an application of tack coat.

Paving courses will be evaluated for bond after 15 days have elapsed since the date of placement. Two (2) core samples shall be randomly taken by the Engineer using a 6 inch diameter wet-core bit specifically designed for cutting pavement. These cores may also be used for density gauge correlation, density verification, thickness determinations, and for density adjustment at the option of the Engineer.

If it is determined that there is poor or no bond between paving layers then the Engineer may require that an increase in tack coat be applied.

HMA Production

The aggregates and the asphalt binder material shall be weighed or metered and introduced into the mixer in the amount specified by the JMF and within the allowable action limits as stated in Table 10 HMA PRODUCTION LIMITS. These limits shall be applied to the target values established in the JMF. Corrective action shall be taken by the Contractor when the calculated individual result for gradation or asphalt content falls outside the target JMF value beyond the action limits listed in Table 10. The Contractor shall take the appropriate action when results indicate the material is out of tolerance. The Contractor shall be required to suspend production when the calculated individual results fall outside the target JMF values beyond the limits allowed in the CORRECTIVE ACTION section of the specification.

Plant Trials

If production is suspended, the Contractor shall be required to produce material on a trial basis for testing purposes without shipment to the project. No payment will be made for material and labor employed for nonconforming plant trials. The Contractor shall pay for any acceptance sampling and testing for the trials necessary to determine conformance with the specification requirements during production suspension. When trials have been approved, the plant will return to its normal operation.

Failure to stop production and make adjustments when required due to an individual test not meeting the specified requirements shall subject all mix from the stop point to the point when the next individual test is back on or within the action limits, or to the point when production is actually stopped, whichever occurs first, to be considered unacceptable. This material shall be removed and replaced with materials that comply with the specifications at the Contractor's expense. Any sampling, testing, or evaluation services required during the Contractor's failure to stop production shall be paid for by the Contractor.

Placing and Finishing

Refer to Standard Section 4.06.03-6 and 4.06.03-7 and as noted herein.

4.06.03-6

Transitions for Roadway Surface: *Transitions shall be formed at any point on the roadway where the pavement surface deviates, vertically, from the uniform longitudinal profile as specified on the plans. Whether formed by milling or by bituminous concrete mixture, all transition lengths shall conform to the criteria below unless otherwise specified.*

Permanent Transitions: A permanent transition is defined as any transition that remains as a permanent part of the work. All permanent transitions, leading and trailing ends shall meet the following length requirements:

a) Posted speed limit is greater than 35 MPH: 30 feet per inch of vertical change (thickness)

b) Posted speed limit is 35 MPH or less: 15 feet per inch of vertical change (thickness).

c) Bridge Overpass and underpass transition length will be 75 feet either
(1) Before and after the bridge expansion joint, or
(2) Before or after the parapet face of the overpass.

In areas where it is impractical to use the above described permanent transition lengths the use of a shorter permanent transition length may be permitted when approved by the Engineer.

Temporary Transitions: A temporary transition is defined as a transition that does not remain a permanent part of the work. All temporary transitions shall meet the following length requirements:

a) Posted speed limit is greater than 35 MPH
(1) Leading Transitions = 15 feet per inch of vertical change (thickness)
(2) Trailing Transitions = 6 feet per inch of vertical change (thickness)

b) Posted speed limit is 35 MPH or less
(1) Leading and Trailing = 4 feet per inch of vertical change (thickness)

***Note:** Any temporary transition to be in-place over the winter shutdown period, holidays, or during extended periods of inactivity (more than 7 calendar days) shall conform to the "Permanent Transition" requirements shown above.*

4.06.03-7

***Spreading and Finishing of Mixture:** Prior to the placement of the bituminous concrete, the underlying base course shall be brought to the plan grade and cross section within the allowable tolerance. Immediately before placing the mixture, the area to be surfaced shall be cleaned by sweeping or by other means acceptable to the Engineer. The HMA mixture shall not be placed whenever the surface is wet or frozen. The temperature of the mix at time of placement must be between 265°F and 325°F. The Engineer will verify the mix temperature by means of a probe or infrared type of thermometer. Rejection of mixture based on temperature will only be allowed if verified by means of a probe type thermometer.*

Placement: The HMA mixture shall be placed and compacted to provide a smooth, dense surface with a uniform texture and no segregation at the specified thickness and dimensions indicated in the plans and specifications. The maximum paver speed during placement shall not exceed 40 ft/min unless authorized by the Engineer.

When unforeseen weather conditions prevent further placement of the mix, the Engineer is not obligated to accept or place the bituminous concrete mixture that is in transit from the plant.

In advance of paving, traffic control requirements shall be set up daily, maintained throughout placement, and shall not be removed until all associated work including density testing is completed.

The Contractor shall inspect the newly placed pavement for defects in the mixture or placement before rolling is started. Any deviation from standard crown or section shall be immediately remedied by placing additional mixture or removing surplus mixture. Such defects shall be corrected to the satisfaction of the Engineer.

Where it is impractical due to physical limitations to operate the paving equipment, the Engineer may permit the use of other methods or equipment. Where hand spreading is permitted, the mixture shall be placed by means of suitable shovels and other tools, and in a uniformly loose layer at a thickness that will result in a completed pavement meeting the designed grade and elevation.

Placement Tolerances: Each lift of HMA placed at a uniform specified thickness shall meet the following requirements for thickness and area. Any pavement exceeding these limits shall be subject to an HMA adjustment or removal. Lift tolerances will not relieve the Contractor from meeting the final designed grade. Lifts of specified non-uniform thickness, i.e. wedge or shim course, shall not be subject to thickness and area adjustments.

a) *Thickness- Where the total thickness of the lift of mixture exceeds that shown on the plans beyond the tolerances shown in Table 4.06-3, the longitudinal limits of such variation including locations and intervals of the measurements will be documented by the Engineer for use in calculating a HMA adjustment in Article 4.06.04.*

TABLE 4.06-3 Thickness Tolerances

Mixture Designation	***Lift Tolerance***
Class 4 and HMA S1	*+/- ⅜ inch*
Class 1, 2 and 12 and HMA S0.25, S0.375, S0.5	*+/- ¼ inch*

Where the thickness of the lift of mixture is less than that shown on the plans beyond the tolerances shown in Table 4.06-3, the Contractor, with the approval of the Engineer, shall take corrective action in accordance with this specification.

b) *Area- Where the width of the lift exceeds that shown on the plans by more than the specified thickness of each lift, the longitudinal limits of such variation including locations and intervals of the measurements will be documented by the Engineer for use in calculating a HMA adjustment in Article 4.06.04.*

c) *Delivered Weight of Mixture - When the delivery ticket shows that the truck exceeds the allowable gross weight for the vehicle type the quantity of tons representing the overweight amount will be documented by the Engineer for use in calculating a HMA adjustment in Article 4.06.04.*

Transverse Joints: All transverse joints shall be formed by saw-cutting a sufficient distance back from the previous run, existing bituminous concrete pavement or bituminous concrete driveways to expose the full thickness of the lift. A brush of tack coat shall be used on any cold joint immediately prior to additional bituminous concrete mixture being placed.

Tack Coat Application: A thin uniform coating of tack coat shall be applied to the pavement immediately before overlaying and be allowed sufficient time to break (set). All surfaces in contact with the HMA that have been in place longer than 3 calendar days shall have an application of tack coat. The tack coat shall be applied by a non-gravity pressurized spray system that results in uniform overlapping coverage at an application rate of 0.03 to 0.05 gallons per square yard for a non-milled surface and an application rate of 0.05 to 0.07 gallons per square yard for a milled surface. For areas where both milled and un-milled surfaces occur, the tack coat shall be an application rate of 0.03 to 0.05 gallons per square yard. The Engineer must approve the equipment and the method of measurement prior to use. The material for tack coat shall not be heated in excess of 160°F and shall not be further diluted.

Compaction: The Contractor shall compact the mixture to meet the density requirements as stated in Article 4.06.03 and eliminate all roller marks without displacement, shoving, cracking, or aggregate breakage.

The Contractor shall only operate rollers in the dynamic mode using the oscillatory system at the lowest frequency setting on concrete structures such as bridges and catch basins. The use of the vibratory system on concrete structures is prohibited.
Rollers operating in the dynamic mode shall be shut off when reversing directions.

If the Engineer determines that the use of compaction equipment in the dynamic vibratory mode may damage highway components, utilities, or adjacent property, the Contractor shall provide alternate compaction equipment. The Engineer may allow the Contractor to operate rollers in the dynamic mode using the oscillatory system at the lowest frequency setting.

These allowances will not relieve the Contractor from meeting pavement compaction requirements.

Surface Requirements: The pavement surface of any lift shall meet the following requirements for smoothness and uniformity. Any irregularity of the surface exceeding these requirements shall be corrected by the Contractor.

a) *Smoothness- Each lift of the surface course shall not vary more than ¼ inch from a Contractor-supplied 10 foot straightedge. For all other lifts of HMA, the tolerance shall be ⅜ inch. Such tolerance will apply to all paved areas.*

b) *Uniformity- The paved surface shall not exhibit segregation, rutting, cracking, disintegration, flushing or vary in composition as determined by the Engineer.*

No traffic of any kind shall be permitted on binder or base when dirt or any other foreign substance may be tracked thereon.

Suspension Control Test Section

Refer to Standard Section 4.06.03-5 except as amended herein.

4.06.03-5

Superpave Test Section: *The Engineer may require the Contractor to place a test section whenever the requirements of this specification or Section M.04 are not met.*
The Contractor shall submit the quantity of mixture to be placed and the location of the test section for review and acceptance by the Engineer. The equipment used in the construction of a passing test section shall be used throughout production.

If a test section fails to meet specifications, the Contractor shall stop production, make necessary adjustments to the job mix formula, plant operations, or procedures for placement and compaction. The Contractor shall construct test sections, as allowed by the Engineer, until all the required specifications are met. All test sections shall also be subject to removal as set forth in Article 1.06.04.

If it is determined by the Engineer during the performance of the contract, that the Marshall or Superpave pavement does not conform to the specifications, tolerance, density and/or uniformity requirements, the Engineer may order the Contractor to cease all operations and construct an HMA SUSPENSION CONTROL TEST SECTION.

The amount of mixture should be sufficient, at a minimum, to construct a test section 300 feet long and 20 to 30 feet wide placed in two lanes, with a longitudinal joint, and shall be of the same depth specified for the construction of the course which it represents. A control section may be required each time a change is made in the Job Mix Formula, sources of supply or paving and rolling equipment. A suspension control test section will be required when either of the following conditions exist:

1. Two consecutive streets or two consecutive 1,000 ton lots of material tested for mat density or longitudinal joint density falls below the minimum threshold density for 100% adjustment, as noted in Table 11 and Table 12.

2. When the average of the last five streets or five 1,000 ton lots of material tested for mat density or longitudinal joint density falls below the threshold density for 100% adjustment, as noted in Table 11 and Table 12.

The mixture shall be prepared, placed, and compacted in accordance with this specification. When the control section pavement has cooled sufficiently, a total of six (6) samples of the finished pavement including three (3) samples from the longitudinal joint, shall be taken and tested for conformance to density requirements.

If the suspension control section tests conducted by the Engineer, and paid for by the Contractor, indicate that pavement does not conform to specification requirements, necessary adjustment to plant operation and placement/rolling procedures shall be made and another control section constructed.

The Contractor shall not be permitted to re-core a control section or place HMA courses until a control section is approved by the Engineer.

Transverse Joints

Refer to Standard Section 4.06.03-7.

4.06.03-7

Transverse Joints: *All transverse joints shall be formed by saw-cutting a sufficient distance back from the previous run, existing bituminous concrete pavement or bituminous concrete driveways to expose the full thickness of the lift. A brush of tack coat shall be used on any cold joint immediately prior to additional bituminous concrete mixture being placed.*

Longitudinal Joints

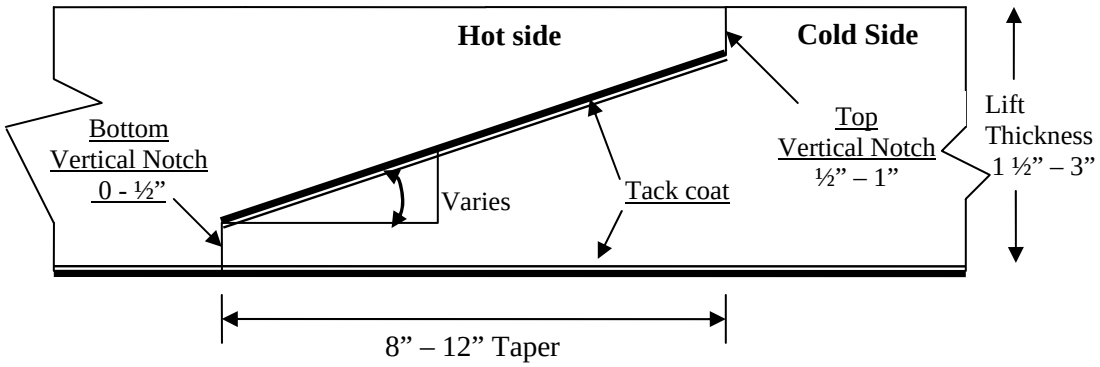
Refer to Standard Section 4.06.03-8.

4.06.03-8

HMA Longitudinal Joint Construction Methods: *Unless noted on the plans or the contract documents or directed by the Engineer, the Contractor shall use Method I- Notched Wedge Joint (see figure 4.06-1) when constructing longitudinal joints where lift thicknesses are between 1½ and 3 inches, except for HMA S1 and Class 4 mixes. Method II Butt Joint (see figure 4.06-2) shall be used for lifts less than 1½ inches or greater than 3 inches and HMA S1 and Class 4 mixes. During placement of multiple lifts of HMA, the longitudinal joint shall be constructed in such a manner that it is located at least 6 inches from the joint in the lift immediately below. The joint in the final lift shall be at the centerline or at lane lines.*

Method I - Notched Wedge Joint*:*

Figure 4.06-1



A notched wedge joint shall be constructed, as shown in the figure using a device that is capable of adjusting the top and bottom vertical notches independently and is attached to the paver screed.

The taper portion of the joint must be placed over the longitudinal joint in the lift immediately below. The top vertical notch must be located at the centerline or lane line in the final lift. The requirement for paving full width "curb to curb" as described in Method II will be waived in those areas where the notched wedge joint is utilized.

The taper portion of the wedge joint shall be compacted and not be exposed to traffic for more than 5 calendar days.

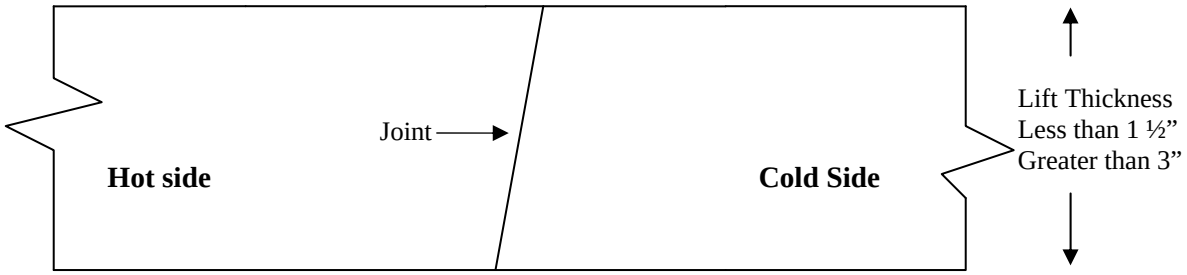
The existing pavement surface under the wedge joint must have an application of tack coat material. Prior to placing completing pass (hot side), an application of tack coat must be applied to the tapered section.

Any exposed wedge joint must be located to allow for the free draining of water from the road surface.

The Engineer reserves the right to define the paving limits when using a wedge joint that will be exposed to traffic.

Method II - Butt Joint:

Figure 4.06-2

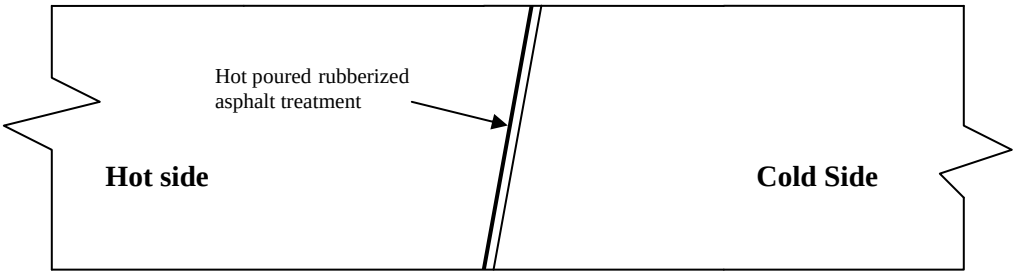


When adjoining HMA passes are placed, the Contractor shall utilize equipment that creates a near vertical edge (refer to figure). The completing pass (hot side) shall have sufficient mixture so that the compacted thickness is not less than the previous pass (cold side). The end gate on the paver should be set so there is an overlap onto the cold side of the joint.

The Contractor shall not allow any butt joint to be incomplete at the end of a work shift unless otherwise allowed by the Engineer. When using this method, the Contractor is not allowed to leave a vertical edge exposed at the end of a work shift and must complete paving of the roadway full width "curb to curb."

Method III- Butt Joint with Hot Poured Rubberized Asphalt Treatment: *When required by the contract or allowed by the Engineer, Method III (see figure 4.06-3) may be used.*

Figure 4.06-3



All of the requirements of Method II must be met with Method III. In addition, the longitudinal vertical edge must be treated with a joint seal material meeting the requirements of Section M.04 prior to placing a completing pass. The joint seal material shall be applied in accordance with the manufacturer's recommendation so as to provide a uniform coverage and avoid excess bleeding onto the newly placed pavement.

Method III – Butt Joint with Hot Poured Rubberized Asphalt Treatment will be at the contractor's expense.

For Methods II and III, the top of the longitudinal joint in one course shall offset the top of the longitudinal joint in the course immediately below by at least 1 foot, however, the joint in the top layer shall be at the centerline for two lane roadways. Longitudinal paving joints shall not fall within the

travel lanes but be located on the solid, skip, or edge lines established for that roadway. Longitudinal joint(s) of the top layer shall be marked prior to paving so as to create a neat, straight line at the lane breaks where necessary. First paver pass shall use the marked joint as the guide to develop the longitudinal joint of the top layer; using the curb edge or edge of pavement as a guide is unacceptable. The goal is to end up with a true straight longitudinal joint at centerline or at lane breaks. The Contractor shall inform the Engineer of the proposed paving joint locations for the entire pavement structure prior to placing the first intermediate course.

Compaction of HMA Mixture after Placing

Refer to Standard Section 4.06.03-7 and as amended herein.

4.06.03-7

Compaction: The Contractor shall compact the mixture to meet the density requirements as stated in Article 4.06.03 and eliminate all roller marks without displacement, shoving, cracking, or aggregate breakage.

The Contractor shall only operate rollers in the dynamic mode using the oscillatory system at the lowest frequency setting on concrete structures such as bridges and catch basins. The use of the vibratory system on concrete structures is prohibited.
Rollers operating in the dynamic mode shall be shut off when reversing directions.

If the Engineer determines that the use of compaction equipment in the dynamic vibratory mode may damage highway components, utilities, or adjacent property, the Contractor shall provide alternate compaction equipment. The Engineer may allow the Contractor to operate rollers in the dynamic mode using the oscillatory system at the lowest frequency setting.

These allowances will not relieve the Contractor from meeting pavement compaction requirements.
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The speed of the roller shall, at all times, be sufficiently slow and of uniform speed to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once.

Pneumatic rollers may be used in the intermediate mode.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with hand tampers and vibratory plate compactors.

Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching shall not be allowed.

Shaping Edges

While the surface is being compacted and finished, the Contractor shall carefully trim the outside edges of the pavement to the proper alignment. Edges so formed shall be beveled while still hot with the back of a lute or smoothing iron and thoroughly compacted by tampers or by other satisfactory methods.

Surface Smoothness

Refer to Standard Section 4.06.03-7.

04.06.03-7

Surface Requirements: *The pavement surface of any lift shall meet the following requirements for smoothness and uniformity. Any irregularity of the surface exceeding these requirements shall be corrected by the Contractor.*

a) Smoothness- Each lift of the surface course shall not vary more than ¼ inch from a Contractor-supplied 10 foot straightedge. For all other lifts of HMA, the tolerance shall be ⅜ inch. Such tolerance will apply to all paved areas.

Corrective Work

Refer to Standard Section 4.06.03-13 and as noted herein.

04.06.03-13

Corrective Work Procedures: *Any portion of the completed pavement that does not meet the requirements of the specification shall be corrected at the expense of the Contractor. Any corrective courses placed as the final wearing surface shall not be less than 1½ inches in thickness after compaction.*

If pavement placed by the Contractor does not meet the specifications, and the Engineer requires its replacement or correction, the Contractor shall:

a) Propose a corrective procedure to the Engineer for review and approval prior to any corrective work commencing. The proposal shall include:
- *Limits of pavement to be replaced or corrected, indicating stationing or other landmarks that are readily distinguishable.*
- *Proposed work schedule.*
- *Construction method and sequence of operations.*
- *Methods of maintenance and protection of traffic.*
- *Material sources.*
- *Names and telephone numbers of supervising personnel.*

b) Perform all corrective work in accordance with the Contract and the approved corrective procedure.

The corrective method(s) chosen by the Contractor shall be approved for use by the Engineer and shall be performed at the Contractor's expense, including all necessary equipment and traffic control. Areas of removal and replacement shall be removed the full width of the lane. The removal areas shall begin and end with a transverse butt joint which shall be constructed with a transverse saw cut perpendicular to the centerline. Replacement materials shall be paver placed in sufficient quantity so the finished surface will conform to grade, smoothness and cross-section requirements.

The Engineer shall retest any sections where corrections were made to verify that the corrections produced a surface that conforms to the grade and smoothness requirements.

Uniformity

Refer to Standard Section 4.06.03-7 and as amended herein.

4.06.03-7

Surface Requirements: *The pavement surface of any lift shall meet the following requirements for smoothness and uniformity. Any irregularity of the surface exceeding these requirements shall be corrected by the Contractor.*

a) Uniformity- The paved surface shall not exhibit segregation, rutting, cracking, disintegration, flushing or vary in composition as determined by the Engineer

The Contractor shall review all potential causes of segregation as it relates to its operation, including but not limited to HMA plant production and storage, loading and transportation, paver/equipment, placement and/or handwork. The Contractor shall employ additional investigation methods and make the necessary changes in their operation such that segregation is eliminated and mat uniformity is acceptable.

At the Engineer's discretion, the Engineer shall obtain two (2) six inch diameter cores from the identified (segregated) area and two (2) six inch diameter cores from the non-segregated area. The cores may be evaluated for resilient modulus, dry tensile strength, change in air voids, maximum in place air voids, aggregate gradation and binder content. The results of the data obtained on the cores from the segregated area will be compared to the results of tests performed on the cores from the non-segregated area.

If any mix property is beyond the tolerance limits stated in the table below, that area shall be considered segregated and shall be repaired by the Contractor.

SEGREGATION LIMITS

Change in Mix Properties Expressed as a Percentage of the Properties in the Non-Segregated Areas	
Property	**Limits**
Resilient Modulus, psi @ 77°F	<80%
Dry Tensile Strength, psi @ 77°F	<90%
Aggregate Gradation and Binder Content	Refer to Table 10 (Action Limits)
Change in Air Voids	>2.5%

The samples for the segregation analysis will be considered separately from the mat and joint cores tested for acceptance.

Segregated areas not meeting the requirements stated above or areas having more than 11% air voids shall be removed and replaced for the entire pavement thickness and lane width, and be paver-machine placed, or as directed by the Engineer. All corrective methods shall be performed at the Contractor's expense. The removal areas shall begin and end with a transverse butt joint which shall be constructed with a transverse saw cut perpendicular to the centerline. The corrective area shall conform to all grades, smoothness, material, and density specification requirements. The Engineer may retest any areas where corrections were made to verify that the material meets specification requirements.

Thickness

Refer to Standard Section 4.06.03-7 and 4.06.04-2 and as noted herein.

4.06.03-7

Placement Tolerances: *Each lift of HMA placed at a uniform specified thickness shall meet the following requirements for thickness and area. Any pavement exceeding these limits shall be subject to an HMA adjustment or removal. Lift tolerances will not relieve the Contractor from meeting the final designed grade. Lifts of specified non-uniform thickness, i.e. wedge or shim course, shall not be subject to thickness and area adjustments.*

a) Thickness- Where the total thickness of the lift of mixture exceeds that shown on the plans beyond the tolerances shown in Table 4.06-3, the longitudinal limits of such variation including locations and intervals of the measurements will be documented by the Engineer for use in calculating a HMA adjustment in Article 4.06.04.

TABLE 4.06-3 Thickness Tolerances

Mixture Designation	***Lift Tolerance***
Class 4 and HMA S1	*+/- ⅜ inch*
Class 1, 2 and 12 and HMA S0.25, S0.375, S0.5	*+/- ¼ inch*

Where the thickness of the lift of mixture is less than that shown on the plans beyond the tolerances shown in Table 4.06-3, the Contractor, with the approval of the Engineer, shall take corrective action in accordance with this specification.

b) Area- Where the width of the lift exceeds that shown on the plans by more than the specified thickness of each lift, the longitudinal limits of such variation including locations and intervals of the measurements will be documented by the Engineer for use in calculating a HMA adjustment in Article 4.06.04.

c) Delivered Weight of Mixture - When the delivery ticket shows that the truck exceeds the allowable gross weight for the vehicle type the quantity of tons representing the overweight amount will be documented by the Engineer for use in calculating a HMA adjustment in Article 4.06.04.

04.06.04-2

HMA Adjustments: *Adjustments may be applied to bituminous concrete quantities and will be measured for payment using the following formulas:*

Yield Factor *for Adjustment Calculation = 0.0575 Tons/SY/inch*

Actual Area *= [(Measured Length (ft)) x (Avg. of width measurements (ft))]*

Actual Thickness (t) *= Total tons delivered / [Actual Area (SY) x 0.0575 Tons/SY/inch]*

a) Area: If the average width exceeds the allowable tolerance, an adjustment will be made using the following formula. The tolerance for width is equal to the specified thickness (in.) of the lift being placed.

Tons Adjusted for Area (T_A) *= [(L x W_{adj})/9] x (t) x 0.0575 Tons/SY/inch = (-) Tons*

Where: L = Length (ft)
(t) = Actual thickness (inches)
W_{adj} = (Designed width (ft) + tolerance /12) - Measured Width)

b) Thickness: If the actual thickness is less than the allowable tolerance, the Contractor shall submit a repair procedure to the Engineer for approval. If the actual thickness exceeds the allowable tolerance, an adjustment will be made using the following formula:

Tons Adjusted for Thickness (T_T) *= A x t_{adj} x 0.0575 = (-) Tons*

Where: A = Area = {[L x (Designed width + tolerance (lift thickness)/12)] / 9}
t_{adj} = Adjusted thickness = [(Dt + tolerance) - Actual thickness]
Dt = Designed thickness (inches)

The thickness requirements contained herein shall apply only when each pavement layer is specified to be a uniform compacted thickness of 1 inch (25mm) or greater. Measurements of thickness for acceptance shall be made by the Engineer using six-inch minimum diameter pavement cores (removed also for subsequent density measurement), and then verified according to Section 4.06.04-2.

CONTRACTOR QUALITY CONTROL OF HMA PAVEMENT

Standard Section 4.06.03-9 is deleted and replaced as amended herein.

General

The Contractor is encouraged to establish, provide, and maintain a Quality Control System (QCS) that will detail the methods and procedures that will be taken to assure that all materials and completed construction conform to project specifications, plans, technical specifications and other requirements, whether manufactured or processed by the Contractor or procured from subcontractors or vendors.

If the project data during production indicates a problem and the Contractor is not taking satisfactory corrective action as is their responsibility under quality control, then the Engineer may suspend production or acceptance of the material, in accordance with these specifications.

TABLE 10 HMA Production Limits for Individual Measurements

Sieve Size	Action	Suspension
1-1/2" (37.5mm)	0%	0%
1" (25.0 mm)	±6%	±9%
3/4" (19.0 mm)	±6%	±9%
1/2" (12.5 mm)	±6%	±9%
3/8" (9.5 mm)	±6%	±9%
#4 (4.75 mm)	±6%	±9%
#8 (2.36 mm)	±5%	±7.5%
#16 (1.18 mm)	±5%	±7.5%
#30 (0.600 mm)	±4%	±5.5%
#50 (0.300 mm)	±3%	±4.5%
#100 (0.150 mm)	±3%	±4.5%
#200 (0.075 mm)	±2%	±3%
Asphalt Binder Content	±0.4%	±0.70%
Design Air Voids (4.0%)	±1.0%	±1.7%

When evaluating the production limits, the sieve sizes above the maximum size aggregate should be deleted from the Individual Measurements Chart and the maximum aggregate sieve size Action and Suspension Limits should be changed to 0%.

CORRECTIVE ACTION

The Contractor's Quality Control system shall include an appropriate action to be taken when the process is believed to be out of tolerance. The Contractor should review the control charts on a continuous basis making adjustments to the process when necessary to keep the product consistent.

As a minimum, a process shall be deemed out of control and production stopped and corrective action taken, if:

One point falls outside the Suspension Limit line for individual measurements; or

Design Air Voids falls outside the Suspension Limit line for its individual measurement or range as indicated in Table 10; or

Design Air Voids and two or more points fall outside the Action Limit line for individual measurements as indicated in Table 10; or

Design Air Voids fall outside the Action Limit and one point falls outside the Suspension Limit for individual measurements or range as indicated in Table 10; or

Three points in a row fall outside the Action Limit line for individual measurements as indicated in Table 10.

Three nonconsecutive samples out of five samples fall outside the Action Limit line for individual measurements as indicated in Table 10.

The dust to effective binder ratio on two consecutive samples fall outside the Control Point limits for individual measurements as indicated in Table 6.

Dust to effective binder ratio of three (3) nonconsecutive samples out of five (5) samples fall outside the Control Point limits for individual measurements as indicated in Table 6.

Two consecutive streets or two consecutive 1,000 ton lots of material tested for mat density or longitudinal joint density falls below the threshold density for 100% adjustment, as noted in Table 11 and Table 12.

The average of the last five streets or five 1,000 ton lots of material tested for mat density or longitudinal joint density falls below the threshold density for 100% adjustment, as noted in Table 12 and Table 13.

Acceptance testing requirements are the responsibility of the Engineer.

QUALITY ACCEPTANCE OF HMA

Standard Section M.04.03-1 and M.04.03-2 are deleted and replaced as amended herein.

All acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the Engineer at no cost to the Contractor, unless otherwise stated herein. Testing organizations performing these tests shall meet the requirements of ASTM D 3666. All equipment in Contractor furnished laboratories shall be calibrated and verified by a testing organization prior to the start of operations. Such verification/certification shall be furnished to the Engineer prior to production. Engineer's testing personnel shall be certified by the Northeast

Transportation Training and Certification Program (NETTCP). This function does not relieve the Contractor from performing their daily quality control tasks as part of their normal operating business.

The Engineer or their agent shall have access at any time to all parts of the producing plant for:

Inspection of the condition and operations of the yard, plant and laboratory.

Confirmation of the adequacy of equipment in use.

Verification of the character and proportions of the mixture.

Determination of temperatures being maintained in the preparation of the mixtures.

Inspection of incidental related procedures.

Samples of all material including compacted specimens and certified copies of all reports and printouts shall be made available to the Engineer or its agent as often as requested including: asphalt binder; recycling agents; virgin aggregates; reclaimed pavement materials; modifiers, loose and compacted mixture specimens; and combined aggregate samples.

Plant-Produced Material

Plant-produced material shall be sampled and tested for VMA, gradation, asphalt binder content, and air voids (Marshall or Superpave) at N_{design} (Superpave only) on a lot basis. The Engineer's testing personnel shall be certified by the Northeast Transportation Training and Certification Program (NETTCP), as HMA Plant Technicians. Sampling shall be from material deposited into trucks at the plant or from trucks at the job site. A lot will consist of:

- one day's production

Where more than one plant is simultaneously producing material for, the job, the lot sizes shall apply separately for each plant.

Sampling

Each lot will be divided into 300 ton sublots. Sufficient material for analysis and preparation of test specimens will be sampled by the Engineer on a random basis, in accordance with the procedures contained in ASTM D 3665. One set of laboratory compacted specimens will be prepared for each sublot in accordance with AASHTO T312, at the number of gyrations at N_{design} required by Table 5 herein for Superpave, or in accordance with AASHTO T245, at the number of blows required by Table M.04.02-1. Each set of laboratory compacted specimens will consist of two test portions prepared from the same field sample, with the volumetric analysis based on the average of the two specimens and a minimum of one theoretical maximum specific gravity sample.

The sample of hot mix asphalt may be put in a covered metal tin and placed in an oven for not more than 30 minutes to regulate or adjust the temperature. The compaction temperature of the specimens should be as specified in the JMF.

In addition to the hot mix asphalt samples, the Contractor shall take one, one-quart sample of the PG binder used to produce the hot mix asphalt at the start of the work. The PG sample shall be turned over to the Engineer on the first day of project production.

Testing

Bulk Specific Gravity - Sample specimens shall be tested for bulk specific gravity in accordance with AASHTO T166 or T275, whichever is applicable, for use in computing air voids and density. Air voids will be determined in accordance with AASHTO T269.

Stability and Flow (Marshall specimens) – Sample specimens shall be tested for stability and flow in accordance with AASHTO T245, paragraph 4.

Gradation and Asphalt Binder Content - The gradation and asphalt binder content of the mixture shall be measured for each sublot in accordance with the following:

Asphalt Binder Content - Extraction tests shall be performed once per sublot in accordance with AASHTO T164 or AASHTO T308 for determination of asphalt content. The weight of ash portion of the extraction test, as described in AASHTO T164, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every twentieth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture. If utilizing AASHTO T308 for asphalt content determination, the calibration process and calibration factor, as described in AASHTO T308, shall be determined as stated, prior to acceptance testing. A verification shall be performed as part of every twentieth test performed thereafter or when changes in the mix are apparent.

Gradation - Aggregate gradations shall be determined once for each sublot from mechanical analysis of extracted aggregate in accordance with AASHTO T30 and AASHTO T27 (Dry Sieve).

The Dust-to-Effective Asphalt ratio shall be determined once for each sublot from the mechanical analysis of extracted aggregate and the effective asphalt binder content. The Dust-to-Effective Asphalt ratio shall be determined by the Engineer in accordance with AASHTO R35.

HMA mixtures shall contain a dust to effective asphalt ratio by mass between 0.6 and 1.2 utilizing AASHTO T30 and a washed sieve, the #4 mixture shall have a dust to effective asphalt ratio between 0.9 and 2.0, utilizing AASHTO T30 and a washed sieve. If the gradation of the mixture passes beneath the Primary Control Sieve (PCS), the Engineer may increase the dust to effective asphalt from 0.6 – 1.2 to 0.8 – 1.6, utilizing AASHTO T30 and a washed sieve.

When tested in accordance with AASHTO T30 utilizing a dry sieve analysis the dust to effective asphalt ratio shall be 0.3 to 0.9, the #4 mixture shall have a dust to effective asphalt ratio between 0.6 to 1.2. If the gradation of the mixture passes beneath the PCS the Engineer may increase the dust to effective asphalt ratio from 0.3 –0.9 to 0.5-1.3, the #4 mixture may be increased from 0.6-1.2 to 0.8-1.6 based on a dry gradation. The Primary Control Sieve (PCS) shall be as determined in accordance with AASHTO M323 for both the Marshall mixes and Superpave mixes.

The Theoretical Maximum Specific Gravity of the mixture shall be measured for each sublot in accordance with AASHTO T209, Type C, D, or E container. Samples shall be taken on a random basis in accordance with ASTM D 3665. The value used in the field placed density computations shall be the average of the most recent maximum specific gravity lot measurements.

Temperatures. Temperatures shall be checked, at least three times per lot, at necessary locations to determine the temperatures of the dryer, the asphalt binder in the storage tank, the mixture at the plant, and the mixture at the job site.

Voids in Mineral Aggregate (VMA), for each plant sample, will be determined by the Engineer in accordance with the procedures contained in Chapter 4, VOLUMETRIC PROPERTIES OF COMPACTED PAVING MIXTURES, of the Asphalt Institute's Manual Series No. 6 (MS-2), Mix Design Methods for Asphalt Concrete. The VMA, and air voids for each sublot shall be computed by averaging the results of the two test specimens representing that sublot.

Acceptance of Plant Produced HMA

Acceptance of plant produced HMA material will be based upon plant air voids, Marshall stability and flow (if applicable), VMA, gradation, asphalt binder content, dust to effective binder ratio, mix temperature, and shall be determined by the Engineer in accordance with these specifications.

Field Placed HMA Material

HMA material placed in the field shall be tested for mat and longitudinal joint density on a completed street or public facility basis. The Engineer's testing personnel shall be certified by the Northeast Transportation Training and Certification Program (NETTCP), as HMA Paving Technicians or HMA Plant Technicians. The Engineer may conduct any necessary testing to monitor the specified density, uniformity and smoothness. A properly correlated density gauge may be used to monitor the pavement density in accordance with ASTM D2950 or ASTM 7113 and these specifications. Monitoring density with density gauges by the Engineer does not imply acceptance or rejection; the Contractor is ultimately responsible to meet the requirements of the specification.

Sampling for Density Adjustment

Density gauges may be used by the Engineer to determine density of the surface course mat and/or surface course longitudinal joints in accordance with the correlation procedures outlined in this specification. Cores of surface course material shall be minimized and only taken at the direction of the Engineer and approval of the City.

Mat and longitudinal joint acceptance density tests will be located by the Engineer on a stratified random sampling basis for each street or facility paved within three days of construction. The length of the longitudinal paving joint will be divided into sub-lots for sampling and testing purposes. If more than one longitudinal joint is formed on a street, then the random sample length will be the total lineal feet of longitudinal joint placed. A mat and longitudinal joint test will be taken by the Engineer randomly from each of these sub-lot intervals. Sub-lots will be determined on the basis of five (5) sub-lots per one thousand (1,000) tons of material placed or a minimum of five (5) sub-lots from each street or facility paved. Sampling and testing for density will be conducted in the following manner:

Intermediate paving courses will be tested with the density gauge (for correlation), then sampled by coring the mat and the longitudinal joint using a 6 inch diameter wet-core bit specifically designed for cutting pavement. The cores will be tested for density and thickness.

Surface courses will be tested for density with a density gauge that has been correlated as described in this section.

When sampling of the longitudinal joint for density determinations by coring, the center of the core will be taken on the hot side of the joint and 6-inches from the top of the wedge joint, or directly over the vertical edge of an existing longitudinal joint.

A core sample for intermediate course density and a density sample for surface course density will be tested from each sub-lot segment. The total width of the paved surface (curb to curb) will be determined at the longitudinal sub-lot location to sample and test for mat density. A transverse off-set distance from the centerline of the roadway will be established for mat density sampling and testing. The location, either right or left of centerline, will be based on whether a random number is "odd or even" (odd=left; even=right). When the off-set location is within 2 foot of the pavement edge, curb, catch basin or structure, or 1 foot off a longitudinal joint, or 10 foot off a transverse joint, the sample shall be relocated.

For nuclear gauge test locations, two 60 second increments will be taken with the gauge turned 180 degrees for each reading. The average of the two surface course mat density values will be reported for each location. For non-nuclear density tests, five (5) increments will be used, moving the gauge six inches after each reading in a square pattern, taking one reading in each corner and one in the center using the manufacturers operating procedures. The average of the five density values will be reported for each location.

If the results of the average density gauge readings for a street or pavement facility are below the threshold for 100% adjustment as indicated in Table 12 and Table 13, pavement cores will be removed as per this specification, and used for determining the actual pavement density.

In-Place Density Gauge Correlation to Pavement Cores

This procedure covers the determination of the in-place density of HMA by using an approved density gauge correlated to HMA cores from the project on a periodic basis.
The correlation (bias) value for each density gauge shall be mix, plant and project specific. A bias for a density gauge cannot be carried over from one project to another using the same mix from the same plant. A new correlation may also be required when a different paver is used, the paver screed is repaired or replaced, a mix design change occurs, conditions otherwise change and at the start of the construction season.

a) The location selected for the correlation shall be on the project site on the street but in a location that is safely accessible for the duration of the project (such as a driveway apron area or non-parking pavement toward the curbline).
b) Five gauge (5) readings and three (3) cores will be used to establish the correct bias and correlation. These readings must be taken four (4) feet from an unconfined edge and a minimum of 50 feet beyond the beginning of a paver pass or as directed by the Engineer. No reading shall be taken in the vicinity of a vertical object or other interferences according to manufacturers' instructions.
c) The five gauge readings will be spaced 4 feet apart for a total distance of sixteen feet thereby taking a reading at 0 foot, 4 foot, 8 foot, 12 foot and 16 foot location. The three (3) cores for the correlation will be taken in the same line and offset and location of the density gauge readings specifically at the 0 foot, 8 foot and 16 foot location. The cores must be taken from within the center of each of the density gauge footprints. Ice should be used to minimize any distortion or damage to the cores.

d) Each density gauge shall be operated using the number of test increments and locations of test increments as given under Sampling for Density Adjustment.
e) The gauge readings must be taken parallel to the direction of paving for nuclear density gauges and on the same longitudinal tangent line for any density gauge.
f) The density difference from the high-low reading of the 5 locations must be $\leq$ 1.0 percent of the mean of the determined density or a new location will be selected.
g) Core thicknesses must match the project plans for the street or a new location must be selected.
h) The final core average of percent maximum density from the three cores must be determined and written on the project pavement near the correlation site to serve as a correlation reference site. The core density average must meet specifications or a new location must be established.
i) The density gauge correlation (bias) will be determined as the difference from the known average core density to the known average gauge density value, as determined above.
j) If the density gauge cannot meet the accuracy requirements of less than or equal to 1.0 percent of know density, the gauge must be repaired.
k) The bias must be utilized by the density gauge user and recorded on the daily test reports.

All core samples shall be neatly cut with a core drill and water cooled bit where the cutting edge of the core drill bit shall be of hardened steel or other suitable material with diamond chips embedded in the metal cutting edge. The minimum diameter of the sample shall be 6 inches. Samples that are clearly defective, as a result of sampling, shall be documented and retained, then another sample taken for testing. The Engineer or the Owner's agent shall furnish all tools, labor, and materials for cutting samples and filling the cored pavement. Cored holes shall be filled by the Engineer and within one day after sampling.

Pavement cores will be used to determine the average percent density and thickness of intermediate courses and correlated density gauge readings may be used for density testing of surface courses. The average density will be used to determine the percent payment. Resampling of the pavement shall be in accordance with applicable provisions of the NETTCP Quality Assurance Technologist Manual, latest edition and these specifications.

With the exception of any Control Strips, if the Contractor is concerned about the test results obtained by the Engineer, the Contractor may request up to one time, that an equal number of random core samples be obtained and tested to supplement (not replace) the original core or density gauge samples. The coring, patching and testing of the additional samples will be the responsibility of the Contractor. Cores for the mat and/or longitudinal joint density tests will be located by the Engineer and witnessed by the Contractor. Cores locations will be based on a new stratified random sampling plan for each street or facility paved in accordance with the procedures stated above. Upon approval of the coring operation, the Contractor will notify the Engineer 48 hours in advance of the cores being taken such that the Engineer can witness the sampling. The additional cores must be tested by a certified HMA plant technician or HMA paving technician in the presence of the Engineer or his designated representative.

Only one (1) set of additional mat and/or longitudinal joint cores will be allowed on a street or lot.

Testing

The bulk specific gravity of each cored sample will be measured by the Engineer's NETTCP certified technician in accordance with AASHTO T166 or T275, whichever is applicable. The theoretical maximum specific gravity shall be measured once for each HMA sub-lot in accordance with the plant-produced material section. The theoretical value used for the percent density determinations of the

random samples shall be the average of the daily sub-lot measurements for maximum specific gravity. When daily sub-lot measurements are not available, the average of the previous five (5) laboratory measurements for that mix, or a representative test sample from the lift cored shall be used. The percent density of each test sample will be determined in accordance with AASHTO T269, using the bulk specific gravity obtained by cores or density gauge readings and the average theoretical maximum specific gravity. Retesting of pavement shall be in accordance with applicable provisions of the NETTCP Quality Assurance Technologist Manual, latest edition and these specifications.

Adjustment Pay Schedule for Density

The total HMA Adjustment (%) will be determined as described below based on the density adjustment schedule (Table 12) for Mat and (Table 13) for Longitudinal Joint (LJ). The total HMA Adjustment (%) shall be applied to the bid price per ton for compacted mixtures greater than or equal to 1 1/2 inches (37.5mm) in thickness as shown in the contract award to arrive at the total Asphalt Adjustment Cost based on density. Any incentive adjustments (greater than 100) will first be applied to offset penalty adjustments (less than 100).

Adjustment Pay Schedule for Mat Density - The pay factor based on the density adjustment schedule will be applied to the bid price per ton for compacted mixtures greater than or equal to 1-1/2 inches thickness as shown in the contract award.

Table 12.
HOT MIX ASPHALT MAT DENSITY
Adjustment Schedule

Average Percent of Maximum Density (minimum 5 samples)	Percent Payment
100.0 - 98.1	98
98.0 - 95.0	102
94.9 - 92.0	100
91.9 – 89.0	90
88.9 – 87.0	75
86.9 or less	rejection

Adjustment Pay Schedule for Longitudinal Joint Density - The pay factor based on the joint density adjustment schedule will be applied to the bid price per ton for compacted mixtures greater than or equal to 1 1/2 inches thickness as shown in the contract award.

Table 13.
HOT MIX ASPHALT LONGITUDINAL-JOINT DENSITY
Adjustment Schedule

Average Percent of Maximum Density (minimum 5 samples)	Percent Payment
100.0 - 98.1	98
98.0 - 95.0	102
94.9 - 90.0	100
89.9 - 89.0	90
88.9 - 88.0	80
87.9 - 87.0	70
86.9 or less	50% or rejection

The total hot mix asphalt adjustment will be based on the weighted sum as follows:

.60 Mat Adjustment + .40 LJ Adjustment = Total HMA Adjustment

When the construction of the pavement does not include the construction of a longitudinal joint, the payment adjustment will be based on Table 12 only, no weighted sum will be calculated. Any bonus will be credited against any payment adjustment in the contract for HMA, but in no case will the payment for HMA exceed 100%.

Rejection of Inferior HMA

The Engineer may at any time, not withstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of hot mix asphalt which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or improper mix temperature. Such rejection may be based on only visual inspection or temperature measurements. Similarly, the Engineer may at any time, not withstanding field acceptance for mat density, reject and require the Contractor to correct any HMA pavement that was placed with unacceptable mat uniformity or paving joints, due to low density, lack of bond, segregation, improper elevation, or tearing. In the event of such rejection, the Contractor and Engineer may take random split samples of the area(s) in question in the presence of the Engineer, and if it can be demonstrated in the laboratory, in the presence of the Engineer, that such material/pavement was erroneously rejected, payment will be made for the material at the contract unit price.

MEASUREMENT

Method of Measurement

The quantity of hot mix asphalt to be paid for shall be measured by the number of tons of hot mix asphalt used in the accepted work. The quantity of each truckload shall be obtained from printed tickets indicating the recorded batch weights or certified truck scale weights that have been properly countersigned by an authorized representative of the Engineer at the time of delivery. HMA quantities shall be verified by the Engineer using HMA yield calculations which will include the in-place bulk specific gravity and actual area and nominal depth for the mixture placed.

PAYMENT

Basis of Payment

Payment shall be made at the contract unit prices per ton complete in place with any applicable adjustments. This payment shall be full compensation for furnishing and placing all quality hot mix asphalt materials, including tack coat where specified, cutting of keyways or milling/stripping of pavement to produce neat joints, mechanical sweeping of streets, costs for Engineer testing due to inferior production or placement, and for all labor, tools, equipment, materials, and all incidentals necessary to complete the work. The payment for individual pavement lifts will be based on the tolerances identified in Table 4.06-3 of the Standard Specifications. An adjustment to the overall tonnage for the roadway will be made prior to paying for the surface course based on the overall tolerance as identified in the table. The Contractor will not be paid for any quantity over these tolerances.

The cost for tack coat and saw cutting of pavement limits where specified on the plans will be paid for under their respective items in the contract.

Adjustment for Density

A payment adjustment for density shall be made when the HMA material varies from the specification target limits, but is within the tolerances stated in Section "Adjustment Pay Schedule for Density". The 'Total HMA Adjustment' for that street or facility shall be applied to the actual tonnage accepted for that street or facility. Incentives will be applied to offset any penalties. Penalties resulting from the "Adjustment Pay Schedule for Density" shall be incorporated into the "Asphalt Adjustment Cost" (AAC) pay item as follows:

AAC = (Total HMA Adjustment (%) – 100) x Contract Price/Ton x Accepted Tonnage

The "Asphalt Adjustment Cost" will be calculated using the formulas indicated above for the Adjustment for Density. An increase in contract payment will NOT be made for incentive density results, any incentive densities payments will be applied to off-set penalty adjustments. A deduction from monies due the contractor will be made for any penalty densities remaining after deducting for incentive densities.

The sum of money shown on the estimate for Asphalt Adjustment Cost, and in the itemized proposal as "Estimated Cost", for this item will be considered the bid price although payment will be made as described above but in no case will the payment for HMA exceed 100%.

PAY ITEM	DESCRIPTION	PAY UNIT
Bid Item ?????	Superpave S0.25 Level 1	TON
Bid Item ?????	Superpave S0.375 Level 1	TON
Bid Item ?????	Superpave S0.5 Level 1	TON
Bid Item ?????	Superpave S1.0 Level 1	TON
Bid Item ?????	Superpave S0.25 Level 2	TON
Bid Item ?????	Superpave S0.375 Level 2	TON
Bid Item ?????	Superpave S0.5 Level 2	TON
Bid Item ?????	Superpave S1.0 Level 2	TON
Bid Item ?????	Superpave S0.25 Level 3	TON
Bid Item ?????	Superpave S0.375 Level 3	TON
Bid Item ?????	Superpave S0.5 Level 3	TON
Bid Item ?????	Superpave S1.0 Level 3	TON
Bid Item ?????	Asphalt Adjustment Cost	EST