HMA REVISIONS FOR 2005

The Standard Specifications are revised as follows:

SECTION 401, BEGIN LINE 714, DELETE AND INSERT AS FOLLOWS:

Standard Practice for ~~Short and Long Term~~ Mixture Conditioning ~~Aging~~ of Hot-Mix Asphalt (HMA) ……AASHTO R 30

Standard Practice for ~~Designing~~ Superpave Volumetric Design for Hot Mix Asphalt (HMA) …… AASHTO PP 28

Maximum Specific Gravity and Density of Bituminous Paving Mixtures…… AASHTO T 209

Resistance of Compacted ~~Bituminous~~ Asphalt Mixture to Moisture Induced Damage …… AASHTO T 283

Method for Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the ~~SHRP~~ Superpave Gyratory Compactor…… AASHTO T 312

SECTION 401, LINE 736C, DELETE AND INSERT AS FOLLOWS:

Primary Control Sieve	*~~9.5~~ 4.75 mm*	*4.75 mm*	*~~4.75~~ 2.36 mm*	*2.36 mm*	*NA*

SECTION 401, BEGIN LINE 737a, DELETE AND INSERT AS FOLLOWS:

Open Graded, Mixture Designation – Control Point (Percent Passing)		
	~~C19.0~~ OG19.0	*~~C25.0~~ OG25.0*

SECTION 401, BEGIN LINE 754, DELETE AND INSERT AS FOLLOWS:

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 ~~short term aging~~ mixture conditioning for 2 h in accordance with AASHTO R 30. The minimum tensile strength ratio, TSR, shall be 80%. The 150 mm (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.

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 ~~0.960~~ 0.980 ≤ MAF ≤ ~~1.040~~ 1.020, then the MAF shall be considered to be 1.000. If the calculated MAF is outside of the above range, then the actual calculated value shall be used. The MAF does not apply to OG mixtures.

SECTION 401, BEGIN LINE 783a, DELETE AND INSERT AS FOLLOWS:

VOIDS IN MINERAL AGGREGATE (VMA) CRITERIA @ N_{des}	
Mixture Designation	*Minimum VMA, Percent*

4.75 mm	*16.0*
9.5 mm	*15.0*
12.5 mm	*14.0*
19.0 mm	*13.0*
25.0 mm	*12.0*
~~C19.0~~ OG19.0 mm	*NA*
~~C25.0~~ OG25.0 mm	*NA*

SECTION 401, BEGIN LINE 791, DELETE AND INSERT AS FOLLOWS:

Note 4: For ~~C19.0~~ OG19.0 mm and ~~C25.0~~ OG25.0 mm mixtures, VFA is not applicable.

SECTION 401, BEGIN LINE 809, DELETE AND INSERT AS FOLLOWS:

~~Mainline surface or open graded mixtures shall not contain recycled materials.~~ Recycled materials shall not be used in ESAL Category 3, 4, or 5 surface mixtures or open graded mixtures.

SECTION 401, BEGIN LINE 858, DELETE AND INSERT AS FOLLOWS:

The bulk specific gravity of gyratory specimens for dense graded mixtures will be determined in accordance with AASHTO T 166 except samples are not required to be dried overnight. The bulk specific gravity of gyratory specimens for open graded mixtures, ~~C19.0~~ OG19.0, ~~C25.0~~ OG25.0 will be determined in accordance with ASTM D 6752, except as follows. The duration of the test from initiating the vacuum extraction to weighing the specimen after the water bath will not exceed five minutes. The mass of water absorbed by the specimen while in the water bath will be subtracted from the mass of the specimen obtained in the water bath. Any test in which the mass of water absorbed by the specimen exceeds ~~2% of the sample mass~~ 5 g is invalid.

SECTION 401, BEGIN LINE 880, DELETE AND INSERT AS FOLLOWS:

The Engineer's acceptance test results for each sublot will be available ~~when~~ after the sublot and testing ~~is~~ are complete.

SECTION 401, BEGIN LINE 902, INSERT AS FOLLOWS:

401.10 General. *Equipment for HMA operations shall be in accordance with 409. For HMA work performed after January 2006,* t*he paver shall be equipped with means of preventing the segregation of the coarse aggregate particles when moving the mixture from the paver hopper to the paver augers. The means and methods used shall be in accordance with the paver manufacturer's instructions and may consist of chain curtains, deflector plates, or other such devices, or any combination of these.*

The following specific requirements shall also apply to identified HMA pavers:

1. *Blaw-Knox HMA pavers shall be equipped with the Blaw-Knox Materials Management Kit, MMK.*

2. *Cedarrapids HMA pavers shall be those that were manufactured in 1989 or later.*

3. *Caterpillar HMA pavers shall be equipped with deflector plates as identified in the December, 2000 Service Magazine entitled "New Asphalt Deflector Kit {6630, 6631, 6640}".*

The Contractor shall submit to the Engineer a written Certificate of Compliance that includes the manufacturer's make, model, serial number, and manufactured year of each paver to be utilized. The Certificate of Compliance shall be submitted prior to the pavers being used and shall certify that the pavers have been modified in accordance with the above information. The Contractor is also required to demonstrate to the Engineer prior to use, that the modifications to the pavers have been implemented on all pavers to be utilized on the project.

SECTION 401, BEGIN LINE 1035, DELETE AS FOLLOWS:

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

SECTION 401, BEGIN LINE 1045, DELETE AND INSERT AS FOLLOWS:

The Engineer's acceptance test results for each sublot will be available when the sublot testing is complete. Acceptance of the pavement for density (%MSG) will be reported to the nearest 0.1%. Rounding will be in accordance with 109.01(a).

SECTION 401, BEGIN LINE 1052, DELETE AND INSERT AS FOLLOWS:

401.18 Pavement Smoothness. *The pavement smoothness will be accepted by means of a profilograph, a 4.9 m (16 ft) long straightedge, or a 3 m (10 ft) long straightedge.*

The profilograph shall be used where all of the following conditions are met:

(a) the design speed is greater than 70 km/h (45 mph),

(b) the pavement lanes are full width and ~~75 m (250 ft)~~ 0.16 km (0.1 mi.) or longer, and

(c) the HMA is placed on a milled surface or the total combined planned lay rate of surface, intermediate, and base is ~~180~~ 210 kg/m^2 (~~330~~ 385 lb/syd) or greater.

If a pay item, profilograph, HMA, is included in the contract and the above conditions are met, the Contractor shall furnish, calibrate, and operate an approved profilograph in accordance with ITM 901. The profilogram produced shall become the property of the Department. The profilograph shall remain the property of the Contractor. When a profilograph, HMA, is not included as a pay item, and the above conditions are met, the Department will furnish, calibrate, and operate the profilograph or the Department will develop an extra work agreement in accordance with 109.05 to include profilograph, HMA as a pay item.

Within the limits of a smoothness section where the posted speed is 65 km/h (40 mph) or less, smoothness of that section may be measured by a profilograph or a 4.9 m (16 ft) long straightedge. The Contractor shall notify the Engineer of the selected process prior to placement of the HMA. Smoothness pay adjustments are only applicable when measured by a profilograph.

The 4.9 m (16 ft) long straightedge shall be used on overlays where the profilograph is not specified. The 4.9 m (16 ft) long straightedge shall be used on all full width pavement lanes shorter than ~~75 m (250 ft)~~ 0.16 km (0.1 mi.), on tapers, within 15 m (50 ft) of ~~bridge ends~~ a reinforced concrete bridge approach, and within 15 m (50 ft) of an existing pavement, which is being joined.

SECTION 401, BEGIN LINE 1095, DELETE AND INSERT AS FOLLOWS:

When the profilograph is being used on a surface course, in addition to the requirements for the profile index, all areas having a high or low point deviation in excess of 8 mm (0.3 in.) shall be corrected. Courses underlying the surface courses that are exposed by corrective actions shall be milled to ~~25 mm (1 in.)~~ 38 mm (1 1/2 in.) and replaced with the same type surface materials. The initial profile index shall be determined prior to any corrective action. The final profile index will be determined after all corrective action has been completed.

SECTION 401, BEGIN LINE 1126, DELETE AND INSERT AS FOLLOWS:

The sublot quality assurance adjustment for mixture properties and density is calculated as follows.

$$q = \sum L \times U \times (SCPF - 1.00)/MAF$$

where:

q = quality assurance adjustment ~~quantity~~ for the sublot
L = sublot quantity
U = unit price for the material, $/Mg ($/TON)
SCPF = sublot composite pay factor

~~*The quality assurance adjustment points for smoothness will be calculated in accordance with 401.19(c).*~~

~~*The total quality assurance adjustments is to be calculated as follows:*~~

~~$$Q = Q_s + (\sum q)/MAF$$~~

~~*where:*~~

~~*Q = total quality assurance adjustment quantity*~~
~~*Q_s = quality assurance adjustment for smoothness as calculated in 401.19(c)*~~
~~*q = quality assurance adjustment quantity*~~

SECTION 401, BEGIN LINE 1152a, DELETE AND INSERT AS FOLLOWS:

~~*BINDER CONTENT*~~	
~~*Deviation from JMF (± %)*~~	~~*Pay Factor*~~
~~*≤ 0.2*~~	~~*1.05*~~
~~*> 0.2 and ≤ 0.3*~~	~~*1.04*~~
~~*> 0.3 and ≤ 0.4*~~	~~*1.02*~~
~~*> 0.4 and ≤ 0.5*~~	~~*1.00*~~

~~> 0.5 and ≤ 0.6~~	~~0.95~~
~~>0.6 and ≤ 0.7~~	~~0.90~~
~~> 0.7 and ≤ 0.8~~	~~0.85~~
~~> 0.8~~	~~0.85 - 0.05 per each 0.1% over 0.8%~~

BINDER CONTENT		
DENSE GRADED	OPEN GRADED	PAY FACTOR
Deviation from JMF (± %)	Deviation from JMF (± %)	Pay Factor
≤ 0.2	≤ 0.2	1.05
0.3	0.3	1.04
0.4	0.4	1.02
0.5	0.5	1.00
0.6	0.6	0.95
0.7	0.7	0.90
0.8	0.8	0.85
> 0.8	> 0.8	0.85 – 0.05 per each 0.1% over 0.8%

~~VMA~~	
~~Deviation from JMF (± %)~~	~~Pay Factor~~
~~DENSE GRADED~~	
~~≤ 0.5~~	~~1.05~~
~~> 0.5 and ≤ 1.0~~	~~1.00~~
~~> 1.0 and ≤ 1.5~~	~~0.95~~
~~> 1.5 and ≤ 2.0~~	~~0.90~~
~~> 2.0 and ≤ 2.5~~	~~0.85~~
~~> 2.5~~	~~0.85 - 0.02 per each 0.1% over 2.5%~~
~~OPEN GRADED~~	
~~All~~	~~1.00~~

VMA		
DENSE GRADED	OPEN GRADED	PAY FACTOR
Deviation from JMF (± %)	Deviation from JMF (± %)	Pay Factor
≤ 0.5		1.05
> 0.5 and ≤ 1.0	All	1.00
> 1.0 and ≤ 1.5		0.95
> 1.5 and ≤ 2.0		0.90
> 2.0 and ≤ 2.5		0.85
> 2.5		0.85 – 0.02 per each 0.1% over 2.5%

~~AIR VOIDS~~	
~~Deviation from JMF (± %)~~	~~Pay Factor~~
~~DENSE GRADED~~	
~~≤ 0.5~~	~~1.05~~
~~> 0.5 and ≤ 1.0~~	~~1.00~~

~~> 1.0 and ≤ 1.5~~	~~0.95~~
~~> 1.5 and ≤ 2.0~~	~~0.85~~
~~> 2.0~~	~~Submitted to the Materials and Tests Division~~
~~OPEN GRADED~~	
~~≤ 1.0~~	~~1.05~~
~~> 1.0 and ≤ 3.0~~	~~1.00~~
~~> 3.0 and ≤ 3.5~~	~~0.95~~
~~> 3.5 and ≤ 4.0~~	~~0.85~~
~~> 4.0~~	~~Submitted to the Materials and Tests Division~~

AIR VOIDS		
DENSE GRADED	OPEN GRADED	PAY FACTOR
Deviation from JMF (± %)	Deviation from JMF (± %)	Pay Factor
≤ 0.5	≤ 1.0	1.05
> 0.5 and ≤ 1.0	> 1.0 and ≤ 3.0	1.00
> 1.0 and ≤ 1.5	> 3.0 and ≤ 3.5	0.95
> 1.5 and ≤ 2.0	> 3.5 and ≤ 4.0	0.85
> 2.0	> 4.0	Submit to Materials and Tests Division*

SECTION 401, BEGIN LINE 1164a, DELETE AND INSERT AS FOLLOWS:

DENSITY		
Percentages are based on %MSG	Pay Factors – Percent	
Dense Graded	Open Graded	
≥ 97.0		Submitted to the Materials and Tests Division*
95.6 - 96.9		1.05 - 0.01 for each 0.1% above ~~95.6~~ 95.5
94.0 - 95.5		1.05
93.1 - 93.9		1.00 + 0.005 for each 0.1% above ~~93.1~~ 93.0
92.0 - 93.0	84.0	1.00
91.0 - 91.9		1.00 - 0.003 for each 0.1% below 92.0
90.0 - 90.9		0.97 - 0.012 for each 0.1% below 91.0
89.0 - 89.9		0.85 - ~~0.015~~ 0.030 for each 0.1% below 90.0
≤ 88.9		Submitted to the Materials and Tests Division*

* 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 1183, DELETE AND INSERT AS FOLLOWS:

~~N~~n = number of layers

SECTION 401, AFTER LINE 1200, INSERT AS FOLLOWS:

The total quality assurance adjustments is to be calculated as follows:

$$Q = Q_s + (\sum q)$$

where:

Q = total quality assurance adjustment
Q_s = quality assurance adjustment for smoothness

q = sublot quality assurance adjustment

SECTION 401, BEGIN LINE 1233, DELETE AND INSERT AS FOLLOWS:

401.21 Method of Measurement. *HMA mixtures will be measured by the megagram (ton) of the type specified, in accordance with 109.01(b). The ~~mass (weight) accepted for payment~~ measured quantity will be divided by the MAF to determine the ~~accepted~~ pay quantity.*

SECTION 402, BEGIN LINE 474, INSERT AS FOLLOWS:

PG 64-28, PG 70-22, PG 76-22…… 902.01(a)*

SECTION 402, BEGIN LINE 501, DELETE AND INSERT AS FOLLOWS:

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 ~~0.960~~ 0.980 ≤ MAF ≤ ~~1.040~~ 1.020, then the MAF shall be considered to be 1.000. If the calculated MAF is outside of the above range, then the actual calculated value shall be used.

SECTION 402, BEGIN LINE 537, DELETE AND INSERT AS FOLLOWS:

(d) Composition Limits for HMA Curbing Mixes. *The mixture shall be HMA surface type A in accordance with 402 except 402.05 shall not apply and ~~no~~ RAP shall not be used. The binder content shall be 7.0% and the gradations shall meet the following.*

SECTION 402, BEGIN LINE 590, INSERT AS FOLLOWS:

402.10 General. *Equipment for HMA operations shall be in accordance with 409. For HMA work performed after January 2006, the Contractor shall submit to the Engineer a written Certificate of Compliance that the proposed pavers have been modified in accordance with 401.10 prior to use of the pavers.*

SECTION 402, BEGIN LINE 745, DELETE AND INSERT AS FOLLOWS:

402.16 Low Temperature ~~Density~~ Compaction Requirements. *Compaction for mixtures placed below the temperatures listed in 402.12, shall be controlled by ~~air voids~~ density determined from MSG of the plate samples ~~a mixture plate sample~~ and cores cut from the compacted pavement placed during a low temperature period. Samples shall be obtained in accordance with ITM 580. Acceptance will be based on a ~~minimum of one~~ plate sample and two cores. The Engineer will randomly select locations in accordance with ITM 802. The transverse core location will be located so that the edge of the core will be no closer than 75 mm (3 in.) from a confined edge or 150 mm (6 in.) from a non-confined edge of the course being placed.*

SECTION 402, BEGIN LINE 765, DELETE AS FOLLOWS:

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 2.0 times the maximum particle size, the core will be discarded and a core from a new random location will be selected for testing.

SECTION 402, BEGIN LINE 775, DELETE AS FOLLOWS:

The ~~percent air voids~~ density ~~of a section~~ for the mixture shall be expressed as:

~~*AV %*~~ *Density* = ~~*(1.0 - BSG/MSG) x*~~ *100 x BSG/MSG*

where:

~~*AV % = percent air voids*~~
BSG = average bulk specific gravity
MSG = maximum specific gravity

The Engineer will determine the bulk specific gravity of the cores in accordance with AASHTO T 166. The maximum specific gravity will be determined in accordance with AASHTO T 209. Density ~~*Air voids*~~ *shall not be* ~~*greater*~~ *less than* ~~*8.0%*~~ *92.0%*. ~~*Within one work day of coring operations, the Contractor shall clean, dry, refill, and compact the core holes with suitable HMA of similar or smaller size particles or other approved materials.*~~

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

SECTION 402, BEGIN LINE 797, DELETE AND INSERT AS FOLLOWS:

402.19 Method of Measurement. *HMA mixtures will be measured by the megagram (ton) of the type specified, in accordance with 109.01(b). The* ~~*mass (weight) accepted for payment*~~ *measured quantity will be divided by the MAF to determine the* ~~*accepted*~~ *pay quantity.*

SECTION 404, BEGIN LINE 148, DELETE AS FOLLOWS:

404.06 Preparation of Surface. *Surfaces to be sealed shall be brought to proper section and grade, compacted, cleaned as required, and approved.* ~~*Aggregate surfaces to be sealed shall be primed in accordance with 406.*~~

SECTION 408, BEGIN LINE 212, DELETE AND INSERT AS FOLLOWS:

408.02 Materials. *Materials shall be in accordance with the following:*

Asphalt Emulsion for
Crack Sealing, AE-90, AE-90S, AE-150…… 902.01(b)
Fine Aggregates, No. 23 or 24…… 904
~~*Sealant for Routed Cracks and Joints …… ASTM D 3405*~~
Joint Sealing Materials…… 906.02

SECTION 408, BEGIN LINE 221, DELETE AND INSERT AS FOLLOWS:

408.03 Equipment. *A distributor in accordance with 409.03 shall be used when crack sealing and an indirect-heat double boiler kettle with mechanical agitator shall be used when routing and* ~~*sealing*~~ *filling. Air compressors shall be capable of producing a minimum air pressure of 690 kPa (100 psi).*

408.04 Weather Limitations. *Sealing or filling operations shall not be conducted on a wet surface, when the ambient temperature is below 4°C (40°F), or when other unsuitable conditions exist, unless approved by the Engineer.*

***408.05 Routing and Filling Cracks and Joints**. Cracks and joints shall be routed when specified, with a vertical-spindle router with carbide-tipped or diamond router bits to form a reservoir not exceeding 13 mm ~~x 13 mm~~ (0.5 in. ~~x 0.5 in.~~) wide with a minimum depth of 19 mm (0.75 in.)~~, when required~~. The operation shall be coordinated such that routed materials do not encroach on pavement lanes carrying traffic and all routed materials are disposed of in accordance with 104.07. Cracks and joints shall be filled with asphalt rubber to within 7 mm (0.25 in.) of the surface in accordance with the manufacturer's recommendations.*

SECTION 408, BEGIN LINE 250, DELETE AND INSERT AS FOLLOWS:

***408.07 Method of Measurement.** Sealing and filling of cracks and joints in asphalt pavements will be measured by the megagram (ton) of ~~asphalt~~ material used. Routing of cracks and joints will not be measured.*

SECTION 408, BEGIN LINE 257, DELETE AND INSERT AS FOLLOWS:

***408.08 Basis of Payment.** Sealing and filling of cracks and joints in asphalt pavements will be paid for by the megagram (ton) of ~~asphalt~~ material used for the type specified.*

SECTION 410, BEGIN LINE 1, DELETE AND INSERT AS FOLLOWS:

~~SECTION 410 – Blank~~

SECTION 410 – QUALITY CONTROL/QUALITY ASSURANCE, QC/QA, HMA SURFACE – SMA PAVEMENT

***410.01 Description.** This work shall consist of one course of QC/QA HMA Surface – SMA mixture constructed on prepared foundations in accordance with 105.03.*

***410.02 Quality Control.** The SMA mixture shall be supplied from a certified HMA plant in accordance with ITM 583; Certified Volumetric Hot Mix Asphalt Producer Program. The QCP shall be modified to include the requirements for the SMA mixtures. The SMA shall be transported and placed according to a Quality Control Plan, QCP, prepared and submitted by the Contractor in accordance with ITM 803; Contractor Quality Control Plans for Hot Mix Asphalt Pavements. The QCP shall be submitted to the Engineer at least 15 days prior to commencing SMA paving operations.*

MATERIAL

***410.03 Materials.** Materials shall be in accordance with the following:*

Asphalt Materials
PG Binder, PG 76-22, PG 70-22..... 902.01(a)
Coarse Aggregates, Class AS 904
Stabilizing Additive .....AASHTO MP 8
Fine Aggregates (sand, mineral filler) 904

***410.04 Design Mix Formula.** A design mix formula, DMF, shall be prepared in accordance with 410.05 and submitted in a format acceptable to the Engineer one week prior to use. The DMF shall state the maximum particle size in the mixture. 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, and a Mixture Adjustment Factor (MAF). The DMF shall state the source, type, dosage rate of any stabilizing additives. Approval of the DMF will be based on the ESAL and mixture designation. A mixture number will be assigned by the Engineer. No mixture will be accepted until the DMF has been approved.

The ESAL category identified in the pay item correlates to the following ESAL ranges:

ESAL CATEGORY	*ESAL*
1	*< 300,000*
2	*300,000 to < 3,000,000*
3	*3,000,000 to < 10,000,000*
4	*10,000,000 to < 30,000,000*
5	*≥ 30,000,000*

410.05 SMA Mix Design. *The DMF shall be determined for each mixture from a SMA mix design by a design laboratory selected from the Department's list of Approved Mix Design Laboratories. A SMA mixture shall be designed in accordance with the respective AASHTO references as listed below.*

Standard Practice for Designing
Stone Matrix Asphalt (SMA) ..... AASHTO PP 41

Standard Practice for Mixture Conditioning
of Hot-Mix Asphalt (HMA).....AASHTO R 30

Standard Specification for Designing
Stone Matrix Asphalt (SMA) .....AASHTO MP 8

Determining the Plastic Limit and Plasticity
Index of Soils.....AASHTO T 90

Maximum Specific Gravity and Density of Bituminous
Paving Mixtures..... AASHTO T 209

Resistance of Compacted Asphalt Mixture to
Moisture Induced Damage ..... AASHTO T 283

Determination of Draindown Characteristics
in Uncompacted Asphalt Mixtures..... AASHTO T 305

Method for Preparing and Determining the
Density of Hot Mix Asphalt (HMA)
Specimens by Means of the Superpave

Gyratory Compactor…… AASHTO T 312

Method for Viscosity Determination of Asphalt Binder Using Rotational Viscometer …… AASHTO T 316

The single percentage of aggregate passing each required sieve shall be within the limits of the following gradation table.

SMA Gradation Control Limits (Percent Passing by Volume)				
	Mixture Designation			
	9.5 mm		*12.5 mm*	
Sieve Size	*Lower*	*Upper*	*Lower*	*Upper*
25.0 mm				
19.0 mm			*100.0*	*100.0*
12.5 mm	*100.0*	*100.0*	*90.0*	*99.0*
9.5 mm	*70.0*	*95.0*	*50.0*	*85.0*
4.75 mm	*30.0*	*50.0*	*20.0*	*40.0*
2.36 mm	*20.0*	*30.0*	*16.0*	*28.0*
1.18 mm	*---*	*21.0*	*---*	*---*
600 μm	*---*	*18.0*	*---*	*---*
300 μm	*---*	*15.0*	*---*	*---*
75 μm	*8.0*	*12.0*	*8.0*	*11.0*

The optimum binder and aggregate gradation content shall produce 4.0% air voids. The maximum specific gravity of the uncompacted mixture shall be determined in accordance with AASHTO T 209. The percent draindown for SMA surface mixture shall not exceed 0.30% in accordance with AASHTO T 305.

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 mixtures. If the MAF calculation results in a value where $0.980 \leq MAF \leq 1.020$, then the MAF shall be considered to be 1.000. If the calculated MAF is outside of the above range, then the actual calculated value shall be used.

The 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 2 h in accordance with AASHTO R 30. The minimum tensile strength ratio, TSR, shall be 70%. The 150 mm (6 in.) mixture specimens shall be compacted to 6.0 ± 1.0% air voids in accordance with AASHTO T 312. Specimens shall be prepared using freeze-thaw preconditioning. 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.

The fine aggregate portion of the aggregate blend shall be non-plastic as determined in accordance with AASHTO T 90.

A change in the source or types of aggregates, change in source or type of stabilizing additives, or a change in the source of the specified binder shall require a new DMF. A new DMF shall be submitted to the District Materials and Tests Engineer for approval one week prior to use.

The specific gravity of SF and the Gsb of an aggregate blend containing SF may be adjusted once per contract upon notification by the SF source and approval by the District Materials and Tests Engineer. A new DMF is not required for this adjustment.

The mixture design compaction temperature for the specimens shall be 150 ± 5°C (300 ± 9°F).

VOIDS IN MINERAL AGGREGATE (VMA) CRITERIA	
Mixture Designation	*Minimum VMA, Percent*
12.5 mm	*17.0*
9.5 mm	*17.0*

410.06 Recycled Materials. *Mainline surface shall not contain recycled materials.*

410.07 Lots and Sublots*. Lots will be defined as 2400 Mg (2400 t) of SMA surface mixture. Lots will be further sub-divided into sublots not to exceed 600 Mg (600 t) of SMA surface mixture. Partial sublots of 100 Mg (100 t) or less will be added to the previous sublot. Partial sublots greater than 100 Mg (100 t) constitute a full sublot.*

410.08 Job Mix Formula*. A job mix formula, JMF, shall be developed by a certified HMA producer in accordance with ITM 583. A JMF used for SMA mixture the current or previous calendar year will be allowed. The mixture compaction temperature shall be 150 ± 5°C (300 ± 9°F). The JMF for each mixture shall be submitted to the Engineer.*

410.09 Acceptance of Mixtures. *Acceptance of mixtures for binder content, moisture, and gradation for each lot will be based on tests performed by the Engineer. The Engineer will randomly select the location(s) within each sublot for sampling in accordance with the ITM 802.*

Samples from each location shall be obtained from each sublot from the pavement in accordance with ITM 580. The second sample shall be located from the random sample by offsetting 0.3 m (1 ft) transversely towards the center of the mat and will be used for the moisture sample. The test results of the sublots will be averaged and shall meet the requirements for tolerances from the JMF for each sieve and binder content.

The maximum percent of moisture in the mixture shall not exceed 0.10 from plate samples.

The Engineer's acceptance test results for each sublot will be available after the sublot and testing are complete. During the adjustment period the test results will be made available after testing is complete.

ACCEPTANCE TOLERANCE FOR MIXTURES (%Percent Mass)										
MIXTURE	NUMBER OF TESTS	SIEVE SIZE								
					*12.5 mm	*9.5 mm	*4.75 mm	2.36 mm	600 μm	75 μm
SURFACE	1							8.0	4.0	2.5
	2							5.7	2.8	2.1
	3							4.6	2.3	1.8
	4							4.0	2.0	1.5

* The acceptance tolerance for this sieve shall be the applicable composition limits specified in 410.05.

ACCEPTANCE TOLERANCE FOR BINDER				
Binder Content	Number of Tests			
	1	2	3	4
% Binder	0.7	0.5	0.4	0.3

Acceptance of mixtures for range will be determined using the results of sublot tests performed by the Engineer from each lot. If the range is not in accordance with the requirements, adjustment points will be assessed in accordance with 410.19(a).

ACCEPTANCE TOLERANCE FOR RANGE (± Percent Mass)		
SIEVE SIZE & BINDER CONTENT	PERCENTAGE POINTS	
		SURFACE
2.36 mm		12.0
600 μm		6.0
75 μm		2.0
% BINDER		1.0

Acceptance tolerances for binder content and gradation will be as set out above for the number of tests performed. The acceptance tolerance for range will be as set out above for lots of more than one sublot. The range of binder shall be the difference between the highest sublot binder content and the lowest sublot binder content in one lot. The range of gradation shall be the difference between the highest sublot percent passing and the lowest sublot percent passing each required sieve in one lot.

Single test values and averages will be reported to the nearest 0.1% except moisture will be reported to the nearest 0.01%. Rounding will be in accordance with 109.01(a).

Lot adjustment points will be assessed in accordance with 410.19(a) when the average or range for binder content or gradation are not met.

The Contractor may request an appeal of the Engineer's test results in accordance with 410.20.

A binder draindown test in accordance with AASHTO T 305 shall be completed once per lot in accordance with 410.07 and shall not exceed 0.30%.

Stabilizing additives incorporated into the mixture will be accepted on the basis of a type A certification for the specified material properties for each shipment of fibers. Stabilizing additives from different manufacturers and different types of additives shall not be intermixed.

In the event that an acceptance sample is not available to represent a sublot(s), all test results of the previous sublot will be used for acceptance. If the previous sublot is not available, the subsequent sublot will be used for acceptance.

CONSTRUCTION REQUIREMENTS

410.10 General. *Equipment for SMA operations shall be in accordance with 409. For SMA work performed after January 2006, the Contractor shall submit to the Engineer a written Certificate of Compliance that the proposed pavers have been modified in accordance with 401.10 prior to use of the pavers.*

Fuel oil, kerosene, or solvents shall not be transported in open containers on equipment. Cleaning of equipment and small tools shall not be accomplished on the pavement or shoulder areas.

Segregation, flushing or bleeding of SMA mixtures will not be permitted. Corrective action shall be taken to prevent continuation of these conditions. Segregated, flushed or bleeding of SMA mixtures shall be removed if directed. All areas showing an excess or deficiency of binder shall be removed and replaced.

All mixtures that become loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced.

410.11 Preparation of Surfaces to be Overlaid. *Milling of an existing pavement surface shall be in accordance with 202.05. Surfaces on which a mixture is placed shall be free from objectionable or foreign materials at the time of placement.*

Milled asphalt surfaces and asphalt surfaces shall be tacked in accordance with 406. Contact surfaces of curbing, gutters, manholes, and other structures shall be tacked in accordance with 406.

410.12 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.*

410.13 Weather Limitations. *SMA courses shall be placed when the ambient temperature and the temperature of the surface on which it is to be placed is 7°C (45°F) or above.*

410.14 Spreading and Finishing. *The mixture shall be placed upon an approved surface by means of a paver or other mechanical devices in accordance with 409.03. Mixtures in areas inaccessible to mechanical devices may be placed by other methods.*

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 or JMF for a given pay item, the MAF will be applied to the applicable portion of the mixture for each.

Planned SMA courses greater than 90 kg/m^2 (165 lb/syd) placed under traffic, shall be brought up even with each adjacent lane at the end of each work day. Planned SMA courses less than or equal to 90 kg/m^2 (165 lb/syd) shall be brought forward concurrently, within practical limits, limiting the work in one lane to not more than one work day of production before moving back to bring forward the adjacent lane.

Hydraulic extensions on the paver will not be permitted for continuous paving operations. Fixed extensions or extendable screeds shall be used on courses greater than the nominal width of the paver except in areas where the paving widths vary. Hydraulic extensions may be used in tapers and added lanes less than 75 m (250 ft) in length.

Automatic slope and grade controls will be required and shall be outlined in the QCP.

SMA mainline and SMA shoulders which are 2.4 m (8.0 ft) or more in width shall be placed with automatic paving equipment.

The rollers shall be operated to avoid shoving of the SMA and at speeds not to exceed 4.5 km/h (3 mph). Rollers shall be in accordance with 409.03 (d) 1, 2, or 6. Vibratory rollers meeting the requirements of 409.03(d)1 may be used but shall not be operated in vibratory mode, except the vibratory mode may be used on the first pass to the paver.

The finished thickness of any course shall be at least two times but not more than four times the maximum particle size as shown on the DMF.

410.15 Joints. *Longitudinal joints in the surface shall be at the lane lines of the pavement.*

Transverse joints shall be constructed by exposing a near vertical full depth face of the previous course. For areas inaccessible to rollers, other mechanical devices shall be used to achieve the required density.

If constructed under traffic, temporary transverse joints shall be feathered to provide a smooth transition to the driving surface.

410.16 Density. *Acceptance will be based on lots and sublots in accordance with 410.07.*

The Engineer's acceptance test results for each sublot will be available after the sublot and testing are complete.

Sublot and lot density values will be reported to the nearest 0.1%. Rounding will be in accordance with 109.01(a).

Density acceptance for all SMA mixtures shall be based on cores cut from the compacted pavement and analysis of pavement samples obtained in accordance with ITM 580. Acceptance will be based on lots and sublots in accordance with 410.07. The Engineer will randomly select two locations in accordance with ITM 802, within each sublot for coring. The transverse core location will be located so that the edge of the core will be no closer than 75 mm (3 in.) from a confined edge or 150 mm (6 in.) from a non-confined edge of the course being placed. The maximum specific gravity will be determined from the sample obtained in 410.09.

The Contractor shall obtain cores in the presence of the Engineer with a device that shall produce a uniform 150 mm (6 in.) diameter pavement sample. Surface courses shall be cored within one work day of placement. Damaged core(s) shall be discarded and replaced with a core from a location selected by adding 0.3 m (1.0 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 2.0 times the maximum particle size, the core will be discarded and a core from a new random location will be selected for testing.

The Engineer will take immediate possession of the cores. If the Engineer's cores are subsequently damaged, additional coring within a specific sublot or sublots will be the responsibility of the Department. Subsequent core locations will be determined by subtracting 0.3 m (1.0 ft) from the random location using the same transverse offset.

The density of 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 sublot, times 100. The Engineer will determine the BSG of the cores in accordance with AASHTO T 166. The maximum specific gravity will be determined in accordance with AASHTO T 209 from plant produced materials prepared in accordance with ITM 572. The target value for density of SMA mixtures of each sublot shall be 93.0%.

The densities of the sublots will be averaged to determine the density of the lot.

Within one work day of coring operations the Contractor shall clean, dry, and refill the core holes with SMA of similar or smaller size particles or other approved materials. The Contractor's plan for refilling core holes shall be outlined in the QCP.

410.17 Shoulder Corrugations. *Shoulder corrugations shall be in accordance with 606.*

410.18 Pavement Smoothness. *The pavement smoothness will be evaluated and determined in accordance with 401.18.*

410.19 Adjustment Points. *When test results for mixture properties or density exceed the allowable tolerances, adjustment points will be assessed. The adjustment points will be used to calculate a quality assurance adjustment quantity (q) for the lot. Quality assurance adjustment points for smoothness will be in accordance with 401.19(c).*

The adjustment for mixture properties and density are calculated as follows.

$$q = (L \times U \times P/100)/MAF$$

where:

q = *quality assurance adjustment quantity*
L = *lot quantity*
U = *unit price for the material, $/Mg ($/TON)*
P = *total adjustment points*

The total quality assurance adjustments is to be calculated as follows:

$$Q = Q_s + \sum (q_m + q_d)$$

where:

Q = *total quality assurance adjustment quantity*
Q_s = *quality assurance adjustment for smoothness as calculated in 401.19(c)*
q_m = *lot adjustments for mixtures*
q_d = *lot adjustments for density*

If the total adjustment points for a lot are greater than 15, the pavement will be evaluated by the Materials and Tests Division. If the Contractor is not required to remove the mixture, quality assurance adjustments of the lot will be assessed or other corrective actions as determined by the Materials and Tests Division.

(a) Mixture. *When test results for the mixture furnished exceed the allowable tolerances, adjustment points will be assessed as follows:*

ADJUSTMENT POINTS FOR GRADATION	
Adjustment Points	*SIEVE SIZE*

				12.5 mm	9.5 mm	4.75 mm	2.36 mm	600 Fm	75 Fm
For Each 0.1% up to 1.0% Out Of Tolerance				0.1	0.1	0.1	0.1	0.2	0.3
For Each 0.1% > 1.0% Out of Tolerance				0.1	0.1	0.1	0.2	0.3	0.6

Gradation adjustment points for the lot shall be the sum of points calculated for up to 1% out of tolerance and the points calculated for greater than 1% out of tolerance in accordance with 410.09.

Binder content adjustment points for the lot shall be two points for each 0.1% above the tolerance or four points for each 0.1% below the tolerance in accordance with 410.09.

When test results for the mixture furnished exceed the allowable range in accordance with 410.09, adjustment points will be assessed as follows:

ADJUSTMENT POINTS FOR RANGE	
Sieve Size and Binder Content	Adjustment Points (For Each 0.1% Out Of Range)
2.36 mm	0.1
600 μm	0.1
75 μm	0.1
% Binder	1.0

For mixtures produced during a certified HMA plant's adjustment period, adjustment points will not be assessed if the mixture produced is in accordance with the following.

1. *The gradation complies with 410.05 with the allowable tolerance limits shown in 410.09.*

2. *The range for the binder content and gradation do not exceed the limits shown in 410.09.*

3. *The binder content is within the tolerance requirements of 410.09.*

If the mixture is not in accordance with these requirements, adjustment points will be assessed in accordance with 410.09 for variations exceeding the requirements shown above.

(b) Density. *When the density of the lot is outside the allowable tolerances, adjustment points will be assessed as follows:*

DENSITY

Percentages are based on %MSG	*Pay Adjustments– Percent*
> 97.0	*Submitted to the Materials and Tests Division **
93.0 – 97.0	*0.00*
92.0 – 92.9	*0.20 points for each 0.10 % below 93.0*
91.0 – 91.9	*2.00 + 0.40 points for each 0.10 % below 92.0*
89.0 – 90.9	*6.00 + 1.00 points for each 0.10 % below 91.0*
≤89.0	*Submitted to the Materials and Tests Division **

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

***410.20 Appeals**. If the QC test results do not agree with the acceptance test results, a request, along with the QC test results, may be made in writing for additional testing. The basis of the appeal shall include applicable QC test results showing acceptable quality results and shall be submitted within seven calendar days of receipt of the Department's written results for that sublot. Acceptable QC test results are defined as QC test results resulting in less pay adjustment to the contract than that determined by the Department. If an appeal is granted, appeal cores shall be taken within seven calendar days after written notification unless otherwise directed. Within one work day of appeal coring operations the Contractor shall clean, dry, and refill the core holes with SMA or HMA surface materials.*

The results of the appeal cores will replace the initial test results for a sublot(s) or lot and be used as the basis for acceptance.

***(a) Mixture**. Upon approval for the additional testing, the Contractor shall take cores in accordance with ITM 580. The core location will be within 0.3 m (1.0 ft) longitudinally of the sample tested using the same transverse offset.*

***(b) Density.** Additional core locations will be determined by adding 0.3 m (1.0 ft) longitudinally of the cores tested using the same transverse offset. Each sublot density will be calculated using the average bulk specific gravity of the cores obtained for that sublot and the average MSG of the lot.*

***410.21 Method of Measurement.** SMA mixtures will be measured by the megagram (ton) of the type specified, in accordance with 109.01(b). The measured quantity will be divided by the MAF to determine the pay quantity.*

***410.22 Basis of Payment.** The accepted quantities for this work will be paid for at the contract unit price per megagram (ton) for QC/QA-HMA, of the type specified, – SMA, complete in place.*

Payment for furnishing, calibrating, and operating the profilograph, and furnishing profile information will be made in accordance with 401.22.

Adjustments to the contract payment with respect to mixture, density, and smoothness for mixture produced will be included in a quality assurance adjustment pay item. The unit

price for this pay item will be one dollar ($1.00) and the quantity will be in units of dollars. The quantity is the total calculated in accordance with 410.19. An extra work order developed in accordance with 109.05 will be prepared to reflect contract adjustments.

Payment will be made under:

Pay Item	*Metric Pay Unit Symbol (English Pay Unit Symbol)*
QC/QA HMA, _____, ____, _____, ____ mm – SMA ..... (ESAL[1]) (PG[2]) (Course[3]) (Mix[4])	*Mg (TON)*
Quality Assurance Adjustment	*DOL*

(1) ESAL Category as defined in 410.04
(2) Number represents the high temperature binder grade. Low temperature grades are –22.
(3) Surface,
(4) Mixture Designation

Preparation of surfaces to be overlaid shall be included in the cost of other pay items within this section.

Coring and refilling of the pavement holes shall be included in the cost of other pay items within this section.

No payments will be made for additional anti-stripping additives, appeal coring or related traffic control expenditures for coring operations.

Corrections for pavement smoothness shall be included in the cost of other pay items within this section.

The price for profilograph, HMA will be full compensation regardless of how often the profilograph is used or how many profilograms are produced.

SECTION 610, BEGIN LINE 22, DELETE AND INSERT AS FOLLOWS:

610.03 General Requirements. ~~Except as otherwise herein provided, subgrade~~ *Subgrade* for approaches shall be prepared in accordance with 207.~~04~~. *Aggregate base shall be constructed in accordance with 301. HMA for approaches shall be constructed in accordance with 402. HMA mixture for approaches shall be HMA surface or intermediate, type A, B, ~~or~~ C, or D in accordance with 402.04. A MAF in accordance with 402.04 will not apply.*

Dense graded subbase shall be constructed in accordance with 302. PCCP for approaches shall be constructed in accordance with 502.

SECTION 718, BEGIN LINE 155, DELETE AND INSERT AS FOLLOWS:

The mixture for HMA for underdrains shall be Intermediate ~~C19.0~~ OG 19.0 mm in accordance with 401. An ESAL Category 5 in accordance with 401.04 and a PG Binder 76-22 shall be used. A MAF in accordance with 401.05 will not apply. Acceptance of the HMA for underdrains will be in accordance with 402.09.

SECTION 718, BEGIN LINE 162, INSERT AS FOLLOWS:

718.03 Pipe Installation. *Trenches shall be excavated to the dimensions and grade shown on the plans. Pipes shall be secured to ensure that the required grade and horizontal alignment of the pipe are maintained. Perforated pipe shall be placed with the perforations down. The pipe sections shall be joined securely with the appropriate couplings, fittings, or bands. Aggregate for underdrains shall be placed in a manner which minimizes aggregate contamination. HMA for underdrains shall be placed and compacted separately from mainline mixtures. HMA for underdrains may be placed in one lift and shall be compacted with equipment in accordance with 409.03(d).*

SECTION 718, BEGIN LINE 172, INSERT AS FOLLOWS:

718.04 Geotextile. *Storage and handling of geotextiles shall be in accordance with the manufacturer's recommendations. Each geotextile roll shall be labeled or tagged. Damaged or defective geotextile shall be replaced as directed. The geotextile shall be placed loosely, but with no wrinkles or folds. The ends of subsequent rolls of geotextile shall be overlapped a minimum of 0.3 m (1.0 ft). The upstream geotextile shall overlap the downstream geotextile. Placement of aggregate shall proceed following placement of the geotextile. HMA for underdrains shall be placed and compacted separately from mainline mixtures. HMA for underdrains may be placed in one lift and shall be compacted with equipment in accordance with 409.03(d).*