

Section 460 Hot Mix Asphalt Pavement

460.1 Description

- (1) This section describes HMA mixture design, providing and maintaining a quality management program for HMA mixtures, and constructing HMA pavement. Unless specifically indicated otherwise, references within 460 to HMA also apply to WMA.

460.2 Materials

460.2.1 General

- (1) Furnish a homogeneous mixture of coarse aggregate, fine aggregate, mineral filler if required, SMA stabilizer if required, recycled material if used, warm mix asphalt additive or process if used, and asphaltic material.

460.2.2 Aggregates

460.2.2.1 General.

- (1) Provide coarse aggregates from a department-approved source as specified under [106.3.4.2](#). Obtain the engineer's approval of the aggregates before producing HMA mixtures.
- (2) Furnish an aggregate blend consisting of hard durable particles containing no more than a combined total of one percent, by weight, of lumps of clay, loam, shale, soft particles, organic matter, adherent coatings, and other deleterious material. Ensure that the aggregate blend conforms to the percent fractured faces and flat & elongated requirements of [table 460-2](#). If the aggregate blend contains materials from different deposits or sources, ensure that material from each deposit or source has an LA wear percent loss meeting the requirements of [table 460-2](#).

460.2.2.2 Freeze-Thaw Soundness

- (1) If the aggregate blend contains materials from different deposits or sources, ensure that material from each deposit or source has a freeze-thaw loss percentage meeting the requirements of [table 460-2](#) and [106.3.4.2.2](#).

460.2.2.3 Aggregate Gradation Master Range

Revise 460.2.2.3(1) table 460-1 to include gradation numbers and traffic levels used for the new combined bid items. This revision incorporates STSP 460-025 HMA Pavement (gradation)(traffic)(binder)(designation).

- (1) Ensure that the aggregate blend, including recycled material and mineral filler, conforms to the gradation requirements in table 460-1. The values listed are design limits; production values may exceed those limits.

TABLE 460-1 AGGREGATE GRADATION MASTER RANGE AND VMA REQUIREMENTS

SIEVE	PERCENT PASSING DESIGNATED SIEVES						
	NOMINAL SIZE						
	No. 1 (37.5 mm)	No. 2 (25.0 mm)	No.3 (19.0 mm)	No. 4 (12.5 mm)	No. 5 (9.5 mm)	SMA No. 4 (12.5 mm)	SMA No. 5 (9.5 mm)
50.0-mm	100						
37.5-mm	90 –100	100					
25.0-mm	90 max	90 -100	100				
19.0-mm	___	90 max	90 -100	100		100	
12.5-mm	___	___	90 max	90 -100	100	90 - 97	100
9.5-mm	___	___	___	90 max	90 -100	58 - 72	90 - 100
4.75-mm	___	___	___	___	90 max	25 - 35	35 - 45
2.36-mm	15 – 41	19 - 45	23 - 49	28 - 58	32 - 67	15 - 25	18 - 28
75-µm	0 – 6.0	1.0 - 7.0	2.0 - 8.0	2.0 - 10.0	2.0 - 10.0	8.0 - 12.0	10.0 - 14.0
% MINIMUM VMA	11.0	12.0	13.0	14.0 ^[1]	15.0 ^[2]	16.0	17.0

^[1] 14.5 for LT and MT mixes.

^[2] 15.5 for LT and MT mixes.

460.2.3 Asphaltic Binders

- (1) The department will designate the grade of asphaltic binder in the HMA Pavement bid item. Use the binder grade the bid item specifies. Do not change the PG binder grade without the engineer's written approval. The department will designate the grade of virgin asphaltic binder in the contract, however, the contractor may use virgin binder, modified binder, a blend of virgin and recovered binder, or a blend of

modified and recovered binder. When the percent asphalt binder replaced exceeds the allowable limits in [460.2.5](#), provide test results from extracted and recovered binder to ensure that the resultant asphaltic binder conforms to the contract specifications.

460.2.4 Additives

460.2.4.1 Hydrated Lime Antistripping Agent

- (1) If used in HMA mixtures, furnish hydrated lime conforming to [ASTM C977](#) and containing no more than 8 percent unhydrated oxides. Percent added is by weight of the total dry aggregate.

460.2.4.2 Liquid Antistripping Agent

- (1) If used in HMA mixtures, add liquid antistripping agent to the asphaltic binder before introducing the binder into the mixture. Provide documentation indicating that addition of liquid antistripping agent will not alter the characteristics of the original asphaltic binder performance grade (PG).

460.2.4.3 Stone Matrix Asphalt Stabilizer

- (1) Add an organic fiber, an inorganic fiber, a polymer-plastic, a polymer-elastomer, or approved alternate stabilizer to all SMA mixtures. If proposing an alternate, submit the proposed additive system, asphaltic binder, and stabilizer additive, along with samples of the other mixture materials to the department at least 14 days before the project let date. The department will approve or reject that proposed alternate additive system no later than 48 hours before the project let date.
- (2) Use a single additive system for all SMA pavement in the contract.

460.2.4.4 Warm Mix Asphalt Additive or Process

- (1) Use additives or processes from the department's approved products list. Follow supplier or manufacturer recommendations for additives and processes when producing WMA mixtures.

460.2.5 Recycled Asphaltic Materials

- (1) The contractor may use recycled asphaltic materials from FRAP, RAP, and RAS in HMA mixtures. Stockpile recycled materials separately from virgin materials and list each as individual JMF components.
- (2) Control recycled materials used in HMA by evaluating the percent binder replacement, the ratio of recovered binder to the total binder. Conform to the following:

RECYCLED ASPHALTIC MATERIAL	MAXIMUM ALLOWABLE PERCENT BINDER REPLACEMENT	
	LOWER LAYERS	UPPER LAYER
RAS if used alone	25	20
RAP and FRAP in any combination	40	25
RAS, RAP, and FRAP in combination ^[1]	35	25

^[1] When used in combination the RAS component cannot exceed 5 percent of the total weight of the aggregate blend.

460.2.6 Recovered Asphaltic Binders

- (1) Establish the percent of recovered asphaltic binder from FRAP, RAP, and RAS for the mixture design according to AASHTO T164 using the appropriate dust correction procedure. If production test results indicate a change in the percent of recovered asphaltic binder, the contractor or the engineer may request a change in the design recovered asphaltic binder. Provide the department with at least 2 recent extraction samples supporting that change. Ensure that those samples were prepared according to [CMM 8-65](#) by a WisDOT qualified laboratory.
- (2) The contractor may replace virgin binder with recovered binder up to the maximum percentage allowed under [460.2.5](#) without changing the asphaltic binder grade. If using more than the maximum allowed under [460.2.5](#), furnish test results indicating that the resultant binder meets the grade the contract originally specified.

460.2.7 HMA Mixture Design

- (1) For each HMA mixture type used under the contract, develop and submit an asphaltic mixture design according to [CMM 8-66](#) and conforming to the requirements of [table 460-1](#) and [table 460-2](#). The values listed are design limits; production values may exceed those limits. The department will review mixture designs and report the results of that review to the designer according to [CMM 8-66](#).

Revise 460.2.7(1) table 460-2 to switch from E mixes to LT, MT, and HT mixes; and change tensile strength ratios. This revision incorporates STSP 460-025 HMA Pavement (gradation)(traffic)(binder)(designation).

TABLE 460-2 MIXTURE REQUIREMENTS

Mixture type	LT	MT	HT	SMA
ESALs x 10 ⁶ (20 yr design life)	<2.0	2 - <8	>8	> 5 mil
LA Wear (AASHTO T96)				
100 revolutions(max % loss)	13	13	13	13
500 revolutions(max % loss)	50	45	45	40
Soundness (AASHTO T104) (sodium sulfate, max % loss)	12	12	12	12
Freeze/Thaw (AASHTO T103) (specified counties, max % loss)	18	18	18	18
Fractured Faces (ASTM D5821) (one face/2 face, % by count)	65/ ___	75 / 60	98 / 90	100/90
Flat & Elongated (ASTM D4791) (max %, by weight)	5 (5:1 ratio)	5 (5:1 ratio)	5 (5:1 ratio)	20 (3:1 ratio)
Fine Aggregate Angularity (AASHTO T304, method A, min)	40	43	45	45
Sand Equivalency (AASHTO T176, min)	40	40	45	50
Gyratory Compaction				
Gyrations for N _{ini}	6	7	8	8
Gyrations for N _{des}	40	75	100	65
Gyrations for N _{max}	60	115	160	160
Air Voids, %V _a (%G _{mm} N _{des})	4.0 (96.0)	4.0 (96.0)	4.0 (96.0)	4.0 (96.0)
% G _{mm} N _{ini}	<= 91.5 ^[1]	<= 89.0 ^[1]	<= 89.0	___
% G _{mm} N _{max}	<= 98.0	<= 98.0	<= 98.0	___
Dust to Binder Ratio ^[2] (% passing 0.075/P _{be})	0.6 - 1.2	0.6 - 1.2	0.6 - 1.2	1.2 - 2.0
Voids filled with Binder (VFB or VFA, %)	68 - 80 ^{[4] [5]}	65 - 75 ^{[3] [5]}	65 - 75 ^{[3] [5]}	70 - 80
Tensile Strength Ratio (TSR) (AASHTO T283)				
no antistripping additive	0.75	0.75	0.75	0.75
with antistripping additive	0.80	0.80	0.80	0.80
Draindown (AASHTO T305) (%)	___	___	___	0.30

^[1] The percent maximum density at initial compaction is only a guideline.

^[2] For a gradation that passes below the boundaries of the caution zone (ref. AASHTO M323), the dust to binder ratio limits are 0.6 - 1.6.

^[3] For No. 5 (9.5mm) and No. 4 (12.5 mm) nominal maximum size mixtures, the specified VFB range is 70 - 76%.

^[4] For No. 2 (25.0mm) nominal maximum size mixes, the specified VFB lower limit is 67%.

^[5] For No. 1 (37.5mm) nominal maximum size mixes, the specified VFB lower limit is 67%.

460.2.8 Quality Management Program

460.2.8.1 General

- (1) Provide and maintain a QC program defined as all activities, including mix design, process control inspection, sampling and testing, and process adjustments related to producing and placing HMA pavement conforming to the specifications.
- (2) The department will provide product quality verification as follows:
 1. By conducting verification testing of independent samples.
 2. By periodically observing contractor sampling and testing.
 3. By monitoring required control charts exhibiting test results and control parameters.
 4. By the engineer directing the contractor to take additional samples at any time during production.
- (3) Refer to [CMM 8-36](#) for detailed guidance on sampling, testing, and documentation under the QMP.

460.2.8.2 Contractor Testing

460.2.8.2.1 Required Quality Control Program

460.2.8.2.1.1 Personnel Requirements

- (1) Provide HTCP-certified sampling and testing personnel. Provide at least one full-time HMA technician certified at a level appropriate for sampling and production control testing at each plant site furnishing material to the project. Before mixture production begins, provide an organizational chart in the contractor's laboratory. Include the names, telephone numbers, and current certifications of personnel with QC responsibilities. Keep the chart updated.
- (2) Ensure that sampling and testing personnel are minimally qualified as follows^[1]:
 - HMA technician certified at a level appropriate for sampling and production control testing.
 - HMA ACT^[2].

^[1] After informing the engineer, a non-certified person under the direct observation of a certified HMA technician may sample for a period not to exceed 3 calendar days.

^[2] A certified HMA technician must coordinate and take responsibility for the work an ACT performs. No more than one ACT can work under a single certified technician.

- (3) Have a certified HMA technician ensure that sampling and testing is performed correctly, analyze test results, and post resulting data.
- (4) Have an HMA technician certified at a level appropriate for process control and troubleshooting or mix design available to make necessary process adjustments.

460.2.8.2.1.2 Laboratory Requirements

- (1) Conduct QC testing in a facility conforming to the department's laboratory qualification program.
- (2) Ensure that testing equipment conforms to the equipment specifications applicable to the required testing methods.

460.2.8.2.1.3 Required Sampling and Testing

460.2.8.2.1.3.1 Contracts with 5000 Tons of Mixture or Greater

- (1) Furnish and maintain a laboratory at the plant site fully equipped for performing contractor QC testing. Have the laboratory on-site and operational before beginning mixture production.
- (2) Obtain random samples and perform tests according to [CMM 8-36](#). Obtain HMA mixture samples from trucks at the plant. Perform tests the same day taking the sample.
- (3) Retain the split portion of the contractor HMA mixture and blended aggregate samples for 14 calendar days at the laboratory site in a dry, protected area. The engineer may decrease this 14-day retention period. At project completion the contractor may dispose of remaining samples if the engineer approves.
- (4) Use the test methods identified below, or other methods the engineer approves, to perform the following tests at a frequency greater than or equal to that indicated:

Blended aggregate gradations:

Drum plants:

- Field extraction by [CMM 8-36](#).
- Belt samples, optional for virgin mixtures, obtained from stopped belt or from the belt discharge using an engineer-approved sampling device and performed according to AASHTO T11 and T27.

Batch plants:

- Field extraction by [CMM 8-36](#).

Asphalt content (AC) in percent:

AC by calculation.

AC by nuclear gauge reading, optional.

AC by inventory, optional.

Bulk specific gravity of the compacted mixture according to AASHTO T166.

Maximum specific gravity according to AASHTO T209.

Air voids (V_a) by calculation according to AASHTO T269.

VMA by calculation according to AASHTO R35.

- (5) Test each design mixture at a frequency at or above the following:

TOTAL DAILY PLANT PRODUCTION

FOR DEPARTMENT CONTRACTS

in tons
 50 to 600
 601 to 1500
 1501 to 2700
 2701 to 4200
 greater than 4200

SAMPLES
 PER DAY^[1]

1
 2
 3
 4

see footnote^[2]

^[1] Frequencies are for planned production. If production is other than planned, conform to [CMM 8-36](#).

^[2] Add a random sample for each additional 1500 tons or fraction of 1500 tons.

- (6) Also conduct field tensile strength ratio tests according to [ASTM D4867](#) on mixtures requiring an antistripping additive. Test each full 50,000 ton production increment, or fraction of an increment, after the first 5000 tons of production. Perform required increment testing in the first week of production of that increment. If field tensile strength ratio values are either below the spec limit or less than the mixture design JMF percentage value by 20 or more, notify the engineer. The engineer and contractor will jointly determine a corrective action.

460.2.8.2.1.3.2 Contracts with Less Than 5000 Tons of Mixture

- (1) Conform to [460.2.8.2.1.3.1](#) modified as follows:
 - The contractor may conduct QC tests in an off-site laboratory.
 - No field tensile strength ratio testing is required.

460.2.8.2.1.3.3 Contracts with Less Than 500 Tons of Mixture

- (1) The engineer may waive QC testing on contracts with less than 500 tons of mixture. If testing is waived, acceptance will be by visual inspection unless defined otherwise by contract change order.
- (2) If HMA density testing is waived under [460.3.3.3](#), QC testing is also waived.

460.2.8.2.1.3.4 Temporary Pavements

- (1) The engineer may waive all testing for temporary pavements, defined for this purpose as pavements that will be placed and removed before contract completion.

460.2.8.2.1.4 Documentation

460.2.8.2.1.4.1 Records

- (1) Document observations, inspection records, mixture adjustments, and test results daily. Note observations and inspection records in a permanent field record as they occur. Record process adjustments and JMF changes. Submit copies of the running average calculation sheets for blended aggregate, mixture properties, and asphalt content along with mixture adjustment records to the engineer each day. Submit testing records and control charts to the engineer in a neat and orderly manner within 10 days after paving is completed.
- (2) Continue charts, records, and testing frequencies, for a mixture produced at one plant site, from contract to contract.

460.2.8.2.1.4.2 Control Charts

- (1) Maintain standardized control charts at the laboratory. Record contractor test results on the charts the same day as testing. Record data on the standardized control charts as follows:
 - Blended aggregate gradation tests in percent passing. Of the following, plot those sieves the design specifications require: 37.5-mm, 25.0-mm, 19.0-mm, 12.5-mm, 9.5-mm, 2.36-mm, and 75-µm.
 - Asphalt material content in percent.
 - Air voids in percent.
 - VMA in percent.
- (2) Plot both the individual test point and the running average of the last 4 data points on each chart. Show QC data in black with the running average in red. Draw the warning limits with a dashed green line and the JMF limits with a dashed red line. The contractor may use computer generated black-and-white printouts with a legend that clearly identifies the specified color coded components.

460.2.8.2.1.5 Control Limits

- (1) Conform to the following control limits for the JMF and warning limits based on a running average of the last 4 data points:

ITEM	JMF LIMITS	WARNING LIMITS
Percent passing given sieve:		
37.5-mm	+/- 6.0	+/- 4.5

25.0-mm	+/- 6.0	+/- 4.5
19.0-mm	+/- 5.5	+/- 4.0
12.5-mm	+/- 5.5	+/- 4.0
9.5-mm	+/- 5.5	+/- 4.0
2.36-mm	+/- 5.0	+/- 4.0
75-µm	+/- 2.0	+/- 1.5
Asphaltic content in percent	- 0.3	- 0.2
Air voids in percent	+/- 1.3	+/- 1.0
VMA in percent ^[1]	- 0.5	- 0.2

^[1] VMA limits based on minimum requirement for mix design nominal maximum aggregate size in [table 460-1](#).

- (2) Warning bands are defined as the area between the JMF limits and the warning limits.

460.2.8.2.1.6 Job Mix Formula Adjustment

- (1) The contractor may request adjustment of the JMF according to [CMM 8-66.2](#). Have an HMA technician certified at a level appropriate for process control and troubleshooting or mix design submit a written JMF adjustment request. Ensure that the resulting JMF is within specified master gradation bands. The department will have a certified Hot Mix Asphalt, Mix Design, Report Submittals technician review the proposed adjustment and, if acceptable, issue a revised JMF.
- (2) The department will not allow adjustments that do the following:
- Exceed specified JMF tolerance limits.
 - Reduce the JMF asphalt content unless the production VMA running average meets or exceeds the minimum VMA design requirement defined in [table 460-1](#) for the mixture produced.
- (3) Have a certified Hot Mix Asphalt, Troubleshooting, Process Control technician make related process adjustments. If mixture redesign is necessary, submit a new JMF, subject to the same specification requirements as the original JMF.

460.2.8.2.1.7 Corrective Action

- (1) When running average values trend toward the warning limits, consider taking corrective action. Document corrective actions undertaken. Include test results in the contract files and in running average calculations.
- (2) Notify the engineer if running average values exceed the warning limits. If two consecutive running average values exceed the warning limits, stop production and make adjustments. Do not restart production until after notifying the engineer of the adjustments made. Do not calculate a new running average until the fourth test after the required production stop.
- (3) If the process adjustment improves the property in question so that the running average after 4 additional tests is within the warning limits, the contractor may continue production with no reduction in payment.
- (4) If the adjustment does not improve the properties and the running average after 4 additional tests stays inside the warning bands, the mixture is nonconforming and subject to pay adjustment.
- (5) If the contractor fails to stop production and make adjustments when required, all mixture produced from the stop point to the point when the running average is back inside the warning limits is nonconforming and subject to pay adjustment.

Delete 460.2.8.2.1.7(6) to move pay adjustment for nonconforming materials to the payment subsection.

- (6) If the running average values exceed the JMF limits, stop production and make adjustments. Do not restart production until after notifying the engineer of the adjustments made. Continue calculating the running average after the production stop.
- (7) If the air voids running average of 4 exceeds the JMF limits, the material is nonconforming. Remove and replace unacceptable material. The engineer will determine the quantity of material to replace based on the testing data using the methods in [CMM 8-36](#) and an inspection of the completed pavement. If the engineer allows the mixture to remain in place, the department will pay for the mixture and asphaltic material as specified in [460.5.2.1](#).
- (8) If the running average of 4 exceeds the JMF limits for other properties, and the engineer allows the mixture to remain in place, the department will pay for the mixture as specified in [460.5.2.1](#). The engineer will determine the quantity of material subject to pay reduction based on the testing data and an inspection of the completed pavement.

Vacate 460.2.8.2.2 to eliminate contractor assurance HMA testing from the contract. The department no longer recognizes these tests as a valid means to assure the accuracy of QC test results.

460.2.8.2.2 (Vacant)

460.2.8.3 Department Testing

460.2.8.3.1 Quality Verification Program

460.2.8.3.1.1 General

- (1) The engineer will conduct QV tests to determine the quality of the final product and measure characteristics that predict relative performance.

460.2.8.3.1.2 Personnel Requirements

- (1) The department will provide at least one HTCP-certified HMA technician, certified at a level appropriate for sampling and mixture production control testing, to observe QV sampling of project mixtures.
- (2) An HMA technician certified at a level appropriate for sampling and mixture production control testing, or an HMA ACT working under the HMA certified technician, will split samples and do the testing. An HMA technician certified at a level appropriate for sampling and mixture production control testing must coordinate and take responsibility for the work an ACT performs. No more than one ACT can work under a single certified technician.
- (3) An HMA technician certified at a level appropriate for sampling and mixture production control testing will ensure that sampling and testing is performed correctly, analyze test results, and post resulting data.
- (4) The department will make an organizational chart available at the testing laboratory and to the contractor before mixture production begins. The department's chart will include names, telephone numbers, and current certifications of QV testing personnel. The department will update the chart with appropriate changes, as they become effective.

460.2.8.3.1.3 Laboratory Requirements

- (1) The department will furnish and maintain a facility for QV testing conforming to the department's laboratory qualification program requirements and fully equipped to perform QV testing. In all cases, the department will conduct testing in a separate laboratory from the contractor's laboratory.

460.2.8.3.1.4 Department Verification Testing Requirements

- (1) HTCP-certified department personnel will obtain random samples by directly supervising HTCP-certified contractor personnel sampling from trucks at the plant. The department will sample according to [CMM 8-36](#). Sample size must be adequate to run the appropriate required tests in addition to one set of duplicate tests that may be required for dispute resolution. The engineer will split the sample for testing and retain the remaining portion for additional testing if needed.
- (2) The department will verify product quality using the test methods specified in 460.2.8.3.1.4(3), other engineer-approved methods, or other methods the industry and department HMA technical team recognizes. The department will identify test methods before construction starts and use only those methods during production of that material unless the engineer and contractor mutually agree otherwise.
- (3) The department will perform testing conforming to the following standards:
 - Bulk specific gravity (G_{mb}) of the compacted mixture according to AASHTO T166.
 - Maximum specific gravity (G_{mm}) according to AASHTO T209.
 - Air voids (V_a) by calculation according to AASHTO T269.
 - VMA by calculation according to AASHTO R35.
- (4) The department will randomly test each design mixture at the following minimum frequency:
 - FOR TONNAGES TOTALING:
 - Less than 501 tons no tests required
 - From 501 to 5,000 tons..... one test
 - More than 5,000 tons..... add one test for each additional 5,000-ton increment

460.2.8.3.1.5 Documentation

- (1) The engineer will document observations during QV sampling, and review QC mixture adjustments and QC test results daily. The engineer will note results of observations and inspection records in a permanent field record as they occur.

460.2.8.3.1.6 Acceptable Verification Parameters

- (1) The engineer will provide test results to the contractor within 2 mixture-production days after obtaining the sample. The quality of the product is acceptably verified if it meets the following limits:

- Va is within a range of 2.7 to 5.3 percent.
 - VMA is within minus 0.5 of the minimum requirement for the mix design nominal maximum aggregate size.
- (2) If QV test results are outside the specified limits, the engineer will investigate immediately through dispute resolution procedures. The engineer may stop production while the investigation is in progress if the potential for a pavement failure is present.
 - (3) If production continues for that mixture design, the engineer will provide additional retained sample testing at the frequency provided for in [CMM 8-36](#). This supplemental testing will continue until the material meets allowable differences or as the engineer and contractor mutually agree.

460.2.8.3.1.7 Dispute Resolution

- (1) When QV test results do not meet the specified limits, the bureau's AASHTO accredited laboratory and certified personnel will referee test the retained portion of the QV sample and the retained portion of the nearest available previous QC sample.
- (2) The department will notify the contractor of the referee test results within 3 business days after receipt of the samples.
- (3) The department will determine mixture conformance and acceptability by analyzing referee test results, reviewing mixture project data, and inspecting the completed pavement all according to [CMM 8-36](#).

460.2.8.3.1.8 Corrective Action

- (1) Remove and replace unacceptable material at no additional expense to the department.
- (2) The department will reduce pay for the tonnage of nonconforming mixture, as determined during QV dispute resolution, if the engineer allows that mixture to remain in place. If production of that mixture design continued during the investigation, the department will also adjust pay for that mixture forward to the next conforming QV or QC point. The department will pay for the affected mixture as specified in [460.5.2.1](#).

460.2.8.3.2 Independent Assurance Testing

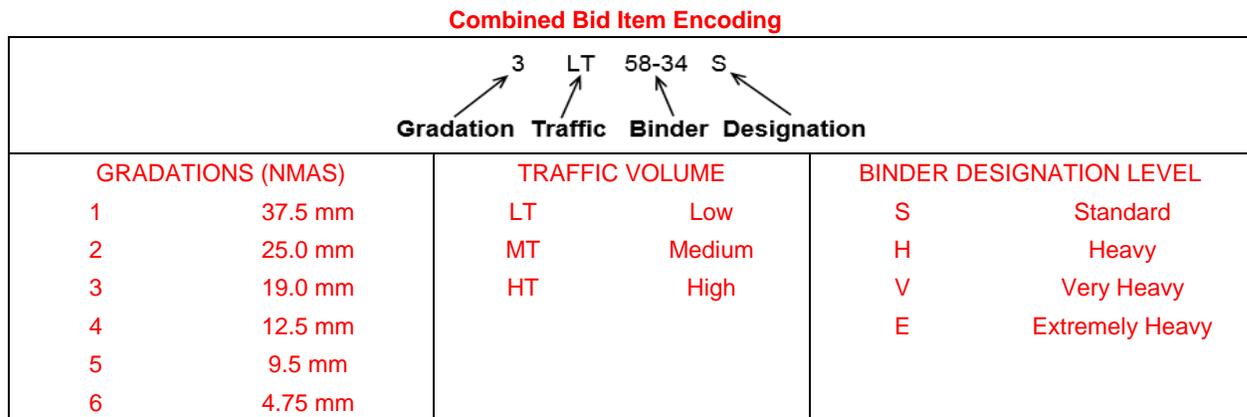
- (1) The department will evaluate both the contractor and department testing personnel and equipment as specified in [106.3.4.3.4](#).

460.3 Construction

460.3.1 General

Revise 460.3.1 to specify the encoding for the combined bid item naming convention.

- (1) Construct HMA pavement of the type the bid item indicates encoded as follows:



- (2) Construct HMA pavement conforming to the general provisions of [450.3](#).

460.3.2 Thickness

Revise 460.3.2(1) to include gradation numbers and update the minimum and maximum required thickness.

- (1) Provide the plan thickness for lower and upper layers limited as follows:

NOMINAL SIZE	MINIMUM LAYER THICKNESS in inches	MAXIMUM LOWER LAYER THICKNESS in inches	MAXIMUM UPPER LAYER THICKNESS in inches	MAXIMUM SINGLE LAYER THICKNESS ^[3] in inches
No. 1 (37.5 mm)	4.5	6	4.5	6
No. 2 (25.0 mm)	3.0	5	4	6
No. 3 (19.0 mm)	2.25	4	3	5
No. 4 (12.5 mm) ^[1] ^[4]	1.75	3 ^[2]	2.5	4
No. 5 (9.5 mm) ^[1] ^[4]	1.5	3 ^[2]	2	3

^[1] SMA mixtures use nominal size No. 4 (12.5 mm) or No. 5 (9.5 mm).

^[2] SMA mixtures with nominal sizes of No. 4 (12.5 mm) and No. 5 (9.5 mm) have no maximum lower layer thickness specified.

^[3] For use on cross-overs and shoulders.

^[4] Can be used for a leveling layer or scratch coat at a reduced thickness.

460.3.3 HMA Pavement Density Maximum Density Method

460.3.3.1 Minimum Required Density

Revise 460.3.3.1(1) table 460-3 to switch from E mixes to LT, MT, and HT mixes. This revision incorporates STSP460-025.

- (1) Compact all layers of HMA mixture to the density table 460-3 shows for the applicable mixture, location, and layer.

TABLE 460-3 MINIMUM REQUIRED DENSITY^[1]

LOCATION	LAYER	PERCENT OF TARGET MAXIMUM DENSITY		
		MIXTURE TYPE		
		LT and MT	HT	SMA ^[5]
TRAFFIC LANES ^[2]	LOWER	91.5 ^[3]	92.0 ^[4]	—
	UPPER	91.5	92.0	—
SIDE ROADS, CROSSOVERS, TURN LANES, & RAMPS	LOWER	91.5 ^[3]	92.0 ^[4]	—
	UPPER	91.5	92.0	—
SHOULDERS & APPURTENANCES	LOWER	89.5	89.5	—
	UPPER	90.5	90.5	—

^[1] The table values are for average lot density. If any individual density test result falls more than 3.0 percent below the minimum required target maximum density, the engineer may investigate the acceptability of that material.

^[2] Includes parking lanes as determined by the engineer.

^[3] Minimum reduced by 2.0 percent for a lower layer constructed directly on crushed aggregate or recycled base courses.

^[4] Minimum reduced by 1.0 percent for a lower layer constructed directly on crushed aggregate or recycled base courses.

^[5] The minimum required densities for SMA mixtures are determined according to [CMM 8-15](#).

460.3.3.2 Pavement Density Determination

- (1) The engineer will determine the target maximum density using department procedures described in [CMM 8-15](#). The engineer will determine density as soon as practicable after compaction and before placement of subsequent layers or before opening to traffic.
- (2) Do not re-roll compacted mixtures with deficient density test results. Do not operate continuously below the specified minimum density. Stop production, identify the source of the problem, and make corrections to produce work meeting the specification requirements.
- (3) A lot is defined in [CMM 8-15](#) and placed within a single layer for each location and target maximum density category indicated in [table 460-3](#). The lot density is the average of all samples taken for that lot. The department determines the number of tests per lot according to either the linear subplot system or the nominal tonnage system defined in [CMM 8-15](#).
- (4) A certified nuclear density technician, or a nuclear density ACT working under a certified nuclear density technician, will locate samples and perform the testing. A certified nuclear density technician must coordinate and take responsibility for the work an ACT performs. No more than one ACT can work under

a single certified technician. The responsible certified technician will ensure that sample location and testing is performed correctly, analyze test results, and provide density results to the contractor weekly.

460.3.3.3 Waiving Density Testing

- (1) The engineer may waive density testing for one or more of the following reasons:
 1. It is impracticable to determine density by the lot system.
 2. The contract contains less than 750 tons of a given mixture type placed within the same layer and target maximum density category.
- (2) If the department waives density testing notify the contractor before paving. The department will accept the mixture by the ordinary compaction procedure as specified in [450.3.2.6.2](#).
- (3) If HMA QC testing is waived under [460.2.8.2.1.3.3](#), density testing is also waived.

460.4 Measurement

- (1) The department will measure the HMA Pavement bid items acceptably completed by the ton as specified in [450.4](#).

460.5 Payment

460.5.1 General

Revise 460.5.1(1) to add combined bid items that specify the gradation, traffic, binder, and designation. This revision incorporates STSP460-025.

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
460.5000 - 5999	HMA Pavement (gradation) LT (binder)(designation)	TON
460.6000 - 6999	HMA Pavement (gradation) MT (binder)(designation)	TON
460.7000 - 7999	HMA Pavement (gradation) HT (binder)(designation)	TON
460.8000 - 8999	HMA Pavement (gradation) SMA (binder)(designation)	TON
460.2000	Incentive Density HMA Pavement	DOL

460.5.2 HMA Pavement

460.5.2.1 General

Revise 460.5.2.1 to specify nonconforming combined bid item pay adjustments. This revision incorporates STSP460-025.

- (1) The department will pay for the HMA Pavement bid items at the contract unit price subject to one or more of the following adjustments:
 1. Disincentive for density of HMA pavement as specified in [460.5.2.2](#).
 2. Incentive for density of HMA pavement as specified in [460.5.2.3](#).
 3. Reduced payment for nonconforming smoothness as specified in [450.3.2.9](#).
 4. Reduced payment for nonconforming QMP HMA mixtures as specified in [460.2.8.2.1.7](#).
- (2) Payment for the HMA Pavement bid items is full compensation for **providing HMA pavement including binder**; for mixture design; for preparing the foundation; and for QMP and aggregate source testing.
- (3) If provided for in the plan quantities, the department will pay for a leveling layer, placed to correct irregularities in an existing paved surface before overlaying, under the pertinent paving bid item. Absent a plan quantity, the department will pay for a leveling layer as extra work.
- (4) The department will administer pay reduction for nonconforming QMP mixture under the Nonconforming QMP HMA Mixture administrative item. The department will reduce pay based on the contract unit price for the HMA Pavement bid item.
- (5) **The department will reduce pay for nonconforming QMP HMA mixtures as specified in [460.2.8.2.1.7](#), starting from the stop point to the point when the running average of 4 is back inside the warning limits. The engineer will determine the quantity of material subject to pay reduction based on the testing data and an inspection of the completed pavement. The department will reduce pay as follows:**

PAYMENT FOR MIXTURE^[1] ^[2]

ITEM	PRODUCED WITHIN	PRODUCED OUTSIDE
	WARNING BANDS	JMF LIMITS
Gradation	90%	75%
Asphalt Content	85%	75%
Air Voids	70%	50%
VMA	90%	75%

^[1] For projects or plants where the total production of each mixture design requires less than 4 tests refer to [CMM 8-36](#).

^[2] Payment is in percent of the contract unit price for the HMA Pavement bid item. The department will reduce pay based on the nonconforming property with lowest percent pay.

^[3] In addition to any pay adjustment listed in the table above, the department will adjust pay for nonconforming binder under the Nonconforming QMP Asphaltic Material administrative item. The department will deduct 25 percent of the contract unit price of the HMA Pavement bid item per ton of pavement placed with nonconforming PG binder the engineer allows to remain in place.

- (6) If the department discovers nonconforming mixture during a QV dispute resolution investigation, and the engineer allows that mixture to remain in place, the department will pay for the quantity of affected material as specified in [460.2.8.3.1.8](#) at 50 percent of the contract price.
- (7) If the department waives density testing under [460.3.3.3](#), the department will not adjust pay under either [460.5.2.2](#) or [460.5.2.3](#).
- (8) Restore the surface after cutting density samples as specified in [460.3.3.2\(1\)](#) at no additional cost to the department.

460.5.2.2 Disincentive for HMA Pavement Density

- (1) The department will administer density disincentives under the Disincentive Density HMA Pavement administrative item. If the lot density is less than the specified minimum in [table 460-3](#), the department will reduce pay based on the contract unit price for the HMA Pavement bid item for that lot as follows:

DISINCENTIVE PAY REDUCTION FOR HMA PAVEMENT DENSITY	
PERCENT LOT DENSITY	PAYMENT FACTOR
BELOW SPECIFIED MINIMUM	(percent of contract price)
From 0.5 to 1.0 inclusive	98
From 1.1 to 1.5 inclusive	95
From 1.6 to 2.0 inclusive	91
From 2.1 to 2.5 inclusive	85
From 2.6 to 3.0 inclusive	70
More than 3.0 ^[1]	—

^[1] Remove and replace the lot with a mixture at the specified density. When acceptably replaced, the department will pay for the replaced work at the contract unit price. Alternatively the engineer may allow the nonconforming material to remain in place with a 50 percent payment factor.

- (2) The department will not assess density disincentives for pavement placed in cold weather because of a department-caused delay as specified in [450.5.2\(3\)](#).

460.5.2.3 Incentive for HMA Pavement Density

- (1) If the lot density is greater than the minimum specified in [table 460-3](#) and all individual air voids test results for that mixture placed during the same day are within +1.0 percent or - 0.5 percent of the design target in [table 460-2](#), the department will adjust pay for that lot as follows:

INCENTIVE PAY ADJUSTMENT FOR HMA PAVEMENT DENSITY	
PERCENT LOT DENSITY ABOVE SPECIFIED MINIMUM	PAY ADJUSTMENT PER TON ^[1]
From -0.4 to 1.0 inclusive	\$0
From 1.1 to 1.8 inclusive	\$0.40
More than 1.8	\$0.80

^[1] The department will prorate the pay adjustment for a partial lot.

- (2) The department will adjust pay under the Incentive Density HMA Pavement bid item. Adjustment under this item is not limited, either up or down, to the bid amount the schedule of items shows.
- (3) The department will restrict incentive payment for shoulders paved integrally with the traffic lane, if the traffic lane does not meet incentive requirements, the department will not pay incentive on the integrally paved shoulder.