



# INDIANA DEPARTMENT OF TRANSPORTATION

Driving Indiana's Economic Growth

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**Eric Holcomb, Governor**  
**Joe McGuinness, Commissioner**


March 1, 2019

## CONSTRUCTION MEMORANDUM

19-03

(REVISED)

TO: District Deputy Commissioners  
District Construction Directors  
District Technical Services Directors  
District Area Engineers,  
Project Engineers/Supervisors  
District Project Management Director,  
Project Management Director  
District Traffic Engineers,  
District Testing Engineers  
District LPA Coordinators,  
Field Engineers,  
Office of Material Management

FROM: John Leckie, Director   
Division of Construction and Materials Management

SUBJECT: QC/QA Hot Mix Asphalt 2019 Specification changes

Recurring Special Provision 401-R-661, effective for contracts with a letting date on or after October 1, 2017 has been reviewed by the Department. This also includes contracts that adopted the Unique Special Provisions related to Construction Memo 18-01. The review has resulted in an updated RSP 401-R-661, revised 01-17-19, which can be found on the Department's website and is attached to this memo.

### “RSP 401-R-661 (Revised 01-17-19)”

This RSP eliminates the requirements in 401.12 regarding the need for a test strip. It also makes changes in 401.19 regarding how the following pay factor parameters are calculated; Percent within Limits, Lot Composite, and Sublot Composite. It also alters 401.20 regarding core appeals.

Lastly, the RSP also includes Superpave 5 specification updates: It modifies 401.05 regarding design requirements for dense graded mixtures. Furthermore it modifies 401.19 regarding air void and density specification limits.

If a contractor chooses to utilize this RSP on a contract where it is not in the original contract documents, a no cost change order will need to be generated in accordance with 109.05.

### “2019 QC/QA HMA – Superpave 4”

The Department has also reviewed RSP 401-R-661, revised 01-17-19, and understands that Superpave 5 requirements may be challenging to fully implement at the start of the construction season. It has resulted in a USP, which is also attached to this memo.

This USP eliminates the requirements in 401.12 regarding the need for a test strip. It also makes changes in 401.19 regarding how the following pay factor parameters are calculated; Percent within Limits, Lot Composite, and Sublot Composite. It also alters 401.20 regarding core appeals. It does not incorporate any of the Superpave 5 specification updates.

**“2019 QC/QA HMA – Superpave 4 and Superpave 5”**

Contractors have expressed interest with utilizing Superpave 5 mix designs on some items or portions of items during the 2019 construction season, without fully implementing for all items. This option allows the contractor to utilize Superpave 4 or Superpave 5 mix designs on a contract, at any time during 2019.

If a contractor chooses to utilize either USP on a contract where it is not in the original contract documents, a no cost change order will need to be generated in accordance with 109.05. These USPs can only be applied to contracts let before September 1, 2019.

Only one provision can be applied to a contract containing RSP 401-R-661 (or CM 18-01 provisions). A contract may **not** have multiple options applied.

This memorandum will **not** apply to mixture placed on contracts let on or after September 1, 2019, and on contracts let after February 6, 2019 but placed after January 1, 2020. Mixture placed on contracts let after February 6, 2019 will be required to utilize Superpave 5 mix designs beginning with the 2020 construction season and beyond.

Further guidance and clarification will be contained in the Testing Memorandum, located on the Office of Materials Management website.

Should you have any questions on the issue of QC/QA HMA, please contact the Office of Materials Management.

**ATTACHMENTS:**

- Unique Special Provision "2019 QC/QA HMA – Superpave 4"
- Unique Special Provision "2019 QC/QA HMA - Superpave 4 and Superpave 5"
- Recurring Special Provision "401-R-661 QC/QA HOT MIX ASPHALT, HMA, PAVEMENT" (*Revised 01-17-19*).

JHL/NEA/mpb

## 2019 QC/QA HMA - SUPERPAVE 4

The Standard Specifications are revised as follows:

SECTION 401, BEGIN LINE 42, DELETE AND INSERT AS FOLLOWS:

The DMF shall state the ~~calibration factor, test temperature, and absorption factors to be used for the determination of binder content using the ignition oven in accordance with ITM 586, the binder content by extraction in accordance with ITM 571,~~ the  $\Delta P_b$  determined in accordance with ITM 591 and a Mixture Adjustment Factor, MAF. The DMF shall state the source, type, and dosage rate of any stabilizing additives.

SECTION 401, BEGIN LINE 79, DELETE AND INSERT AS FOLLOWS:

Dust/Calculated Effective Binder Ratio shall be 0.6 to 1.4. The Dust/Calculated Effective Binder Ratio for 4.75 mm mixtures shall be ~~in accordance with AASHTO M 3231.0 to 2.0.~~

SECTION 401, BEGIN LINE 85, DELETE AND INSERT AS FOLLOWS:

AIR VOIDS AT OPTIMUM BINDER CONTENT								
	Dense Graded					Open Graded		
Mixture Designation	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.75 mm	25.0 mm	19.0 mm	9.5 mm
Air Voids	4.0%	4.0%	4.0%	4.0%	5.0%	15.0% - 20.0%		10.0% - 15.0%

The design for dense graded mixtures shall have at least four points, including a minimum of two points above and one point below the optimum. A one point design may be used for open graded mixtures. The maximum specific gravity shall be mass determined in water in accordance with AASHTO T 209. The bulk specific gravity of the gyratory specimens shall be determined in accordance with AASHTO T 166, Method A or AASHTO T 275331, if required, for dense graded mixtures and AASHTO T 331 for open graded mixtures.

The percent draindown of open graded mixtures shall not exceed 0.30% in accordance with AASHTO T 305. Open graded mixtures may incorporate recycled materials and fibers. The recycled materials shall be in accordance with 401.06, and the fiber type and minimum dosage rate shall be in accordance with AASHTO M 325. The binder for open graded mixtures may have the upper temperature classification reduced by 6°C from the specified binder grade if fibers are incorporated into the mixture or if 3.0% reclaimed asphalt shingles by weight of the total mixture is used.

*The percent draindown of dense graded mixtures shall not exceed 0.30% in accordance with AASHTO T 305.* Dense graded mixture shall be tested for moisture susceptibility in accordance with AASHTO T 283 except that the loose mixture curing shall be replaced by mixture conditioning for 4 h in accordance with AASHTO R 30. The minimum tensile strength ratio, TSR, shall be 80%. The 6 in. mixture specimens shall be compacted in accordance with AASHTO T 312. If anti-stripping additives are added to the mixture to be in accordance with the minimum TSR requirements, the dosage rate shall be submitted with the DMF.

A PG binder grade or source change will not require a new mix design. If the upper temperature classification of the PG binder is lower than the original PG grade, a new TSR value is required.

The MAF equals the Gmm from the mixture design divided by the following: 2.465 for 9.5 mm mixtures and 2.500 for 12.5 mm, 19.0 mm, and 25.0 mm mixtures. If the MAF calculation results in a value where  $0.980 \leq \text{MAF} \leq 1.020$ , then the MAF shall be considered to be 1.000. If the MAF is greater than 1.020, the calculated MAF value shall have 0.020 subtracted from the value. If the MAF is less than 0.980, the calculated MAF value shall have 0.020 added to the value. The MAF does not apply to OG mixtures.

Changes in the source or types of aggregates shall require a new DMF.

The mixture design compaction temperature for the specimens shall be  $300 \pm 9^\circ\text{F}$  for dense graded mixtures and  $260^\circ\text{F}$  for open graded mixtures.

Design criteria for each mixture shall be based on the ESAL shown in the contract documents and shall be as follows:

GYRATORY COMPACTION EFFORT					
ESAL	$N_{ini}^*$	$N_{des}^*$	$N_{max}^*$	Max. % Gmm @ $N_{ini}$	Max. % Gmm @ $N_{max}$
Dense Graded					
< 3,000,000	7	75	115	90.5	98.0
3,000,000 to < 10,000,000	8	100	160	89.0	98.0
$\geq 10,000,000$	8	100	160	89.0	98.0
Open Graded					
All ESAL	n/a	20	n/a	n/a	n/a
* $N_{ini}$ , $N_{des}$ , $N_{max}$ - definitions are included in AASHTO R 35					

VOIDS IN MINERAL AGGREGATE, VMA, CRITERIA @ $N_{des}$	
Mixture Designation	Minimum VMA, %
4.75 mm	17.0
9.5 mm	15.0
12.5 mm	14.0
19.0 mm	13.0
25.0 mm	12.0
OG19.0 mm	n/a
OG25.0 mm	n/a

VOLUME OF EFFECTIVE BINDER, $V_{be}$ , CRITERIA @ $N_{des}$	
Mixture Designation	Minimum $V_{be}$ , %
4.75 mm	12.0
9.5 mm	11.0
12.5 mm	10.0

19.0 mm	9.0
25.0 mm	8.0
OG	n/a

VOIDS FILLED WITH ASPHALT, VFA, CRITERIA @ N <sub>des</sub>	
ESAL	VFA, %
< 3,000,000	65–78
3,000,000 to < 10,000,000	65–75
≥ 10,000,000	65–75

Notes: 1. For 9.5 mm mixtures, the specified VFA range shall be 73% to 76% for design traffic levels ≥ 3 million ESALs.  
2. For 25.0 mm mixtures, the specified lower limit of the VFA shall be 67% for design traffic levels < 0.3 million ESALs.  
3. For 4.75 mm mixtures, the specified VFA range shall be 67% to 79%.  
4. For ~~OG9.5 mm, OG19.0 mm, OG25.0 mm~~ mixtures, VFA is not applicable.

#### 401.06 Recycled Materials

Recycled materials may consist of reclaimed asphalt pavement, RAP, or reclaimed asphalt shingles, RAS, or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. Before entering the plant, RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve and RAS shall be processed so that 100% will pass the 3/8 in. (9.5 mm) sieve. The RAP coarse aggregate shall pass the maximum size sieve for the mixture being produced.

RAP for the ESAL category 3 and 4 surface mixtures shall be a *fine RAP* with 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve. *The Contractor may request the use of coarse RAP in a category 4 surface mixture up to a maximum 20.0% by volume of material retained on the No. 4 (4.75 mm) sieve. The election to use coarse RAP in a category 4 surface mixture will void the allowed use of crushed stone and gravel coarse aggregate materials in accordance with 904.03(d). SMA RAP as defined in 410.06 shall not be used in any HMA mixture.*

SECTION 401, BEGIN LINE 180, DELETE AND INSERT AS FOLLOWS:

HMA mixtures utilizing RAP or RAS or a blend of RAP and RAS

MAXIMUM BINDER REPLACEMENT, %										
Mixture Category	Base and Intermediate							Surface		
	Dense Graded				Open Graded			Dense Graded		
	25.0 mm	19.0 mm	12.5 mm	9.5 mm	25.0 mm	19.0 mm	9.5 mm	12.5 mm	9.5 mm	4.75 mm
2	25.0*				25.0*			25.0*		
3	25.0*				25.0*			25.0*		
4	25.0*				25.0*			25.0*		

\* The contribution of RAS to any HMA mixture shall be ≤ 3.0% by total mass of mixture and ≤ 15.0% binder replacement.

SECTION 401, BEGIN LINE 197, DELETE AND INSERT AS FOLLOWS:

#### 401.09 Acceptance of Mixtures

Acceptance of mixtures for ~~VMA~~*V<sub>be</sub>* at N<sub>des</sub>, and air voids at N<sub>des</sub> for each lot will be based on tests performed by the Engineer for dense graded 9.5 mm, 12.5 mm, 19.0

mm and 25.0 mm mixtures with original contract pay item quantities greater than or equal to 300 t.

SECTION 401, BEGIN LINE 222, DELETE AND INSERT AS FOLLOWS:

Acceptance samples will be reduced to the appropriate size for testing in accordance with ITM 587. The binder content and gradation will be determined in accordance with ~~ITM 586 or~~ ITM 571 ~~as directed by the Engineer~~. The maximum specific gravity will be mass determined in water in accordance with AASHTO T 209.

The effective specific gravity,  $G_{se}$ , of the mixture will be determined in each subplot and reported from the acceptance sample testing.

*The total aggregate bulk specific gravity,  $G_{sb}$ , value will be determined in accordance with ITM 597.*

The air voids will be determined in accordance with AASHTO R 35 based on the average bulk specific gravity from two gyratory specimens and the MSG for the subplot. The VMA will be determined in accordance with AASHTO R 35 based on the average bulk specific gravity from two gyratory specimens, the percent aggregate in the mixture from the subplot and the BSG of the aggregate blend from the DMF as applicable. The gyratory pills will be prepared in accordance with AASHTO T 312.

The dust/calculated effective binder ratio and the volume of effective binder in the mixture will be determined and reported from the acceptance sample testing conducted in each subplot. The volume of effective binder will be the difference between VMA and air voids. The Contractor shall take action in accordance with ITM 583 to address a dust/calculated effective binder ratio ~~greater than 1.4~~ *not in accordance with 401.05, or a volume of effective binder in the mixture below design minimums, or a volume of effective binder in the mixture greater than 2.0% above design minimums.*

The bulk specific gravity of gyratory specimens for dense graded mixtures will be determined in accordance with AASHTO T 166, Method A or AASHTO T ~~275~~331, if required, except samples are not required to be dried overnight. The bulk specific gravity of gyratory specimens for open graded mixtures, ~~OG19.0 mm, OG25.0 mm~~ will be determined in accordance with AASHTO T 331.

SECTION 401, BEGIN LINE 261, DELETE AND INSERT AS FOLLOWS:

Air voids, binder content and ~~VMA~~*ve* values will be reported to the nearest 0.01%. Draindown test results will be rounded to the nearest 0.01%. Rounding will be in accordance with 109.01(a).

SECTION 401, BEGIN LINE 285, INSERT AS FOLLOWS:

Samples shall not be obtained from areas placed with paving equipment in accordance with 409.03(c)2 or 409.03(c)3. If a random location falls within this area, the Engineer will randomly select another location within the subplot for sampling. If an entire subplot falls within this area, test results from the previous subplot will be used for acceptance. If the previous subplot is not available, the subsequent subplot will be used for acceptance. *If previous or subsequent subplot results for a mixture accepted by 401.19(a) will be replicated for an entire lot, each subplot in that lot will be accepted by 401.19(b).*

SECTION 401, BEGIN LINE 360, DELETE AND INSERT AS FOLLOWS:

**401.12 Process Control**

The Engineer and Contractor will jointly review the operations to ensure compliance with the QCP. Continuous violations of compliance with the QCP will result in suspension of paving operations.

*A test strip in accordance with RSP 401-R-661 will not be required.*

**401.13 Weather Limitations**

HMA courses of less than 138 lb/sq yd shall be placed when the ambient temperature and the temperature of the surface on which it is to be placed is 45°F or above. No mixture shall be placed on a frozen subgrade.

**401.14 Spreading and Finishing**

The mixture shall be placed upon an approved surface by means of laydown equipment in accordance with 409.03(c). Prior to paving, both the planned quantity and lay rate shall be adjusted by multiplying by the MAF. When mixture is produced from more than one DMF for a given pay item, the MAF will be applied to the applicable portion of the mixture for each. The temperature of each mixture at the time of spreading shall ~~not~~ be ~~more~~less than 315°F whenever PG 64-22 or PG 70-22 binders are used or not more than 325°F whenever PG 76-22 binder is used.

SECTION 401, BEGIN LINE 482, DELETE AND INSERT AS FOLLOWS:

Density of any random core location in these areas will be assigned a value of 92.0% MSG and compaction shall be in accordance with 402.15.

SECTION 401, BEGIN LINE 504, DELETE AND INSERT AS FOLLOWS:

The Contractor shall obtain cores in the presence of the Engineer with a device that shall produce a uniform  $6.00 \pm 0.25$  in. diameter pavement sample. Coring shall be completed prior to the random location being covered by the next course.

~~Surface courses.~~ *All core locations will be marked and shall be cored within two work days of placement. A damaged core shall be discarded and replaced with a core from a location selected by adding 1 ft to the longitudinal location of the damaged core using the same transverse offset.*

The Contractor and the Engineer shall mark the core to define the course to be tested. If the core indicates a course thickness of less than two times the maximum particle size, the core will be discarded and a core from a new random location will be selected for testing.

Cores shall not be obtained from areas placed with paving equipment in accordance with 409.03(c)2 or 409.03(c)3. If a random location falls within this area, the Engineer will randomly select another location within the subplot for coring. If an entire subplot falls within this area, test results from the previous subplot will be used for acceptance. If the previous subplot is not available, the subsequent subplot will be used for acceptance.

The Engineer will take immediate possession of the cores. If the Engineer's cores are subsequently damaged, additional coring will be the responsibility of the Department. Subsequent core locations will be determined by subtracting 1 ft from the random location using the same transverse offset.

The density for the mixture will be expressed as the percentage of maximum specific gravity, % MSG, obtained by dividing the average bulk specific gravity by the maximum specific gravity for the subplot, times 100. Samples for the bulk specific gravity and maximum specific gravity will be dried in accordance with ITM 572. The Engineer will determine the bulk specific gravity of the cores in accordance with AASHTO T 166, Method A or AASHTO T ~~275~~331, if required. The maximum specific gravity will be mass determined in water in accordance with AASHTO T 209.

Within one work day of coring operations the Contractor shall clean, dry, and refill the core holes with HMA of similar or smaller size particles.

The Engineer's acceptance test results for each subplot will be available when the subplot testing is complete. Acceptance of the pavement for density (% MSG) will be reported to the nearest 0.01%. Rounding will be in accordance with 109.01(a).

SECTION 401, BEGIN LINE 660, DELETE AND INSERT AS FOLLOWS:

#### **401.19 Pay Factors**

##### **(a) Dense Graded Mixture $\geq$ One Lot**

Pay factors, PF, are calculated for the air voids at  $N_{des}$ , ~~VMA~~ $V_{be}$  at  $N_{des}$  and in-place density, % Gmm. The Percent Within Limits, PWL, for each lot will be determined in accordance with ITM 588. The appropriate pay factor for each property is calculated as follows:

Estimated PWL greater than 90:

$$PF = ((0.50 \times PWL) + 55.00)/100$$

Estimated PWL greater than ~~or equal to 50~~70 and equal to or less than 90:

$$PF = ((0.40 \times PWL) + 64.00)/100$$

*Estimated PWL greater than or equal to 50 and equal to or less than 70:*

$$PF = ((0.62585 \times PWL) + 43.7532.5)/100$$

If the Lot PWL for any one of the properties is less than 50 ~~or~~, a subplot has an air void content less than 1.0% or greater than 7.0%, *or a subplot has a volume of effective binder greater than 3.0% above design minimums*, the lot will be referred to the Office of Materials Management for adjudication as a failed material in accordance with normal Department practice as listed in 105.03.

Air voids, ~~VMA~~ $V_{be}$ , and in-place density, % Gmm, PF values will be reported to the nearest 0.01. Rounding will be in accordance with 109.01(a).

A composite pay factor for each lot based on test results for mixture properties and density is determined by a weighted formula as follows:

$$\text{Lot PF} = 0.30(\text{PF}_{\text{VOIDS}}) + 0.35(\text{PF}_{\text{VMA/VE}}) + 0.35(\text{PF}_{\text{DENSITY}})$$

where:

Lot PF = Lot Composite Pay Factor for Mixture and Density  
 PF<sub>VOIDS</sub> = Lot Pay Factor for Air Voids at N<sub>des</sub>  
 PF<sub>VMA/VE</sub> = Lot Pay Factor for VMA/ve at N<sub>des</sub>  
 PF<sub>DENSITY</sub> = Lot Pay Factor for In-Place Density, %Gmm

The lot quality assurance adjustment for mixture properties and density is calculated as follows:

$$q = L \times U \times (\text{Lot PF} - 1.00) / \text{MAF}$$

where:

q = quality assurance adjustment for mixture properties and density of the lot  
 L = Lot quantity  
 U = Unit price for the material, \$/ton  
 Lot PF = Lot Pay Factor

Lot test results for the air voids at N<sub>des</sub>, VMA/ve at N<sub>des</sub>, and density will be used to determine the Lot Pay Factors.

The specification limits for the air voids at N<sub>des</sub>, VMA/ve at N<sub>des</sub>, and density will be as follows:

SPECIFICATION LIMITS		
MIXTURE		
	LSL*	USL**
Air Voids at N <sub>des</sub> , %	2.60	5.40
<del>Voids In Mineral Aggregate Volume of Effective Binder</del> at N <sub>des</sub> , %	Spec	Spec + 2.0050
DENSITY		
	LSL*	USL**
Roadway Core Density (% Gmm), %	91.00	n/a
* LSL, Lower Specification Limit		
** USL, Upper Specification Limit		

#### (b) Dense Graded Mixture < One Lot and Open Graded Mixture

A composite pay factor for each subplot based on test results for mixture properties and density is determined in a weighted formula as follows:

Dense Graded Mixture:

$$SCPF = 0.30(PF_{\text{VOIDS}}) + 0.35(PF_{\text{VMA/VE}}) + 0.35(PF_{\text{DENSITY}})$$

Open Graded Mixture:

$$SCPF = 0.20(PF_{\text{BINDER}}) + 0.35(PF_{\text{VOIDS}}) + 0.45$$

where:

SCPF = Sublot Composite Pay Factor for Mixture and Density

PF<sub>BINDER</sub> = Sublot Pay Factor for Binder Content

PF<sub>VOIDS</sub> = Sublot Pay Factor for Air Voids at N<sub>des</sub>

PF<sub>VMA/VE</sub> = Sublot Pay Factor for VMA/ve at N<sub>des</sub>

PF<sub>DENSITY</sub> = Sublot Pay Factor for Density

If the SCPF for a sublot is less than 0.85 or the volume of effective binder is greater than 3.0% above design minimums, the Office of Materials Management will evaluate the pavement. If the Contractor is not required to remove the mixture, quality assurance adjustments of the lot will be assessed or other corrective actions taken as determined by the Office of Materials Management. Sublot will be referred to the Office of Materials Management for adjudication as a failed material in accordance with 105.03.

SECTION 401, BEGIN LINE 756, DELETE AND INSERT AS FOLLOWS:

<del>VMA/ve</del>		Pay Factors
Dense Graded	Open Graded	
Deviation from Spec Minimum	Deviation from Spec Minimum	
<del>&gt; + 2.53.0</del>		Submitted to the Office of Materials Management*
<del>&gt; ≥ + 2.02.5 and ≤ + 2.53.0</del>		<del>0.25</del> 1.00 minus 0.05 for each 0.1% over +2.5%
<del>&gt; ≥ + 1.52.0 and ≤ &lt; + 2.02.5</del>		<del>0.65</del> 1.05 minus 0.01 for each 0.1% over +2.0%
<del>&gt; + 0.5 and ≤ &lt; + 1.52.0</del>		1.05
<del>≥ 0.0 and ≤ + 0.5</del>	All	<del>1.00</del> 1.05 minus 0.01 for each 0.1% under +0.5%
<del>≥ - 0.5 and &lt; 0.0</del>		<del>0.85</del> 1.00 minus 0.02 for each 0.1% under 0.0%
<del>≥ -2.0 and &lt; -0.5</del>		0.90 minus 0.06 for each 0.1% under - 0.5%
<del>≥ - 1.0 and &lt; - 0.5</del>		0.65
<del>≥ - 1.5 and &lt; - 1.0</del>		0.45
<del>≥ - 2.0 and &lt; - 1.5</del>		0.25
<del>≥ - 2.5 and &lt; - 2.0</del>		0.00
<del>&lt; -2.5 - 2.0</del>		Submitted to the Office of Materials Management*
* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.		

AIR VOIDS		
Dense Graded	Open Graded	Pay Factor
Deviation from DMF <sub>Spec</sub> (± %)	Deviation** from DMF (± %)	
≤ 0.5	≤ 3.0	1.05
> 0.5 and ≤ 1.07	> 3.0 and ≤ 34.0	1.00
<del>1.1</del>	34.1	0.98
<del>1.28</del>	34.2	0.96
<del>1.3</del>	34.3	0.94
<del>1.4</del>	34.4	0.92
<del>1.59</del>	34.5	0.90
<del>1.62.0</del>	34.6	0.84
<del>1.7</del>	34.7	0.78
<del>1.8</del>	34.8	0.72
<del>1.9</del>	34.9	0.66
<del>2.0</del>	45.0	0.60
> 2.0	> 45.0	Submitted to the Office of Materials Management*

\* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.  
\*\* Deviation shall be from 17.5% for OG25.0 and OG19.0 mm mixtures and shall be from 12.5% for OG9.5mm mixtures.

For mixtures produced during a plant's adjustment period, pay factors based on the DMF with the above tolerances will be used to compute quality assurance adjustments.

Sublot test results for density will be assigned pay factors in accordance with the following:

DENSITY	
Percentages are based on %MSG	Pay Factors, %
Dense Graded	
≥ 97.0	Submitted to the Office of Materials Management*
95.6 - 96.9	1.05 - 0.01 for each 0.1% above 95.5
94.0 - 95.5	1.05
93.1 - 93.9	1.00 + 0.005 for each 0.1% above 93.0
92.0 - 93.0	1.00
91.0 - 91.9	1.00 - 0.005 for each 0.1% below 92.0
90.0 - 90.9	0.95 - 0.010 for each 0.1% below 91.0
89.0 - 89.9	0.85 - 0.030 for each 0.1% below 90.0
≤ 88.9	Submitted to the Office of Materials Management*

\* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.

SECTION 401, BEGIN LINE 826, DELETE AND INSERT AS FOLLOWS:

The Contractor may appeal an individual subplot for the binder content, the MSG, the BSG of the gyratory specimens or the BSG of the density cores when the QC results are greater than one standard deviation from the acceptance test results as follows: 0.25 for binder content, 0.010 for the MSG and 0.010 for ~~both~~ the BSG of the gyratory specimens and *0.020 for the BSG of the density cores. Upon request from the Contractor, the BSG of the density core will be exempted from the individual subplot appeal if both the QC and QA results show a %MSG for the density greater than or equal to 92.0%.*

SECTION 401, BEGIN LINE 862, DELETE AND INSERT AS FOLLOWS:

**(c) Binder Content**

The backup binder content sample will be prepared and tested in accordance with ~~the test method that was used for acceptance or as directed by the Engineer~~ ITM 571.

**(d) BSG of the Density Core**

Additional cores shall be taken within seven calendar days unless otherwise directed. Additional core locations will be determined by adding 1 ft longitudinally of the cores tested using the same transverse offset. The appeal density cores will be dried in accordance with ITM 572 and tested in accordance with AASHTO T 166, Method A or AASHTO T ~~275~~331, if required.

SECTION 401, BEGIN LINE 940, DELETE AND INSERT AS FOLLOWS:

If QC/QA-HMA ~~intermediate~~19.0 mm over QC/QA-HMA ~~base~~25.0 mm mixtures are specified, QC/QA-HMA ~~intermediate~~19.0 mm mixture may be considered as a substitute for the QC/QA-HMA ~~intermediate~~19.0 mm and QC/QA-HMA ~~base~~25.0 mm mixtures upon a written request by the Contractor. The request for the substitution shall be prepared in advance of the work. A computation will be made in order to obtain a unit price for the QC/QA-HMA ~~intermediate~~19.0 mm mixture. The quantity and amount for QC/QA-HMA ~~intermediate~~19.0 mm mixture shall equal the sum of the contract quantities and amounts shown for QC/QA-HMA ~~intermediate~~19.0 mm and QC/QA-HMA ~~base~~25.0 mm mixtures. The unit price for QC/QA-HMA ~~intermediate~~19.0 mm mixture shall be equal to the sum of contract amounts divided by the sum of contract quantities. Payment for the QC/QA-HMA ~~intermediate~~19.0 mm mixture will be made at the unit price per ton for QC/QA-HMA ~~intermediate~~19.0 mm mixture. No payment will be made for additional work or costs which may result due to this change.

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## 2019 QC/QA HMA - SUPERPAVE 4 and SUPERPAVE 5

2019 QC/QA HMA - SUPERPAVE 4 and SUPERPAVE 5

The Standard Specifications are revised as follows:

SECTION 401, BEGIN LINE 42, DELETE AND INSERT AS FOLLOWS:

The DMF shall state the ~~calibration factor, test temperature, and absorption factors to be used for the determination of binder content using the ignition oven in accordance with ITM 586, the binder content by extraction in accordance with ITM 571,~~ the  $\Delta P_b$  determined in accordance with ITM 591 and a Mixture Adjustment Factor, MAF. The DMF shall state the source, type, and dosage rate of any stabilizing additives.

SECTION 401, BEGIN LINE 79, DELETE AND INSERT AS FOLLOWS:

Dust/Calculated Effective Binder Ratio shall be 0.6 to 1.4. The Dust/Calculated Effective Binder Ratio for 4.75 mm mixtures shall be ~~in accordance with AASHTO M 3231.0 to 2.0.~~

SECTION 401, BEGIN LINE 85, DELETE AND INSERT AS FOLLOWS:

AIR VOIDS AT OPTIMUM BINDER CONTENT, <i>Superpave 4</i>								
	Dense Graded					Open Graded		
Mixture Designation	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.75 mm	25.0 mm	19.0 mm	9.5 mm
Air Voids	4.0%	4.0%	4.0%	4.0%	5.0%	15.0% - 20.0%		10.0% - 15.0%

AIR VOIDS AT OPTIMUM BINDER CONTENT, <i>Superpave 5</i>								
	Dense Graded					Open Graded		
Mixture Designation	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.75 mm	25.0 mm	19.0 mm	9.5 mm
Air Voids	<del>4.05.0%</del>	<del>4.05.0%</del>	<del>4.05.0%</del>	<del>4.05.0%</del>	5.0%	15.0% - 20.0%		10.0% - 15.0%

The design for dense graded mixtures shall have at least four points, including a minimum of two points above and one point below the optimum. A one point design may be used for open graded mixtures. The maximum specific gravity shall be mass determined in water in accordance with AASHTO T 209. The bulk specific gravity of the gyratory specimens shall be determined in accordance with AASHTO T 166, Method A or AASHTO T 275331, if required, for dense graded mixtures and AASHTO T 331 for open graded mixtures.

The percent draindown of open graded mixtures shall not exceed 0.30% in accordance with AASHTO T 305. Open graded mixtures may incorporate recycled materials and fibers. The recycled materials shall be in accordance with 401.06, and the fiber type and minimum dosage rate shall be in accordance with AASHTO M 325. The binder for open graded mixtures may have the upper temperature classification reduced by 6°C from the specified binder grade if fibers are incorporated into the mixture or if 3.0% reclaimed asphalt shingles by weight of the total mixture is used.

*The percent draindown of dense graded mixtures shall not exceed 0.30% in accordance with AASHTO T 305.* Dense graded mixture shall be tested for moisture susceptibility in accordance with AASHTO T 283 except that the loose mixture curing shall be replaced by mixture conditioning for 4 h in accordance with AASHTO R 30. The minimum tensile strength ratio, TSR, shall be 80%. The 6 in. mixture specimens shall be

compacted in accordance with AASHTO T 312. If anti-stripping additives are added to the mixture to be in accordance with the minimum TSR requirements, the dosage rate shall be submitted with the DMF.

A PG binder grade or source change will not require a new mix design. If the upper temperature classification of the PG binder is lower than the original PG grade, a new TSR value is required.

The MAF equals the Gmm from the mixture design divided by the following: 2.465 for 9.5 mm mixtures and 2.500 for 12.5 mm, 19.0 mm, and 25.0 mm mixtures. If the MAF calculation results in a value where  $0.980 \leq \text{MAF} \leq 1.020$ , then the MAF shall be considered to be 1.000. If the MAF is greater than 1.020, the calculated MAF value shall have 0.020 subtracted from the value. If the MAF is less than 0.980, the calculated MAF value shall have 0.020 added to the value. The MAF does not apply to OG mixtures.

Changes in the source or types of aggregates shall require a new DMF.

The mixture design compaction temperature for the specimens shall be  $300 \pm 9^\circ\text{F}$  for dense graded mixtures and  $260^\circ\text{F}$  for open graded mixtures.

Design criteria for each mixture shall be based on the ESAL shown in the contract documents and shall be as follows:

GYRATORY COMPACTION EFFORT					
ESAL	$N_{ini}^*$	$N_{des}^*$	$N_{max}^*$	Max. % Gmm @ $N_{ini}$	Max. % Gmm @ $N_{max}$
<i>Dense Graded, Superpave 4</i>					
< 3,000,000	7	75	115	90.5	98.0
3,000,000 to < 10,000,000	8	100	160	89.0	98.0
$\geq 10,000,000$	8	100	160	89.0	98.0
<i>Dense Graded, Superpave 5</i>					
< 3,000,000	5	30	40	91.5	97.0
3,000,000 to < 10,000,000	6	50	75	91.5	97.0
$\geq 10,000,000$	6	50	75	91.5	97.0
Open Graded					
All ESAL	n/a	20	n/a	n/a	n/a
* $N_{ini}$ , $N_{des}$ , $N_{max}$ - definitions are included in AASHTO R 35					

VOIDS IN MINERAL AGGREGATE, VMA, CRITERIA @ $N_{des}$ <i>Superpave 4</i>	
Mixture Designation	Minimum VMA, %
4.75 mm	17.0
9.5 mm	15.0
12.5 mm	14.0
19.0 mm	13.0
25.0 mm	12.0
OG19.0 mm	n/a

OG25.0 mm	n/a
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VOIDS IN MINERAL AGGREGATE, VMA, CRITERIA @ $N_{des}$ <i>Superpave 5</i>	
Mixture Designation	Minimum VMA, %
4.75 mm	17.0
9.5 mm	<del>15.0</del> 16.0
12.5 mm	<del>14.0</del> 15.0
19.0 mm	<del>13.0</del> 14.0
25.0 mm	<del>12.0</del> 13.0
OG19.0 mm	n/a
OG25.0 mm	n/a

VOLUME OF EFFECTIVE BINDER, $V_{be}$ , CRITERIA @ $N_{des}$	
Mixture Designation	Minimum $V_{be}$ , %
4.75 mm	12.0
9.5 mm	11.0
12.5 mm	10.0
19.0 mm	9.0
25.0 mm	8.0
OG	n/a

VOIDS FILLED WITH ASPHALT, VFA, CRITERIA @ $N_{des}$ <i>Superpave 4</i>	
ESAL	VFA, %
< 3,000,000	65–78
3,000,000 to < 10,000,000	65–75
$\geq$ 10,000,000	65–75

Notes:

- For 9.5 mm mixtures, the specified VFA range shall be 73% to 76% for design traffic levels  $\geq$  3 million ESALs.
- For 25.0 mm mixtures, the specified lower limit of the VFA shall be 67% for design traffic levels < 0.3 million ESALs.
- For 4.75 mm mixtures, the specified VFA range shall be 67% to 79%.
- For OG9.5 mm, OG19.0 mm, OG25.0 mm mixtures, VFA is not applicable.

VOIDS FILLED WITH ASPHALT, VFA, CRITERIA @ $N_{des}$ <i>Superpave 5</i>	
ESAL	VFA, %
< 3,000,000	<del>65–78</del> 60-73
3,000,000 to < 10,000,000	<del>65–75</del> 60-70
$\geq$ 10,000,000	<del>65–75</del> 60-70

Notes:

- For 9.5 mm mixtures, the specified VFA range shall be ~~73% to 76%~~68% to 71% for design traffic levels  $\geq$  3 million ESALs.
- For 25.0 mm mixtures, the specified lower limit of the VFA shall be ~~67%~~62% for design traffic levels < 0.3 million ESALs.
- For 4.75 mm mixtures, the specified VFA range shall be 67% to 79%.
- For OG9.5 mm, OG19.0 mm, OG25.0 mm mixtures, VFA is not applicable.

**401.06 Recycled Materials**

Recycled materials may consist of reclaimed asphalt pavement, RAP, or reclaimed asphalt shingles, RAS, or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. Before entering the plant, RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve and RAS shall be processed so that 100% will pass the 3/8 in. (9.5 mm) sieve. The RAP coarse aggregate shall pass the maximum size sieve for the mixture being produced.

RAP for the ESAL category 3 and 4 surface mixtures shall be a *fine RAP* with 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve. *The Contractor may request the use of coarse RAP in a category 4 surface mixture up to a maximum 20.0% by volume of material retained on the No. 4 (4.75 mm) sieve. The election to use coarse RAP in a category 4 surface mixture will void the allowed use of crushed stone and gravel coarse aggregate materials in accordance with 904.03(d). SMA RAP as defined in 410.06 shall not be used in any HMA mixture.*

SECTION 401, BEGIN LINE 180, DELETE AND INSERT AS FOLLOWS:

HMA mixtures utilizing RAP or RAS or a blend of RAP and RAS

MAXIMUM BINDER REPLACEMENT, %											
Mixture Category	Base and Intermediate						Surface				
	Dense Graded				Open Graded		Dense Graded				
	25.0 mm	19.0 mm	12.5 mm	9.5 mm	25.0 mm	19.0 mm	9.5 mm	12.5 mm	9.5 mm	4.75 mm	
2	25.0*				25.0*			25.0*			
3	25.0*				25.0*			25.0*			
4	25.0*				25.0*			25.0*			
* The contribution of RAS to any HMA mixture shall be $\leq 3.0\%$ by total mass of mixture and $\leq 15.0\%$ binder replacement.											

SECTION 401, BEGIN LINE 197, DELETE AND INSERT AS FOLLOWS:

**401.09 Acceptance of Mixtures**

Acceptance of mixtures for  $VMA/Vbe$  at  $N_{des}$ , and air voids at  $N_{des}$  for each lot will be based on tests performed by the Engineer for dense graded 9.5 mm, 12.5 mm, 19.0 mm and 25.0 mm mixtures with original contract pay item quantities greater than or equal to 300 t.

SECTION 401, BEGIN LINE 222, DELETE AND INSERT AS FOLLOWS:

Acceptance samples will be reduced to the appropriate size for testing in accordance with ITM 587. The binder content and gradation will be determined in accordance with ~~ITM 586~~ or ITM 571 as directed by the Engineer. The maximum specific gravity will be mass determined in water in accordance with AASHTO T 209.

The effective specific gravity,  $G_{se}$ , of the mixture will be determined in each subplot and reported from the acceptance sample testing.

*The total aggregate bulk specific gravity,  $G_{sb}$ , value will be determined in accordance with ITM 597.*

The air voids will be determined in accordance with AASHTO R 35 based on the average bulk specific gravity from two gyratory specimens and the MSG for the subplot.

The VMA will be determined in accordance with AASHTO R 35 based on the average bulk specific gravity from two gyratory specimens, the percent aggregate in the mixture from the subplot and the BSG of the aggregate blend from the DMF as applicable. The gyratory pills will be prepared in accordance with AASHTO T 312.

The dust/calculated effective binder ratio and the volume of effective binder in the mixture will be determined and reported from the acceptance sample testing conducted in each subplot. The volume of effective binder will be the difference between VMA and air voids. The Contractor shall take action in accordance with ITM 583 to address a dust/calculated effective binder ratio ~~greater than 1.4~~*not in accordance with 401.05, or a volume of effective binder in the mixture below design minimums, or a volume of effective binder in the mixture greater than 2.0% above design minimums.*

The bulk specific gravity of gyratory specimens for dense graded mixtures will be determined in accordance with AASHTO T 166, Method A or AASHTO T ~~275~~331, if required, except samples are not required to be dried overnight. The bulk specific gravity of gyratory specimens for open graded mixtures, ~~OG19.0 mm, OG25.0 mm~~ will be determined in accordance with AASHTO T 331.

SECTION 401, BEGIN LINE 261, DELETE AND INSERT AS FOLLOWS:

Air voids, binder content and ~~VMA~~*ve* values will be reported to the nearest 0.01%. Draindown test results will be rounded to the nearest 0.01%. Rounding will be in accordance with 109.01(a).

SECTION 401, BEGIN LINE 285, INSERT AS FOLLOWS:

Samples shall not be obtained from areas placed with paving equipment in accordance with 409.03(c)2 or 409.03(c)3. If a random location falls within this area, the Engineer will randomly select another location within the subplot for sampling. If an entire subplot falls within this area, test results from the previous subplot will be used for acceptance. If the previous subplot is not available, the subsequent subplot will be used for acceptance. *If previous or subsequent subplot results for a mixture accepted by 401.19(a) will be replicated for an entire lot, each subplot in that lot will be accepted by 401.19(b).*

SECTION 401, BEGIN LINE 370, DELETE AND INSERT AS FOLLOWS:

#### **401.14 Spreading and Finishing**

The mixture shall be placed upon an approved surface by means of laydown equipment in accordance with 409.03(c). Prior to paving, both the planned quantity and lay rate shall be adjusted by multiplying by the MAF. When mixture is produced from more than one DMF for a given pay item, the MAF will be applied to the applicable portion of the mixture for each. The temperature of each mixture at the time of spreading shall ~~not be more~~*less* than 315°F whenever PG 64-22 or PG 70-22 binders are used or not more than 325°F whenever PG 76-22 binder is used.

SECTION 401, BEGIN LINE 482, DELETE AND INSERT AS FOLLOWS:

Density of any random core location in these areas will be assigned a value of 92.0% *MSG if DMF is Superpave4* and 94.0% *MSG if DMF is Superpave 5* and compaction shall be in accordance with 402.15.

SECTION 401, BEGIN LINE 504, DELETE AND INSERT AS FOLLOWS:

The Contractor shall obtain cores in the presence of the Engineer with a device that shall produce a uniform  $6.00 \pm 0.25$  in. diameter pavement sample. Coring shall be completed prior to the random location being covered by the next course.

~~Surface courses~~ All core locations will be marked and shall be cored within two work days of placement. A damaged core shall be discarded and replaced with a core from a location selected by adding 1 ft to the longitudinal location of the damaged core using the same transverse offset.

The Contractor and the Engineer shall mark the core to define the course to be tested. If the core indicates a course thickness of less than two times the maximum particle size, the core will be discarded and a core from a new random location will be selected for testing.

Cores shall not be obtained from areas placed with paving equipment in accordance with 409.03(c)2 or 409.03(c)3. If a random location falls within this area, the Engineer will randomly select another location within the subplot for coring. If an entire subplot falls within this area, test results from the previous subplot will be used for acceptance. If the previous subplot is not available, the subsequent subplot will be used for acceptance.

The Engineer will take immediate possession of the cores. If the Engineer's cores are subsequently damaged, additional coring will be the responsibility of the Department. Subsequent core locations will be determined by subtracting 1 ft from the random location using the same transverse offset.

The density for the mixture will be expressed as the percentage of maximum specific gravity, % MSG, obtained by dividing the average bulk specific gravity by the maximum specific gravity for the subplot, times 100. Samples for the bulk specific gravity and maximum specific gravity will be dried in accordance with ITM 572. The Engineer will determine the bulk specific gravity of the cores in accordance with AASHTO T 166, Method A or AASHTO T 275331, if required. The maximum specific gravity will be mass determined in water in accordance with AASHTO T 209.

Within one work day of coring operations the Contractor shall clean, dry, and refill the core holes with HMA of similar or smaller size particles.

The Engineer's acceptance test results for each subplot will be available when the subplot testing is complete. Acceptance of the pavement for density (% MSG) will be reported to the nearest 0.01%. Rounding will be in accordance with 109.01(a).

SECTION 401, BEGIN LINE 660, DELETE AND INSERT AS FOLLOWS:

#### **401.19 Pay Factors**

##### **(a) Dense Graded Mixture $\geq$ One Lot**

Pay factors, PF, are calculated for the air voids at  $N_{des}$ ,  $VMA/b_e$  at  $N_{des}$  and in-place density, % Gmm. The Percent Within Limits, PWL, for each lot will be determined in accordance with ITM 588. The appropriate pay factor for each property is calculated as follows:

Estimated PWL greater than 90:

$$PF = ((0.50 \times PWL) + 55.00)/100$$

Estimated PWL greater than or equal to 50 and equal to or less than 90:

$$PF = ((0.40 \times PWL) + 64.00)/100$$

Estimated PWL greater than or equal to 50 and equal to or less than 70:

$$PF = ((0.62585 \times PWL) + 43.7532.5)/100$$

If the Lot PWL for any one of the properties is less than 50 or, a subplot has an air void content less than 1.0% or greater than 7.0%, or a subplot has a volume of effective binder greater than 3.0% above design minimums, the lot will be referred to the Office of Materials Management for adjudication as a failed material in accordance with normal Department practice as listed in 105.03.

Air voids,  $VMA/Vbe$ , and in-place density, % Gmm, PF values will be reported to the nearest 0.01. Rounding will be in accordance with 109.01(a).

A composite pay factor for each lot based on test results for mixture properties and density is determined by a weighted formula as follows:

$$\text{Lot PF} = 0.30(PF_{\text{VOIDS}}) + 0.35(PF_{\text{VMA/VBE}}) + 0.35(PF_{\text{DENSITY}})$$

where:

Lot PF = Lot Composite Pay Factor for Mixture and Density  
 $PF_{\text{VOIDS}}$  = Lot Pay Factor for Air Voids at  $N_{\text{des}}$   
 $PF_{\text{VMA/VBE}}$  = Lot Pay Factor for  $VMA/Vbe$  at  $N_{\text{des}}$   
 $PF_{\text{DENSITY}}$  = Lot Pay Factor for In-Place Density, %Gmm

The lot quality assurance adjustment for mixture properties and density is calculated as follows:

$$q = L \times U \times (\text{Lot PF} - 1.00)/MAF$$

where:

q = quality assurance adjustment for mixture properties and density of the lot  
 L = Lot quantity  
 U = Unit price for the material, \$/ton  
 Lot PF = Lot Pay Factor

Lot test results for the air voids at  $N_{\text{des}}$ ,  $VMA/Vbe$  at  $N_{\text{des}}$ , and density will be used to determine the Lot Pay Factors.

The specification limits for the air voids at  $N_{des}$ ,  $VMA/be$  at  $N_{des}$ , and density will be as follows:

SPECIFICATION LIMITS <i>Superpave 4</i>		
MIXTURE		
	LSL*	USL**
Air Voids at $N_{des}$ , %	2.60	5.40
<del>Voids In Mineral Aggregate Volume of Effective Binder</del> <i>Volume of Effective Binder</i> at $N_{des}$ , %	Spec	Spec + 2.0050
DENSITY		
	LSL*	USL**
Roadway Core Density (% Gmm), %	91.00	n/a
* LSL, Lower Specification Limit		
** USL, Upper Specification Limit		

SPECIFICATION LIMITS <i>Superpave 5</i>		
MIXTURE		
	LSL*	USL**
Air Voids at $N_{des}$ , %	<del>2.60</del> 3.60	<del>5.40</del> 6.40
<del>Voids In Mineral Aggregate Volume of Effective Binder</del> <i>Volume of Effective Binder</i> at $N_{des}$ , %	Spec	Spec + 2.0050
DENSITY		
	LSL*	USL**
Roadway Core Density (% Gmm), %	<del>91.00</del> 93.00	n/a
* LSL, Lower Specification Limit		
** USL, Upper Specification Limit		

**(b) Dense Graded Mixture < One Lot and Open Graded Mixture**

A composite pay factor for each subplot based on test results for mixture properties and density is determined in a weighted formula as follows:

Dense Graded Mixture:

$$SCPF = 0.30(PF_{VOIDS}) + 0.35(PF_{VMA/BE}) + 0.35(PF_{DENSITY})$$

Open Graded Mixture:

$$SCPF = 0.20(PF_{BINDER}) + 0.35(PF_{VOIDS}) + 0.45$$

where:

- SCPF = Sublot Composite Pay Factor for Mixture and Density
- $PF_{BINDER}$  = Sublot Pay Factor for Binder Content
- $PF_{VOIDS}$  = Sublot Pay Factor for Air Voids at  $N_{des}$
- $PF_{VMA/BE}$  = Sublot Pay Factor for  $VMA/be$  at  $N_{des}$
- $PF_{DENSITY}$  = Sublot Pay Factor for Density

If the SCPF for a subplot is less than 0.85 or the volume of effective binder is greater than 3.0% above design minimums, the Office of Materials Management will

evaluate the pavement. If the Contractor is not required to remove the mixture, quality assurance adjustments of the lot will be assessed or other corrective actions taken as determined by the Office of Materials Management. *sublot will be referred to the Office of Materials Management for adjudication as a failed material in accordance with normal Department practice as listed in 105.03.*

SECTION 401, BEGIN LINE 756, DELETE AND INSERT AS FOLLOWS:

VMA/Vbe		
Dense Graded	Open Graded	Pay Factors
Deviation from Spec Minimum	Deviation from Spec Minimum	
> + 2.53.0		Submitted to the Office of Materials Management*
<del>&gt;= + 2.02.5</del> and <del>≤ + 2.53.0</del>		<del>0.25</del> 1.00 minus 0.05 for each 0.1% over +2.5%
<del>&gt;= + 1.52.0</del> and <del>≤ &lt; + 2.02.5</del>		<del>0.65</del> 1.05 minus 0.01 for each 0.1% over +2.0%
> + 0.5 and <del>≤ &lt; + 1.52.0</del>		1.05
≥ 0.0 and ≤ + 0.5	All	<del>1.00</del> 1.05 minus 0.01 for each 0.1% under +0.5%
≥ - 0.5 and < 0.0		<del>0.85</del> 1.00 minus 0.02 for each 0.1% under 0.0%
≥ -2.0 and < -0.5		0.90 minus 0.06 for each 0.1% under - 0.5%
<del>≥ - 1.0 and &lt; - 0.5</del>		0.65
<del>≥ - 1.5 and &lt; - 1.0</del>		0.45
<del>≥ - 2.0 and &lt; - 1.5</del>		0.25
<del>≥ - 2.5 and &lt; - 2.0</del>		0.00
< -2.5 - 2.0		Submitted to the Office of Materials Management*

\* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.

AIR VOIDS		
Dense Graded	Open Graded	Pay Factor
Deviation from DMF <sub>Spec</sub> (± %)	Deviation** from DMF (± %)	
≤ 0.5	≤ 43.0	1.05
> 0.5 and ≤ 1.07	> 43.0 and ≤ 44.0	1.00
<del>1.1</del>	<del>44.1</del>	0.98
<del>1.28</del>	<del>44.2</del>	0.96
<del>1.3</del>	<del>44.3</del>	0.94
<del>1.4</del>	<del>44.4</del>	0.92
<del>1.59</del>	<del>44.5</del>	0.90
<del>1.62.0</del>	<del>44.6</del>	0.84
<del>1.7</del>	<del>44.7</del>	0.78
<del>1.8</del>	<del>44.8</del>	0.72
<del>1.9</del>	<del>44.9</del>	0.66
<del>2.0</del>	<del>45.0</del>	0.60
> 2.0	> 45.0	Submitted to the Office of Materials

Management*
* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.
** Deviation shall be from 17.5% for OG25.0 mm and OG19.0 mm mixtures and shall be from 12.5% for OG9.5 mm mixtures.

For mixtures produced during a plant’s adjustment period, pay factors based on the DMF with the above tolerances will be used to compute quality assurance adjustments.

Sublot test results for density will be assigned pay factors in accordance with the following:

DENSITY <i>Superpave 4</i>	
Percentages are based on %MSG	Pay Factors, %
Dense Graded	
≥ 97.0	Submitted to the Office of Materials Management*
95.6 - 96.9	1.05 - 0.01 for each 0.1% above 95.5
94.0 - 95.5	1.05
93.1 - 93.9	1.00 + 0.005 for each 0.1% above 93.0
92.0 - 93.0	1.00
91.0 - 91.9	1.00 - 0.005 for each 0.1% below 92.0
90.0 - 90.9	0.95 - 0.010 for each 0.1% below 91.0
89.0 - 89.9	0.85 - 0.030 for each 0.1% below 90.0
≤ 88.9	Submitted to the Office of Materials Management*
* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.	

DENSITY <i>Superpave 5</i>	
Percentages are based on %MSG	Pay Factors, %
Dense Graded	
≥ <del>97.0</del> 98.0	Submitted to the Office of Materials Management*
<del>97.0 - 97.9</del>	<del>1.00</del>
<del>95.6 - 96.9</del> 96.6 - 96.9	1.05 - 0.01 for each 0.1% above 95.596.5
<del>94.0 - 95.5</del> 95.0 - 96.5	1.05
<del>93.1 - 93.9</del> 94.1 - 94.9	1.00 + 0.005 for each 0.1% above 93.094.0
<del>92.0 - 93.0</del> 93.0 - 94.0	1.00
<del>91.0 - 91.9</del> 92.0 - 92.9	1.00 - 0.005 for each 0.1% below 92.093.0
<del>90.0 - 90.9</del> 91.0 - 91.9	0.95 - 0.010 for each 0.1% below 91.092.0
<del>89.0 - 89.9</del> 90.0 - 90.9	0.85 - 0.030 for each 0.1% below 90.091.0
≤ <del>88.9</del> 89.9	Submitted to the Office of Materials Management*
* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.	

SECTION 401, BEGIN LINE 826, DELETE AND INSERT AS FOLLOWS:

The Contractor may appeal an individual sublot for the binder content, the MSG, the BSG of the gyratory specimens or the BSG of the density cores when the QC results

are greater than one standard deviation from the acceptance test results as follows: 0.25 for binder content, 0.010 for the MSG and 0.010 for ~~both~~ the BSG of the gyratory specimens and 0.020 for the BSG of the density cores. Upon request from the Contractor, the BSG of the density core will be exempted from the individual subplot appeal if both the QC and QA results show a %MSG for the density greater than or equal to 93.0%.

SECTION 401, BEGIN LINE 862, DELETE AND INSERT AS FOLLOWS:

**(c) Binder Content**

The backup binder content sample will be prepared and tested in accordance with ~~the test method that was used for acceptance or as directed by the Engineer~~ ITM 571.

**(d) BSG of the Density Core**

Additional cores shall be taken within seven calendar days unless otherwise directed. Additional core locations will be determined by adding 1 ft longitudinally of the cores tested using the same transverse offset. The appeal density cores will be dried in accordance with ITM 572 and tested in accordance with AASHTO T 166, Method A or AASHTO T 275331, if required.

SECTION 401, BEGIN LINE 940, DELETE AND INSERT AS FOLLOWS:

If QC/QA-HMA ~~intermediate~~ 19.0 mm over QC/QA-HMA ~~base~~ 25.0 mm mixtures are specified, QC/QA-HMA ~~intermediate~~ 19.0 mm mixture may be considered as a substitute for the QC/QA-HMA ~~intermediate~~ 19.0 mm and QC/QA-HMA ~~base~~ 25.0 mm mixtures upon a written request by the Contractor. The request for the substitution shall be prepared in advance of the work. A computation will be made in order to obtain a unit price for the QC/QA-HMA ~~intermediate~~ 19.0 mm mixture. The quantity and amount for QC/QA-HMA ~~intermediate~~ 19.0 mm mixture shall equal the sum of the contract quantities and amounts shown for QC/QA-HMA ~~intermediate~~ 19.0 mm and QC/QA-HMA ~~base~~ 25.0 mm mixtures. The unit price for QC/QA-HMA ~~intermediate~~ 19.0 mm mixture shall be equal to the sum of contract amounts divided by the sum of contract quantities. Payment for the QC/QA-HMA ~~intermediate~~ 19.0 mm mixture will be made at the unit price per ton for QC/QA-HMA ~~intermediate~~ 19.0 mm mixture. No payment will be made for additional work or costs which may result due to this change.

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# 401-R-661 QC/QA HOT MIX ASPHALT, HMA, PAVEMENT

401-R-661 QC/QA HOT MIX ASPHALT, HMA, PAVEMENT

(Revised 01-17-19)

The Standard Specifications are revised as follows:

SECTION 401, BEGIN LINE 42, DELETE AND INSERT AS FOLLOWS:

The DMF shall state the ~~calibration factor, test temperature, and absorption factors to be used for the determination of binder content using the ignition oven in accordance with ITM 586, the binder content by extraction in accordance with ITM 571,~~ the  $\Delta P_b$  determined in accordance with ITM 591 and a Mixture Adjustment Factor, MAF. The DMF shall state the source, type, and dosage rate of any stabilizing additives.

SECTION 401, BEGIN LINE 79, DELETE AND INSERT AS FOLLOWS:

Dust/Calculated Effective Binder Ratio shall be 0.6 to 1.4. The Dust/Calculated Effective Binder Ratio for 4.75 mm mixtures shall be ~~in accordance with AASHTO M 323~~ 1.0 to 2.0.

SECTION 401, BEGIN LINE 85, DELETE AND INSERT AS FOLLOWS:

AIR VOIDS AT OPTIMUM BINDER CONTENT								
	Dense Graded					Open Graded		
Mixture Designation	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.75 mm	25.0 mm	19.0 mm	9.5 mm
Air Voids	<del>4.0</del> 5.0%	<del>4.0</del> 5.0%	<del>4.0</del> 5.0%	<del>4.0</del> 5.0%	5.0%	15.0% - 20.0%	10.0% - 15.0%	

The design for dense graded mixtures shall have at least four points, including a minimum of two points above and one point below the optimum. A one point design may be used for open graded mixtures. The maximum specific gravity shall be mass determined in water in accordance with AASHTO T 209. The bulk specific gravity of the gyratory specimens shall be determined in accordance with AASHTO T 166, Method A or AASHTO T 275331, if required, for dense graded mixtures and AASHTO T 331 for open graded mixtures.

The percent draindown of open graded mixtures shall not exceed 0.30% in accordance with AASHTO T 305. Open graded mixtures may incorporate recycled materials and fibers. The recycled materials shall be in accordance with 401.06, and the fiber type and minimum dosage rate shall be in accordance with AASHTO M 325. The binder for open graded mixtures may have the upper temperature classification reduced by 6°C from the specified binder grade if fibers are incorporated into the mixture or if 3.0% reclaimed asphalt shingles by weight of the total mixture is used.

*The percent draindown of dense graded mixtures shall not exceed 0.30% in accordance with AASHTO T 305.* Dense graded mixture shall be tested for moisture susceptibility in accordance with AASHTO T 283 except that the loose mixture curing shall be replaced by mixture conditioning for 4 h in accordance with AASHTO R 30. The minimum tensile strength ratio, TSR, shall be 80%. The 6 in. mixture specimens shall be compacted in accordance with AASHTO T 312. If anti-stripping additives are added to the mixture to be in accordance with the minimum TSR requirements, the dosage rate shall be submitted with the DMF.

A PG binder grade or source change will not require a new mix design. If the upper temperature classification of the PG binder is lower than the original PG grade, a new TSR value is required.

The MAF equals the Gmm from the mixture design divided by the following: 2.465 for 9.5 mm mixtures and 2.500 for 12.5 mm, 19.0 mm, and 25.0 mm mixtures. If the MAF calculation results in a value where  $0.980 \leq \text{MAF} \leq 1.020$ , then the MAF shall be considered to be 1.000. If the MAF is greater than 1.020, the calculated MAF value shall have 0.020 subtracted from the value. If the MAF is less than 0.980, the calculated MAF value shall have 0.020 added to the value. The MAF does not apply to OG mixtures.

Changes in the source or types of aggregates shall require a new DMF.

The mixture design compaction temperature for the specimens shall be  $300 \pm 9^\circ\text{F}$  for dense graded mixtures and  $260^\circ\text{F}$  for open graded mixtures.

Design criteria for each mixture shall be based on the ESAL shown in the contract documents and shall be as follows:

GYRATORY COMPACTION EFFORT					
ESAL	$N_{ini}^*$	$N_{des}^*$	$N_{max}^*$	Max. % Gmm @ $N_{ini}$	Max. % Gmm @ $N_{max}$
<i>Dense Graded 4.75 mm</i>					
< 3,000,000	7	75	115	90.5	98.0
3,000,000 to < 10,000,000	8	100	160	89.0	98.0
$\geq 10,000,000$	8	100	160	89.0	98.0
<i>Dense Graded 9.5 mm, 12.5 mm, 19.0 mm and 25.0 mm</i>					
< 3,000,000	5	30	40	91.5	97.0
3,000,000 to < 10,000,000	6	50	75	91.5	97.0
$\geq 10,000,000$	6	50	75	91.5	97.0
<i>Open Graded</i>					
All ESAL	n/a	20	n/a	n/a	n/a
* $N_{ini}$ , $N_{des}$ , $N_{max}$ - definitions are included in AASHTO R 35					

VOIDS IN MINERAL AGGREGATE, VMA, CRITERIA @ $N_{des}$	
Mixture Designation	Minimum VMA, %
4.75 mm	17.0
9.5 mm	<del>15.0</del> 16.0
12.5 mm	<del>14.0</del> 15.0
19.0 mm	<del>13.0</del> 14.0
25.0 mm	<del>12.0</del> 13.0
OG19.0 mm	n/a
OG25.0 mm	n/a

VOLUME OF EFFECTIVE BINDER,  $V_{be}$ , CRITERIA @  $N_{des}$

<i>Mixture Designation</i>	<i>Minimum Vbe, %</i>
<i>4.75 mm</i>	<i>12.0</i>
<i>9.5 mm</i>	<i>11.0</i>
<i>12.5 mm</i>	<i>10.0</i>
<i>19.0 mm</i>	<i>9.0</i>
<i>25.0 mm</i>	<i>8.0</i>
<i>OG</i>	<i>n/a</i>

VOIDS FILLED WITH ASPHALT, VFA, CRITERIA @ N <sub>des</sub>	
ESAL	VFA, %
< 3,000,000	<del>65-78</del> 60-73
3,000,000 to < 10,000,000	<del>65-75</del> 60-70
≥ 10,000,000	<del>65-75</del> 60-70

Notes: 1. For 9.5 mm mixtures, the specified VFA range shall be ~~73% to 76%~~68% to 71% for design traffic levels ≥ 3 million ESALs.  
 2. For 25.0 mm mixtures, the specified lower limit of the VFA shall be ~~67%~~62% for design traffic levels < 0.3 million ESALs.  
 3. For 4.75 mm mixtures, the specified VFA range shall be 67% to 79%.  
 4. For ~~OG9.5 mm, OG19.0 mm, OG25.0 mm~~ mixtures, VFA is not applicable.

**401.06 Recycled Materials**

Recycled materials may consist of reclaimed asphalt pavement, RAP, or reclaimed asphalt shingles, RAS, or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. Before entering the plant, RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve and RAS shall be processed so that 100% will pass the 3/8 in. (9.5 mm) sieve. The RAP coarse aggregate shall pass the maximum size sieve for the mixture being produced.

RAP for the ESAL category 3 and 4 surface mixtures shall be a *fine RAP with 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve. The Contractor may request the use of coarse RAP in a category 4 surface mixture up to a maximum 20.0% by volume of material retained on the No. 4 (4.75 mm) sieve. The election to use coarse RAP in a category 4 surface mixture will void the allowed use of crushed stone and gravel coarse aggregate materials in accordance with 904.03(d). SMA RAP as defined in 410.06 shall not be used in any HMA mixture.*

SECTION 401, BEGIN LINE 180, DELETE AND INSERT AS FOLLOWS:

**HMA mixtures utilizing RAP or RAS or a blend of RAP and RAS**

MAXIMUM BINDER REPLACEMENT, %										
Mixture Category	Base and Intermediate							Surface		
	Dense Graded				Open Graded			Dense Graded		
	25.0 mm	19.0 mm	12.5 mm	9.5 mm	25.0 mm	19.0 mm	9.5 mm	12.5 mm	9.5 mm	4.75 mm
2	25.0*				25.0*			25.0*		
3	25.0*				25.0*			25.0*		
4	25.0*				25.0*			25.0*		

\* The contribution of RAS to any HMA mixture shall be ≤ 3.0% by total mass of mixture and ≤ 15.0% binder replacement.

SECTION 401, BEGIN LINE 197, DELETE AND INSERT AS FOLLOWS:

**401.09 Acceptance of Mixtures**

Acceptance of mixtures for  $VMA/Vbe$  at  $N_{des}$ , and air voids at  $N_{des}$  for each lot will be based on tests performed by the Engineer for dense graded 9.5 mm, 12.5 mm, 19.0 mm and 25.0 mm mixtures with original contract pay item quantities greater than or equal to 300 t.

SECTION 401, BEGIN LINE 222, DELETE AND INSERT AS FOLLOWS:

Acceptance samples will be reduced to the appropriate size for testing in accordance with ITM 587. The binder content and gradation will be determined in accordance with ~~ITM 586 or~~ ITM 571 as directed by the Engineer. The maximum specific gravity will be mass determined in water in accordance with AASHTO T 209.

The effective specific gravity,  $G_{se}$ , of the mixture will be determined in each subplot and reported from the acceptance sample testing.

*The total aggregate bulk specific gravity,  $G_{sb}$ , value will be determined in accordance with ITM 597.*

The air voids will be determined in accordance with AASHTO R 35 based on the average bulk specific gravity from two gyratory specimens and the MSG for the subplot. The VMA will be determined in accordance with AASHTO R 35 based on the average bulk specific gravity from two gyratory specimens, the percent aggregate in the mixture from the subplot and the BSG of the aggregate blend from the DMF as applicable. The gyratory pills will be prepared in accordance with AASHTO T 312.

The dust/calculated effective binder ratio and the volume of effective binder in the mixture will be determined and reported from the acceptance sample testing conducted in each subplot. The volume of effective binder will be the difference between VMA and air voids. The Contractor shall take action in accordance with ITM 583 to address a dust/calculated effective binder ratio ~~greater than 1.4~~ *not in accordance with 401.05, or a volume of effective binder in the mixture below design minimums, or a volume of effective binder in the mixture greater than 2.0% above design minimums.*

The bulk specific gravity of gyratory specimens for dense graded mixtures will be determined in accordance with AASHTO T 166, Method A or AASHTO T ~~275~~331, if required, except samples are not required to be dried overnight. The bulk specific gravity of gyratory specimens for open graded mixtures, ~~OG19.0 mm, OG25.0 mm~~ will be determined in accordance with AASHTO T 331.

SECTION 401, BEGIN LINE 261, DELETE AND INSERT AS FOLLOWS:

Air voids, binder content and  $VMA/Vbe$  values will be reported to the nearest 0.01%. Draindown test results will be rounded to the nearest 0.01%. Rounding will be in accordance with 109.01(a).

SECTION 401, BEGIN LINE 285, INSERT AS FOLLOWS:

Samples shall not be obtained from areas placed with paving equipment in accordance with 409.03(c)2 or 409.03(c)3. If a random location falls within this area, the Engineer will randomly select another location within the subplot for sampling. If an entire subplot falls within this area, test results from the previous subplot will be used for acceptance. If the previous subplot is not available, the subsequent subplot will be used for acceptance. *If previous or subsequent subplot results for a mixture accepted by 401.19(a) will be replicated for an entire lot, each subplot in that lot will be accepted by 401.19(b).*

SECTION 401, BEGIN LINE 370, DELETE AND INSERT AS FOLLOWS:

#### **401.14 Spreading and Finishing**

The mixture shall be placed upon an approved surface by means of laydown equipment in accordance with 409.03(c). Prior to paving, both the planned quantity and lay rate shall be adjusted by multiplying by the MAF. When mixture is produced from more than one DMF for a given pay item, the MAF will be applied to the applicable portion of the mixture for each. The temperature of each mixture at the time of spreading shall ~~not be more~~ *less* than 315°F whenever PG 64-22 or PG 70-22 binders are used or not more than 325°F whenever PG 76-22 binder is used.

SECTION 401, BEGIN LINE 482, DELETE AND INSERT AS FOLLOWS:

Density of any random core location in these areas will be assigned a value of ~~92.0~~ *94.0*% MSG and compaction shall be in accordance with 402.15.

SECTION 401, BEGIN LINE 504, DELETE AND INSERT AS FOLLOWS:

The Contractor shall obtain cores in the presence of the Engineer with a device that shall produce a uniform  $6.00 \pm 0.25$  in. diameter pavement sample. Coring shall be completed prior to the random location being covered by the next course.

~~Surface courses~~ *All core locations will be marked and shall be cored within two work days of placement. A damaged core shall be discarded and replaced with a core from a location selected by adding 1 ft to the longitudinal location of the damaged core using the same transverse offset.*

The Contractor and the Engineer shall mark the core to define the course to be tested. If the core indicates a course thickness of less than two times the maximum particle size, the core will be discarded and a core from a new random location will be selected for testing.

Cores shall not be obtained from areas placed with paving equipment in accordance with 409.03(c)2 or 409.03(c)3. If a random location falls within this area, the Engineer will randomly select another location within the subplot for coring. If an entire subplot falls within this area, test results from the previous subplot will be used for acceptance. If the previous subplot is not available, the subsequent subplot will be used for acceptance.

The Engineer will take immediate possession of the cores. If the Engineer's cores are subsequently damaged, additional coring will be the responsibility of the Department. Subsequent core locations will be determined by subtracting 1 ft from the random location using the same transverse offset.

The density for the mixture will be expressed as the percentage of maximum specific gravity, % MSG, obtained by dividing the average bulk specific gravity by the maximum specific gravity for the subplot, times 100. Samples for the bulk specific gravity and maximum specific gravity will be dried in accordance with ITM 572. The Engineer will determine the bulk specific gravity of the cores in accordance with AASHTO T 166, Method A or AASHTO T 275331, if required. The maximum specific gravity will be mass determined in water in accordance with AASHTO T 209.

Within one work day of coring operations the Contractor shall clean, dry, and refill the core holes with HMA of similar or smaller size particles.

The Engineer's acceptance test results for each subplot will be available when the subplot testing is complete. Acceptance of the pavement for density (% MSG) will be reported to the nearest 0.01%. Rounding will be in accordance with 109.01(a).

SECTION 401, BEGIN LINE 660, DELETE AND INSERT AS FOLLOWS:

#### **401.19 Pay Factors**

##### **(a) Dense Graded Mixture $\geq$ One Lot**

Pay factors, PF, are calculated for the air voids at  $N_{des}$ ,  $VMA/be$  at  $N_{des}$  and in-place density, % Gmm. The Percent Within Limits, PWL, for each lot will be determined in accordance with ITM 588. The appropriate pay factor for each property is calculated as follows:

Estimated PWL greater than 90:

$$PF = ((0.50 \times PWL) + 55.00)/100$$

Estimated PWL greater than or equal to 50 and equal to or less than 90:

$$PF = ((0.40 \times PWL) + 64.00)/100$$

Estimated PWL greater than or equal to 50 and equal to or less than 70:

$$PF = ((0.62585 \times PWL) + 43.7532.5)/100$$

If the Lot PWL for any one of the properties is less than 50 or, a subplot has an air void content less than 1.0% or greater than 7.0%, or a subplot has a volume of effective binder greater than 3.0% above design minimums, the lot will be referred to the Office of Materials Management for adjudication as a failed material in accordance with normal Department practice as listed in 105.03.

Air voids,  $VMA/be$ , and in-place density, % Gmm, PF values will be reported to the nearest 0.01. Rounding will be in accordance with 109.01(a).

A composite pay factor for each lot based on test results for mixture properties and density is determined by a weighted formula as follows:

$$\text{Lot PF} = 0.30(\text{PF}_{\text{VOIDS}}) + 0.35(\text{PF}_{\text{VMA/VE}}) + 0.35(\text{PF}_{\text{DENSITY}})$$

where:

- Lot PF = Lot Composite Pay Factor for Mixture and Density
- PF<sub>VOIDS</sub> = Lot Pay Factor for Air Voids at N<sub>des</sub>
- PF<sub>VMA/VE</sub> = Lot Pay Factor for VMA/ve at N<sub>des</sub>
- PF<sub>DENSITY</sub> = Lot Pay Factor for In-Place Density, %Gmm

The lot quality assurance adjustment for mixture properties and density is calculated as follows:

$$q = L \times U \times (\text{Lot PF} - 1.00) / \text{MAF}$$

where:

- q = quality assurance adjustment for mixture properties and density of the lot
- L = Lot quantity
- U = Unit price for the material, \$/ton
- Lot PF = Lot Pay Factor

Lot test results for the air voids at N<sub>des</sub>, VMA/ve at N<sub>des</sub>, and density will be used to determine the Lot Pay Factors.

The specification limits for the air voids at N<sub>des</sub>, VMA/ve at N<sub>des</sub>, and density will be as follows:

SPECIFICATION LIMITS		
MIXTURE		
	LSL*	USL**
Air Voids at N <sub>des</sub> , %	2.60 3.60	5.40 6.40
Voids In Mineral Aggregate Volume of Effective Binder at N <sub>des</sub> , %	Spec	Spec + 2.00 5.0
DENSITY		
	LSL*	USL**
Roadway Core Density (% Gmm), %	91.00 93.00	n/a
* LSL, Lower Specification Limit		
** USL, Upper Specification Limit		

**(b) Dense Graded Mixture < One Lot and Open Graded Mixture**

A composite pay factor for each subplot based on test results for mixture properties and density is determined in a weighted formula as follows:

Dense Graded Mixture:

$$SCPF = 0.30(PF_{VOIDS}) + 0.35(PF_{VMA/VE}) + 0.35(PF_{DENSITY})$$

Open Graded Mixture:

$$SCPF = 0.20(PF_{BINDER}) + 0.35(PF_{VOIDS}) + 0.45$$

where:

- SCPF = Sublot Composite Pay Factor for Mixture and Density
- PF<sub>BINDER</sub> = Sublot Pay Factor for Binder Content
- PF<sub>VOIDS</sub> = Sublot Pay Factor for Air Voids at N<sub>des</sub>
- PF<sub>VMA/VE</sub> = Sublot Pay Factor for VMA/ve at N<sub>des</sub>
- PF<sub>DENSITY</sub> = Sublot Pay Factor for Density

If the SCPF for a sublot is less than 0.85 or the volume of effective binder is greater than 3.0% above design minimums, the Office of Materials Management will evaluate the pavement. If the Contractor is not required to remove the mixture, quality assurance adjustments of the lot will be assessed or other corrective actions taken as determined by the Office of Materials Management. *sublot will be referred to the Office of Materials Management for adjudication as a failed material in accordance with normal Department practice as listed in 105.03.*

SECTION 401, BEGIN LINE 756, DELETE AND INSERT AS FOLLOWS:

<del>VMA/ve</del>		Pay Factors
Dense Graded Deviation from Spec Minimum	<del>Open Graded</del> Deviation from Spec Minimum	
<del>&gt; + 2.5</del> 3.0		Submitted to the Office of Materials Management*
<del>&gt;= + 2.0</del> 2.5 and <del>≤ + 2.5</del> 3.0		<del>0.25</del> 1.00 minus 0.05 for each 0.1% over +2.5%
<del>&gt;= + 1.5</del> 2.0 and <del>≤ &lt; + 2.0</del> 2.5		<del>0.65</del> 1.05 minus 0.01 for each 0.1% over +2.0%
<del>&gt; + 0.5</del> and <del>≤ &lt; + 1.5</del> 2.0		1.05
<del>≥ 0.0</del> and <del>≤ + 0.5</del>	All	<del>1.00</del> 1.05 minus 0.01 for each 0.1% under +0.5%
<del>≥ - 0.5</del> and < 0.0		<del>0.85</del> 1.00 minus 0.02 for each 0.1% under 0.0%
<del>≥ -2.0</del> and < -0.5		0.90 minus 0.06 for each 0.1% under - 0.5%
<del>≥ - 1.0</del> and < -0.5		0.65
<del>≥ - 1.5</del> and < -1.0		0.45
<del>≥ - 2.0</del> and < -1.5		0.25
<del>≥ - 2.5</del> and < -2.0		0.00
<del>&lt; -2.5</del> - 2.0		Submitted to the Office of Materials Management*
* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.		

AIR VOIDS		
Dense Graded	Open Graded	Pay Factor
Deviation from DMF <sub>Spec</sub> (± %)	Deviation** from DMF (± %)	
≤ 0.5	≤ 3.0	1.05
> 0.5 and ≤ 1.07	> 3.0 and ≤ 34.0	1.00
<del>1.1</del>	34.1	0.98
<del>1.28</del>	34.2	0.96
<del>1.3</del>	34.3	0.94
<del>1.4</del>	34.4	0.92
<del>1.59</del>	34.5	0.90
<del>1.62.0</del>	34.6	0.84
<del>1.7</del>	34.7	0.78
<del>1.8</del>	34.8	0.72
<del>1.9</del>	34.9	0.66
<del>2.0</del>	45.0	0.60
> 2.0	> 45.0	Submitted to the Office of Materials Management*

\* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.  
 \*\* Deviation shall be from 17.5% for OG25.0 mm and OG19.0 mm mixtures and shall be from 12.5% for OG9.5 mm mixtures.

For mixtures produced during a plant’s adjustment period, pay factors based on the DMF with the above tolerances will be used to compute quality assurance adjustments.

Sublot test results for density will be assigned pay factors in accordance with the following:

DENSITY	
Percentages are based on %MSG	Pay Factors, %
Dense Graded	
≥ <del>97.0</del> 98.0	Submitted to the Office of Materials Management*
<del>97.0</del> – 97.9	1.00
<del>95.6</del> – <del>96.9</del> 96.6 - 96.9	1.05 - 0.01 for each 0.1% above <del>95.5</del> 96.5
<del>94.0</del> – <del>95.5</del> 95.0 - 96.5	1.05
<del>93.1</del> – <del>93.9</del> 94.1 - 94.9	1.00 + 0.005 for each 0.1% above <del>93.0</del> 94.0
<del>92.0</del> – <del>93.0</del> 93.0 - 94.0	1.00
<del>91.0</del> – <del>91.9</del> 92.0 - 92.9	1.00 - 0.005 for each 0.1% below <del>92.0</del> 93.0
<del>90.0</del> – <del>90.9</del> 91.0 - 91.9	0.95 - 0.010 for each 0.1% below <del>91.0</del> 92.0
<del>89.0</del> – <del>89.9</del> 90.0 - 90.9	0.85 - 0.030 for each 0.1% below <del>90.0</del> 91.0
≤ <del>88.9</del> 89.9	Submitted to the Office of Materials Management*

\* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.

SECTION 401, BEGIN LINE 826, DELETE AND INSERT AS FOLLOWS:

The Contractor may appeal an individual subplot for the binder content, the MSG, the BSG of the gyratory specimens or the BSG of the density cores when the QC results are greater than one standard deviation from the acceptance test results as follows: 0.25 for binder content, 0.010 for the MSG and 0.010 for ~~both~~ the BSG of the gyratory specimens and 0.020 for the BSG of the density cores. Upon request from the Contractor, the BSG of the density core will be exempted from the individual subplot appeal if both the QC and QA results show a %MSG for the density greater than or equal to 93.0%.

SECTION 401, BEGIN LINE 862, DELETE AND INSERT AS FOLLOWS:

**(c) Binder Content**

The backup binder content sample will be prepared and tested in accordance with ~~the test method that was used for acceptance or as directed by the Engineer~~ ITM 571.

**(d) BSG of the Density Core**

Additional cores shall be taken within seven calendar days unless otherwise directed. Additional core locations will be determined by adding 1 ft longitudinally of the cores tested using the same transverse offset. The appeal density cores will be dried in accordance with ITM 572 and tested in accordance with AASHTO T 166, Method A or AASHTO T ~~275~~331, if required.

SECTION 401, BEGIN LINE 940, DELETE AND INSERT AS FOLLOWS:

If QC/QA-HMA ~~intermediate~~19.0 mm over QC/QA-HMA ~~base~~25.0 mm mixtures are specified, QC/QA-HMA ~~intermediate~~19.0 mm mixture may be considered as a substitute for the QC/QA-HMA ~~intermediate~~19.0 mm and QC/QA-HMA ~~base~~25.0 mm mixtures upon a written request by the Contractor. The request for the substitution shall be prepared in advance of the work. A computation will be made in order to obtain a unit price for the QC/QA-HMA ~~intermediate~~19.0 mm mixture. The quantity and amount for QC/QA-HMA ~~intermediate~~19.0 mm mixture shall equal the sum of the contract quantities and amounts shown for QC/QA-HMA ~~intermediate~~19.0 mm and QC/QA-HMA ~~base~~25.0 mm mixtures. The unit price for QC/QA-HMA ~~intermediate~~19.0 mm mixture shall be equal to the sum of contract amounts divided by the sum of contract quantities. Payment for the QC/QA-HMA ~~intermediate~~19.0 mm mixture will be made at the unit price per ton for QC/QA-HMA ~~intermediate~~19.0 mm mixture. No payment will be made for additional work or costs which may result due to this change.

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