

## 400-R-553 HMA PROVISIONS

(Revised 02-21-11)

The Standard Specifications are revised as follows:

SECTION 401, BEGIN LINE 46, INSERT AS FOLLOWS:

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

*QC/QA HMA may be produced as warm-mix asphalt, WMA, by using a water-injection foaming device for ESAL category 1, 2 and 3 mixtures. The DMF shall list the minimum plant discharge temperature for HMA and WMA as applicable to the mixture.*

SECTION 401, BEGIN LINE 48, DELETE AND INSERT AS FOLLOWS:

**401.05 Volumetric Mix Design**

The DMF shall be determined for each mixture from a volumetric mix design by a design laboratory selected from the Department's list of approved Mix Design Laboratories. A volumetric mixture shall be designed in accordance with AASHTO R 35 and the respective AASHTO references as listed below.

Bulk Specific Gravity and Density of Compacted Asphalt

Mixtures Using Automatic Vacuum Sealing ..... ~~ASTM D 6752~~  
*AASHTO T 331*

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

	Dense Graded, Mixture Designation – Control Point (Percent Passing)				
	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.75 mm
Sieve Size					
50.0 mm					
37.5 mm	100.0				
25.0 mm	90.0 - 100.0	100.0			
19.0 mm	< 90.0	90.0 - 100.0	100.0		
12.5 mm		< 90.0	90.0 - 100.0	100.0	100.0
9.5 mm			< 90.0	90.0 - 100.0	95.0 - 100.0
4.75 mm				< 90.0	90.0 - 100.0
2.36 mm	19.0 - 45.0	23.0 - 49.0	28.0 - 58.0	32.0 - 67.0*	
1.18 mm					30.0 - 60.0
600 µm					
300 µm					
75 µm	1.0 - 7.0	2.0 - 8.0	2.0 - 10.0	2.0 - 10.0	6.0 - 12.0
* The mix design gradation shall be less than or equal to the PCS control point for 9.5 mm category 4 and 5 surface mixtures.					
PCS Control Point for Mixture Designation (Percent Passing)					

Mixture Designation	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.75 mm
Primary Control Sieve	4.75 mm	4.75 mm	2.36 mm	2.36 mm	NA
PCS Control Point	40	47	39	47	NA

SECTION 401, BEGIN LINE 71, DELETE AND INSERT AS FOLLOWS:

may be used for open graded mixtures. The maximum specific gravity of the ~~uncompacted mixture~~ shall be *mass* determined *in water* in accordance with AASHTO T 209, ~~Section 9.5.1.~~

SECTION 401, BEGIN LINE 118, DELETE AND INSERT AS FOLLOWS:

#### **401.06 Recycled Materials**

~~Recycled materials may consist of reclaimed asphalt pavement, RAP, or asphalt roofing shingles, ARS, or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. The RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve when entering the HMA plant. ARS shall consist of waste from a shingle manufacturing facility. No tear-off materials from roofs will be allowed. ARS shall be stockpiled separately from other materials. The coarse aggregate in the recycled materials shall pass the maximum size sieve for the mixture being produced.~~

~~Recycled materials may be used as a substitute for a portion of the new materials required to produce HMA mixtures. When only RAP is used in the mixture, the RAP shall not exceed 25.0% by weight (mass) of the total mixture. When only ARS is used in the mixture, the ARS shall not exceed 5.0% by weight (mass) of the total mixture. For substitution or use, 1.0% of ARS is considered equal to 5.0% RAP. The percentages of recycled materials shall be as specified on the DMF.~~

~~A maximum of 15.0% RAP or 3.0% ARS by weight (mass) of the total mixture may be used in ESAL category 3, 4, or 5 surface mixtures and open graded mixtures. The recycled material for the ESAL category 3, 4, or 5 surface mixtures shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve.~~

~~The combined aggregate properties of a mixture with recycled materials shall be determined in accordance with ITM 584 and shall be in accordance with 904. Gradations of the combined aggregates shall be in accordance with 401.05.~~

~~Mixtures containing 15.0% or less RAP shall use the same grade of binder as specified. The binder for mixtures containing greater than 15.0% and up to 25.0% RAP shall be reduced by one temperature classification, 6°C, for both the upper and lower temperature classifications.~~

*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. The RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve when entering the HMA plant. The RAP coarse aggregate shall pass the maximum size sieve for the mixture being produced and the RAS shall be 100% passing the 1/2 in. (12.5 mm) sieve. RAP for the ESAL category 3, 4 and 5 surface mixtures shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve.*

Recycled materials may be used as a substitute for a portion of the new materials required to produce HMA mixtures. The amount of total binder replaced by binder in the recycled material shall be computed as follows:

$$\text{Binder Replacement, \%} = \frac{(A \times B) + (C \times D)}{E} \times 100\%$$

where:

- A* = RAP, % Binder Content
- B* = RAP, % in Mixture
- C* = RAS, % Binder Content
- D* = RAS, % in Mixture
- E* = Total, % Binder Content in Mixture

RAS may be obtained from either pre-consumer or post-consumer asphalt shingles. Post-consumer asphalt shingles shall be in accordance with AASHTO MP 15 and prepared by a processing company with an IDEM Legitimate Use Approval letter. A copy of this letter shall be submitted to the Engineer. Deleterious material present in post-consumer asphalt shingles shall be limited to the percentages stated in AASHTO MP 15. Pre-consumer and post-consumer asphalt shingles shall not be blended for use in HMA mixtures and shall be stockpiled separately from other materials.

The recycled material percentages shall be as specified on the DMF. HMA mixtures utilizing recycled materials shall be limited to the binder replacement percentages in the following table:

*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	12.5 mm	9.5 mm	4.75 mm
1	40.0*				25.0		40.0*		
2	40.0*				25.0		40.0*		
3	40.0*				25.0		15.0		
4	40.0*				25.0		15.0		
5	40.0*				25.0		15.0		

\*RAS materials shall not contribute more than 25% by weight (mass) of the total binder content for any HMA mixture.

The combined aggregate properties shall be in accordance with 904. The combined aggregate bulk specific gravity shall be determined in accordance with ITM 584 and the combined aggregate gradation shall be in accordance with 401.05 for the HMA mixture specified.

*HMA mixtures with a binder replacement less than or equal to 25.0% by weight (mass) of the total binder content by utilizing RAP or RAS or a blend of RAP and RAS materials shall use the specified binder grade.*

*HMA mixtures with a binder replacement greater than 25.0% and less than or equal to 40.0% by weight (mass) of the total binder content by utilizing RAP or a blend of RAP and RAS shall use a binder grade with upper and lower temperature classifications reduced by 6°C from the specified binder grade. RAS materials shall not contribute more than 25.0% by weight (mass) of the total binder content for any HMA mixture.*

SECTION 401, BEGIN LINE 158, INSERT AS FOLLOWS:

**401.08 Job Mix Formula**

A job mix formula, JMF, shall be developed by a certified HMA producer. A JMF used in the current or previous calendar year that was developed to  $N_{des}$  will be allowed. The mixture compaction temperature shall be  $300 \pm 9^{\circ}\text{F}$  ( $150 \pm 5^{\circ}\text{C}$ ) for dense graded mixtures and  $260 \pm 9^{\circ}\text{F}$  ( $125 \pm 5^{\circ}\text{C}$ ) for open graded mixtures. *The JMF shall list the minimum plant discharge temperature for HMA and WMA as applicable to the mixture.* The JMF for each mixture shall be submitted to the Engineer and shall use the same MAF as the DMF.

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

The binder content 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, ~~Section 9.5.1.~~

SECTION 401, BEGIN LINE 392, DELETE AND INSERT AS FOLLOWS:

AASHTO T 166, Method A. The maximum specific gravity will be *mass* determined in *water* in accordance with AASHTO T 209, ~~Section 9.5.1.~~

SECTION 401, BEGIN LINE 405, DELETE AND INSERT AS FOLLOWS:

**401.18 Pavement Smoothness**

~~The~~ Pavement smoothness will be accepted by means of a profilograph, a 16 ft (4.9 m) long straightedge, or a 10 ft (3 m) long straightedge *as described below.*

**(a) Profilograph**

*When a pay item for Profilograph, HMA is included in the contract, the Contractor shall furnish, calibrate, and operate an approved profilograph in accordance with ITM 912 on the mainline traveled way and ramps, including adjacent acceleration or deceleration lane, where all of the following conditions are met:*

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

- (a)1. ~~†~~The design speed is greater than 45 mph (70 km/h).
- (b)2. ~~†~~The ~~pavement~~ traveled way or ramp lanes ~~are~~ width is ~~full~~ constant width and is 0.1 mi (0.16 km) in length or longer, ~~and~~.

- (e)3. The HMA is placed on a milled surface or the total combined planned lay rate of surface, intermediate, and base courses is 385 lb/syd (210 kg/m<sup>2</sup>) 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 912. 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 a change order 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 45 mph (70 km/h) or less, smoothness of that section may be measured by a profilograph or a 16 ft (4.9 m) 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 project area, less paving exceptions and areas exempt from profilograph operation in accordance with ITM 912, will be divided into individual smoothness sections measuring 0.1 mi (0.16 km) in length for each lane. Partial length smoothness sections adjacent to project limits, paving exceptions, or areas exempt from profilograph operation will be considered in accordance with ITM 912.*

*If the posted speed limit for an entire smoothness section is less than or equal to 45 mph, the section will be exempt from profilograph operation and the smoothness within the section will be accepted by a 16 ft (4.9 m) straightedge.*

*If the posted speed limit is greater than 45 mph for a portion of a smoothness section and is less than or equal to 45 mph for the remainder, the section smoothness acceptance will be as follows:*

1. *By profilograph for the portion of the section with a posted speed limit greater than 45 mph.*
2. *By 16 ft (4.9 m) straightedge for the portion of the section with a posted speed limit less than or equal to 45 mph.*

*At locations where the profilograph is required, it shall be used on the surface course and on any dense graded intermediate courses immediately below the surface course.*

***(b) 16 ft (4.9 m) Straightedge and 10 ft (3 m) Straightedge***

*The Department will furnish and operate 16 ft (4.9 m) and 10 ft (3 m) straightedges as described below. The 16 ft (4.9 m) straightedge is used to accept smoothness along the direction of mainline traffic and the 10 ft (3.0 m) straightedge is*

*used to accept smoothness transverse to the direction of mainline traffic. This includes longitudinal smoothness on public road approaches and median crossovers.*

*For contracts which include the Profilograph, HMA pay item, the 16 ft (4.9 m) long straightedge will be used to accept longitudinal smoothness on surface courses at the following locations:*

1. *All mainline traveled way lanes shorter than 0.1 mi (0.16 km).*
2. *All mainline traveled way lanes within smoothness sections with posted speed limits less than or equal to 45 mph throughout the entire section length.*
3. *All mainline traveled way lanes at locations exempted from profilograph operation in accordance with ITM 912.*
4. *All tapers.*
5. *All turn lanes, including bi-directional left turn lanes.*
6. *All ramps with design speeds of 45 mph (70 km/h) or less.*
7. *All acceleration and deceleration lanes associated with ramps with design speeds of 45 mph (70 km/h) or less.*
8. *All shoulders.*

*For contracts where the profilograph is not used for smoothness acceptance, the 16 ft (4.9 m) straightedge will be used to accept longitudinal smoothness on all dense graded courses at the above locations as well as all mainline travel way lanes and ramps with design speeds of greater than 45 mph (70 km/h). Smoothness acceptance on ramp acceleration or deceleration lanes will also be based on operation of the 16 ft (4.9 m) straightedge.*

~~The 16 ft (4.9 m) long straightedge is used to check longitudinal profile and shall be used on all overlays where the profilograph is not specified. For contracts that include a profilograph item, the 16 ft (4.9 m) long straightedge shall be used on shoulders, on all full width pavement lanes shorter than 0.1 mi (0.16 km), in length, on tapers, within 50 ft (15 m) of a reinforced concrete bridge approach, and within 50 ft (15 m) of an existing pavement, which is being joined.~~

The 10 ft (3 m) long straightedge shall be used to check transverse slopes, across travel lanes and shoulders, approaches, and crossovers.

***(c) Smoothness Correction***

~~All wavelike irregularities and abrupt changes in profile caused by paving operations shall be corrected.~~

~~Each finished course of base and intermediate shall be subject to approval. The pavement smoothness shall be checked on any new intermediate course located immediately below a surface course and the surface course at the locations as designated in ITM 912.~~

*At locations where the profilograph is being used on an intermediate course, all areas having a high or low point deviation in excess of 0.3 in. (8 mm) shall be corrected.*

*After corrective action is taken on an intermediate course, a 16 ft (4.9 m) straightedge may be used to verify the adequacy of the corrective action.*

*At locations where the profilograph is being used on a surface course, all areas having a high or low point deviation in excess of 0.3 in. (8 mm) shall be corrected. All smoothness sections with a deficient profile index in accordance with 401.19(d) shall be corrected. Underlying courses that are exposed by corrective action shall be milled to a depth of 1 1/2 in (38 mm) and replaced with surface course. After the corrective action is taken on a surface course, the profilograph shall be operated throughout the entire affected smoothness section to verify the adequacy of the corrective action.*

*At locations where the 16 ft (4.9 m) straightedge is used, the pavement variations shall be corrected to 1/4 in. (6 mm) or less. When the 10 ft (3 m) straightedge is used, the pavement variations shall be corrected to 1/8 in. (3 mm) or less.*

If grinding of ~~the~~an intermediate course is used for pavement smoothness corrections, the grinding shall not precede the surface placement by more than 30 calendar days if open to traffic.

~~When the 16 ft (4.9 m) straightedge is used on a surface course, the pavement variations shall be corrected to 1/4 in. (6 mm) or less. When the 10 ft (3 m) straightedge is used, the pavement variations shall be corrected to 1/8 in. (3 mm) or less.~~

~~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 0.3 in. (8 mm) shall be corrected. Courses underlying the surface courses that are exposed by corrective actions shall be milled to 1 1/2 in (38 mm) and replaced with the same type surface materials. The initial profile index shall be determined prior to any corrective action. The final profile index for each section requiring corrective action will be determined after all corrective action within that section has been completed.~~

~~When the profilograph is being used on an intermediate course, all areas having a high or low point deviation in excess of 0.3 in. (8 mm) shall be corrected. After corrective action is taken on an intermediate course, a 16 ft (4.9 m) straightedge may be used to verify the adequacy of the corrective action. When the 16 ft (4.9 mm) or 10 ft (3 m) straightedge is being used on an intermediate course, all areas having a high or low point deviation in excess of 1/4 in. (6 mm) shall be corrected.~~

SECTION 401, BEGIN LINE 493, INSERT AS FOLLOWS:

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%, 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.

SECTION 401, BEGIN LINE 578, DELETE AND INSERT AS FOLLOWS:

**(c) Smoothness**

~~When the pavement smoothness is tested with a profilograph, payment will be based on a zero blanking band on the final profile index in accordance with the following table. A Quality Assurance Pay Factor, PFs, for smoothness will apply to the planned~~

~~typical section including the aggregate base, and the HMA base, intermediate, and surface courses. The quality assurance adjustment for each section will include the total area of each pavement lane excluding shoulders for 0.1 mi (0.16 km) long section represented by the profile index calculated by the following formula.~~

*Smoothness pay adjustments will only be applied when the smoothness is measured by a profilograph. The pay adjustment will be based on the profile index generated on the surface course only.*

*At locations where a profilograph is used to accept smoothness, a quality assurance adjustment will be determined for each 0.1 mi (0.16 km) section of each lane. This adjustment will be applied to all QC/QA HMA pay items within the pavement section. The adjustment for each section will be calculated using the following formula.*

$$q_s = (PF_s - 1.00) \sum_{i=1}^n \left( A \times \frac{S}{T} \times U \right)$$

where:

- $q_s$  = quality assurance adjustment for smoothness for one section
- $PF_s$  = pay factor for smoothness
- $n$  = number of layers
- $A$  = area of the section, syd ( $m^2$ )
- $S$  = planned spread rate for material, lb/syd ( $kg/m^2$ )
- $T$  = conversion factor: 2000 lb/ton (1000 kg/Mg)
- $U$  = unit price for the material, \$/ton (\$/Mg)

*For smoothness sections that are less than 0.1 mi (0.16 km) in length or require profilograph operation along both lane edges, the profile index used to obtain the smoothness pay factor used in the above formula will be determined in accordance with ITM 912.*

The quality assurance adjustment for smoothness,  $Q_s$ , for the contract will be the total of the quality assurance adjustments for smoothness,  $q_s$ , on each section by the following formula.

$$Q_s = \sum q_s$$

*When smoothness is measured by a profilograph, payment adjustments will be made based on a zero blanking band on the final profile index in accordance with the following table. Regardless of the tabulated value, the maximum pay factor for a smoothness section where corrective action has been performed will be 1.00.*

<b>PAY FACTORS ADJUSTMENT FOR SMOOTHNESS (PI<sub>0.0</sub>) ZERO BLANKING BAND</b>
Design Speed Greater Than 45 mph (70 km/hr)

Profile Index in./0.1 mi. (mm per 0.16 km)	Pay Factor, $PF_s$
Over 0.00 to 1.20 in. (Over 0 to 30 mm)	1.06
Over 1.20 to 1.40 in. (Over 30 to 35 mm)	1.05
Over 1.40 to 1.60 in. (Over 35 to 40 mm)	1.04
Over 1.60 to 1.80 in. (Over 40 to 45 mm)	1.03
Over 1.80 to 2.00 in. (Over 45 to 50 mm)	1.02
Over 2.00 to 2.40 in. (Over 50 to 60 mm)	1.01
Over 2.40 to 3.20 in. (Over 60 to 80 mm)	1.00
Over 3.20 to 3.40 in. (Over 80 to 85 mm)	0.96
All pavement with a profile index ( $PI_{0.0}$ ) greater than 3.40 in. (85 mm) shall be corrected to a profile index less than or equal to 3.40 in. (85 mm).	

~~Quality assurance pay factors greater than 1.00 will be applicable only to the initial measured profile index, prior to any corrective work. Regardless of the pay factor tabulated above, quality assurance pay factors for individual sections that require corrective action for high or low points in excess of 0.3 in. (8 mm) will not be greater than 1.00. Quality assurance pay factors of 1.00 or less will be applied to pavement sections where corrective work has been completed.~~

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 = lot or subplot quality assurance adjustment

#### 401.20 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 appeal sample will be analyzed in a lab different than the lab that analyzed the original sample when requested by the Contractor. Additional testing may be requested for one or more of the following tests: MSG, BSG of the gyratory specimens, binder content, or BSG of the density cores. The request for the appeal for MSG, BSG of gyratory specimens, binder content or BSG of the density cores shall be submitted within seven calendar days of receipt of the Department's written results for ~~that~~ the lot accepted under 401.19(a) or

the subplot *accepted under 401.19(b)*. The subplot and specific test(s) shall be specified at the time of the appeal request. Only one appeal request per *lot for mixture accepted under 401.19(a)* or subplot *for mixture accepted under 401.19(b)* is permitted. Upon approval of the appeal, the Engineer will perform additional testing as follows.

The backup or new sample(s) will be tested in accordance with the applicable test method for the test requested.

**(a) MSG**

The backup MSG ~~sample~~ will be dried in accordance with ITM 572 and ~~tested~~ *mass determined in water* in accordance with AASHTO T 209, ~~Section 9.5.1.~~

SECTION 402, BEGIN LINE 18, DELETE AS FOLLOWS:

**402.03 Materials**

Materials shall be in accordance with the following:

Asphalt Materials

PG Binder, ~~PG 58-28\*, PG 64-22,~~  
~~PG 64-28\*, PG 70-22, PG 76-22~~ .....902.01(a)

Coarse Aggregates .....904

Base Mixtures, – Class D or Higher  
 Intermediate Mixtures – Class C or Higher

**\*\* Surface Mixtures – Class B or Higher\***

Fine Aggregates .....904

~~\* Only for use in mixtures containing greater than 15% RAP. Refer to 402.05.~~

~~\*\* Surface aggregate requirements are listed in 904.03(d).~~

SECTION 402, BEGIN LINE 39, INSERT AS FOLLOWS:

Mixture Type	Type A	Type B	Type C	Type D
Design ESAL	200,000	2,000,000	9,000,000	11,000,000
Surface	4.75 mm	4.75 mm	4.75 mm	4.75 mm
	9.5 mm	9.5 mm	9.5 mm	9.5 mm
	12.5 mm	12.5 mm	12.5 mm	12.5 mm
Surface – PG Binder	64-22	64-22	70-22	70-22
Intermediate	9.5 mm	9.5 mm	9.5 mm	9.5 mm
	12.5 mm	12.5 mm	12.5 mm	12.5 mm
	19.0 mm	19.0 mm	19.0 mm	19.0 mm
	25.0 mm	25.0 mm	25.0 mm	25.0 mm
Intermediate – PG Binder	64-22	64-22	64-22	70-22
Base	19.0 mm	19.0 mm	19.0 mm	19.0 mm
	25.0 mm	25.0 mm	25.0 mm	25.0 mm
Base – PG Binder	64-22	64-22	64-22	64-22

*HMA may be produced as warm-mix asphalt, WMA by using a water-injection foaming device for temporary HMA mixtures and type A, B and C mixtures. The DMF shall list the minimum plant discharge temperature for HMA and WMA as applicable to the mixture.*

SECTION 402, BEGIN LINE 87, DELETE AND INSERT AS FOLLOWS:

**(c) Composition Limits for Temporary HMA Mixtures**

Temporary HMA mixtures shall be *the type B specified* in accordance with 402.04. A MAF in accordance with 402.05 will not apply.

SECTION 402, BEGIN LINE 102, DELETE AND INSERT AS FOLLOWS:

**402.08 Recycled Materials**

~~Recycled materials may consist of reclaimed asphalt pavement, RAP, or asphalt roofing shingles, ARS, or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. The RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve when entering the HMA plant. ARS shall consist of waste from a shingle manufacturing facility. No tear off materials from roofs will be allowed. ARS shall be stockpiled separately from other materials. The coarse aggregate in the recycled materials shall pass the maximum size sieve for the mixture being produced.~~

~~Recycled materials may be used as a substitute for a portion of the new materials required to produce HMA mixtures. When only RAP is used in the mixture, the RAP shall not exceed 25.0% by weight (mass) of the total mixture. When only ARS is used in the mixture, the ARS shall not exceed 5.0% by weight (mass) of the total mixture. For substitution or use, 1.0% of ARS is considered equal to 5.0% RAP. The percentages of recycled materials shall be as specified on the JMF.~~

~~A maximum of 15.0% RAP or 3.0% ARS by weight (mass) of the total mixture may be used in type C and D surface mixtures provided the recycled material is 100% passing the 3/8 in. (9.5 mm) sieve and 95% to 100% passing the No. 4 (4.75 mm) sieve.~~

~~The combined aggregate properties of a mixture with recycled materials shall be determined in accordance with ITM 584 and shall be in accordance with 904. Gradations of the combined aggregates shall be in accordance with 402.03.~~

~~Mixtures containing 15.0% or less RAP shall use the same grade of binder as specified. The binder for mixtures containing greater than 15.0% and up to 25.0% RAP shall be reduced by one temperature classification, 6°C, for both the upper and lower temperature classifications.~~

*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. The RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve when entering the HMA plant. The RAP coarse aggregate shall pass the maximum size sieve for the mixture being produced and the RAS shall be 100% passing the 1/2 in. (12.5 mm) sieve. RAP for the type C and D surface mixtures shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve.*

*Recycled materials may be used as a substitute for a portion of the new materials required to produce HMA mixtures. The amount of total binder replaced by binder in the recycled material shall be computed as follows:*

$$\text{Binder Replacement, \%} = \frac{(A \times B) + (C \times D)}{E} \times 100\%$$

where:

- A* = RAP, % Binder Content
- B* = RAP, % in Mixture
- C* = RAS, % Binder Content
- D* = RAS, % in Mixture
- E* = Total, % Binder Content in Mixture

RAS may be obtained from either pre-consumer or post-consumer asphalt shingles. Post-consumer asphalt shingles shall be in accordance with AASHTO MP 15 and prepared by a processing company with an IDEM Legitimate Use Approval letter. A copy of this letter shall be submitted to the Engineer. Deleterious material present in post-consumer asphalt shingles shall be limited to the percentages stated in AASHTO MP 15. Pre-consumer and post-consumer asphalt shingles shall not be blended for use in HMA mixtures and shall be stockpiled separately from other materials.

The recycled material percentages shall be as specified on the DMF. HMA mixtures utilizing recycled materials shall be limited to the binder replacement percentages in the following table:

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

<i>Maximum Binder Replacement, %</i>							
<i>Mixture Category</i>	<i>Base and Intermediate</i>				<i>Surface</i>		
	<i>Dense Graded</i>				<i>Dense Graded</i>		
	<i>25.0 mm</i>	<i>19.0 mm</i>	<i>12.5 mm</i>	<i>9.5 mm</i>	<i>12.5 mm</i>	<i>9.5 mm</i>	<i>4.75 mm</i>
<i>A</i>	<i>40.0*</i>				<i>40.0*</i>		
<i>B</i>	<i>40.0*</i>				<i>40.0*</i>		
<i>C</i>	<i>40.0*</i>				<i>15.0</i>		
<i>D</i>	<i>40.0*</i>				<i>15.0</i>		

\*RAS materials shall not contribute more than 25% by weight (mass) of the total binder content for any HMA mixture.

The combined aggregate properties shall be in accordance with 904. The combined aggregate bulk specific gravity shall be determined in accordance with ITM 584 and the combined aggregate gradation shall be in accordance with 401.05 for the HMA mixture specified.

HMA mixtures with a binder replacement less than or equal to 25.0% by weight (mass) of the total binder content by utilizing RAP or RAS or a blend of RAP and RAS materials shall use the specified binder grade.

HMA mixtures with a binder replacement greater than 25.0% and less than or equal to 40.0% by weight (mass) of the total binder content by utilizing RAP or a blend of RAP and RAS shall use a binder grade with upper and lower temperature classifications

*reduced by 6°C from the specified binder grade. RAS materials shall not contribute more than 25.0% by weight (mass) of the total binder content for any HMA mixture.*

SECTION 402, BEGIN LINE 350, DELETE AND INSERT AS FOLLOWS:

The Engineer will determine the bulk specific gravity of the cores in accordance with AASHTO T 166 Method A. The maximum specific gravity will be *mass* determined *in water* in accordance with AASHTO T 209, ~~Section 9.5.1.~~

SECTION 402, BEGIN LINE 392, INSERT AS FOLLOWS:

HMA for Temporary Pavement, Type   \*   ..... TON (Mg)

SECTION 410, BEGIN LINE 44, DELETE AND INSERT AS FOLLOWS:

#### **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 AASHTO M 325 and R 35 46.

SECTION 410, BEGIN LINE 54, DELETE AND INSERT AS FOLLOWS:

The optimum binder and aggregate gradation content shall produce 4.0% air voids. The maximum specific gravity ~~of the uncompact mixture~~ shall be *mass* determined *in water* in accordance with AASHTO T 209, ~~Section 9.5.1.~~ The percent draindown for SMA surface mixture shall not exceed 0.30% in accordance with AASHTO T 305.

SECTION 410, BEGIN LINE 93, DELETE AND INSERT AS FOLLOWS:

#### **410.06 Recycled Materials**

~~Recycled materials may consist of reclaimed asphalt pavement, RAP, or asphalt roofing shingles, ARS, or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. The recycled material shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95% to 100% passing the No. 4 (4.75 mm) sieve when entering the HMA plant. ARS shall consist of waste from a shingle manufacturing facility. No tear off materials from roofs will be allowed. ARS shall be stockpiled separately from other materials.~~

~~Recycled materials may be used as a substitute for a portion of the new materials required to produce mainline surface. When only RAP is used in the mixture, the RAP shall not exceed 15.0% by weight (mass) of the total mixture. When only ARS is used in the mixture, the ARS shall not exceed 3.0% by weight (mass) of the total mixture. For substitution or use, 1.0% of ARS is considered equal to 5.0% RAP. The percentages of recycled materials shall be as specified on the DMF.~~

~~The combined aggregate properties of a mixture with recycled materials shall be determined in accordance with ITM 584 and shall be in accordance with 904. Gradations of the combined aggregates shall be in accordance with 410.05.~~

~~Mixtures containing RAP shall use the same grade of binder as specified.~~

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. The RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve when entering the HMA plant. RAS shall be 100% passing the 1/2 in. (12.5 mm) sieve. RAP shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve.

Recycled materials may be used as a substitute for a portion of the new materials required to produce SMA mixtures. The amount of total binder replaced by binder in the recycled material shall be computed as follows:

$$\text{Binder Replacement, \%} = \frac{(A \times B) + (C \times D)}{E} \times 100\%$$

where:

- A = RAP, % Binder Content
- B = RAP, % in Mixture
- C = RAS, % Binder Content
- D = RAS, % in Mixture
- E = Total, % Binder Content in Mixture

RAS may be obtained from either pre-consumer or post-consumer asphalt shingles. Post-consumer asphalt shingles shall be in accordance with AASHTO MP 15 and prepared by a processing company with an IDEM Legitimate Use Approval letter. A copy of this letter shall be submitted to the Engineer. Deleterious material present in post-consumer asphalt shingles shall be limited to the percentages stated in AASHTO MP 15. Pre-consumer and post-consumer asphalt shingles shall not be blended for use in SMA mixtures and shall be stockpiled separately from other materials.

The recycled material percentages shall be as specified on the DMF. SMA mixtures utilizing recycled materials shall be limited to the binder replacement percentages in the following table:

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

Maximum Binder Replacement, %		
SMA Surface		
Mixture Category	12.5 mm	9.5 mm
1	40.0*	40.0*
2	40.0*	40.0*
3	15.0	15.0
4	15.0	15.0
5	15.0	15.0

\*RAS materials shall not contribute more than 25% by weight (mass) of the total binder content for any HMA mixture.

*The combined aggregate properties shall be in accordance with 904. The combined aggregate bulk specific gravity shall be determined in accordance with ITM 584 and the combined aggregate gradation shall be in accordance with 401.05410.05 for the SMA mixture specified.*

*SMA mixtures with a binder replacement less than or equal to 25.0% by weight (mass) of the total binder content by utilizing RAP or RAS or a blend of RAP and RAS materials shall use the specified binder grade.*

*SMA mixtures with a binder replacement greater than 25.0% and less than or equal to 40.0% by weight (mass) of the total binder content by utilizing RAP or a blend of RAP and RAS shall use a binder grade with upper and lower temperature classifications reduced by 6° C from the specified binder grade. RAS materials shall not contribute more than 25.0% by weight (mass) of the total binder content for any SMA mixture.*

SECTION 410, BEGIN LINE 139, DELETE AND INSERT AS FOLLOWS:

A maximum specific gravity sample and a binder content and gradation sample will be obtained from the plate sample in accordance with ITM 587. The binder content will be determined in accordance with ITM 586 or ITM 571 as directed by the Engineer and the gradation will be determined in accordance with AASHTO T 30. The maximum specific gravity will be *mass* determined *in water* in accordance with AASHTO T 209, ~~Section 9.5.1~~. 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.

SECTION 410, BEGIN LINE 313, DELETE AND INSERT AS FOLLOWS:

The Engineer will determine the BSG of the cores in accordance with AASHTO T 166, Method A. The maximum specific gravity will be *mass* determined *in water* in accordance with AASHTO T 209, ~~Section 9.5.1~~. The target value for density of SMA mixtures of each subplot shall be 93.0%.

The Engineer will determine the bulk specific gravity of the cores in accordance with AASHTO T 166, Method A. The maximum specific gravity will be *mass* determined *in water* in accordance with AASHTO T 209, ~~Section 9.5.1~~. Density shall not be less than 92.0%.

SECTION 410, BEGIN LINE 406, INSERT AS FOLLOWS:

#### **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. Additional testing may be requested for one or more of the following tests: binder content, gradation, or MSG of the mixture samples and bulk specific gravity of the density cores. The appeal request shall be submitted within ~~seven~~7 calendar days of receipt of the Department's written results for that subplot. *The request for the appeal for MSG, BSG of the density cores or binder content and gradation shall be submitted within seven7 calendar days of receipt of the Department's written results for that subplot. The subplot and specific tests shall be specified at the time of the appeal request. Only one appeal request per subplot is permitted. Upon approval of the appeal, the Engineer will perform additional testing.*

The appeal results will replace all previous test results for acceptance of mixture in accordance with 410.09 and density in accordance with 410.16. The results will be furnished to the Contractor. The backup mixture samples or density cores will be tested in accordance with the following:

**(a) MSG**

The backup ~~maximum specific gravity~~ *MSG sample* will be dried in accordance with ITM 572 and ~~tested mass determined in water~~ in accordance with AASHTO T 209; section 9.5.1.

SECTION 902, AFTER LINE 16, INSERT AS FOLLOWS:

*A PG 58-28 or PG 64-22 binder may be modified by in-line blending with styrene butadiene rubber, SBR, polymer latex at the HMA plant in accordance with ITM 581. A PG 58-28 may be modified to a PG 64-28 and a PG 64-22 may be modified to a PG 70-22.*

*The SBR polymer latex shall be in accordance with the following:*

<i>SBR POLYMER LATEX</i>	
<i>Total Polymer Solids, % by weight</i>	<i>60 – 72</i>
<i>Butadiene, % by weight</i>	<i>68 minimum</i>
<i>Residual Styrene, % by weight</i>	<i>0.1 maximum</i>
<i>Ash, % of total polymer solids by weight</i>	<i>3.5 maximum</i>
<i>pH</i>	<i>9 – 11</i>
<i>Viscosity, Brookfield model RVF, Spindle No. 2 @ 20 rpm @ 25°C</i>	<i>2000 maximum</i>

*A type A certification for the SBR polymer latex shall be furnished in accordance with 916.*

*The minimum SBR polymer latex content shall be 2.5 %. The SBR polymer latex content may be reduced below the minimum content provided, if the following requirements are met:*

- 1. An AASHTO accredited laboratory shall blend the PG binder and SBR polymer latex at the proposed SBR polymer latex content and test and grade the modified PG binder in accordance with AASHTO M 320.*
- 2. The laboratory test results verifying the blend and compliance with 902.01(a) shall be submitted to the Engineer for approval.*
- 3. The source of the PG Binder or SBR polymer latex shall not be changed.*

SECTION 902, AFTER LINE 149, INSERT AS FOLLOWS:

**902.02 Sampling and Testing Asphalt Materials**

The tests and AASHTO references are as follows:

## (a) Sampling Bituminous Materials .....AASHTO T 40

The following exceptions to AASHTO T 40 shall apply:

1. Samples may be obtained at any time before material is incorporated into the work.
2. Samples for all grades of asphalt emulsion shall be a minimum of 1/2 gal. (1.9 L). The size of samples of other liquid material may be 1 qt (1.0 L).
3. Samples of liquid materials shall be obtained at one of the following:
  - a. bulk storage tanks from sampling valves located in the tank or line and asphalt plant storage tanks from sampling valves located in the tank
  - b. transports from sampling valves
  - c. distributors from valves
  - d. other storage or locations as approved
  - e. sampling by other recognized devices may be approved
  - f. *sampling valves beyond the in-line blending location*

SECTION 902, BEGIN LINE 87, DELETE AND INSERT AS FOLLOWS:

*AE-F is a medium setting, hard penetration, diluted emulsion intended for fog sealing.*

The requirements for asphalt emulsions shall be in accordance with the following:

Characteristic <sup>(1)(2)</sup>	AASHTO Test Method	RS-2	HFRS-2	AE-90	AE-90S	AE-T	AE-F	SS-1h	AE-150	AE-150L	AE-PL	AE-PMT <sup>(6)</sup>	AE-PMP <sup>(6)</sup>
Test on Emulsion													
Viscosity, Saybolt Furol at 25°C, min.	<del>T</del> 72T 59			50				20	50				20+
Viscosity, Saybolt Furol at 25°C, max.	<del>T</del> 72T 59					100	100	100		100	115	100	
Viscosity, Saybolt Furol at 50°C, min.	<del>T</del> 72T 59	75	75		50				75				
Viscosity, Saybolt Furol at 50°C, max.	<del>T</del> 72T 59	400	400						300				
Demulsibility w/35 mL, 0.02N CaCl <sub>2</sub> , %, min.	T 59	50	50		30		25						
Demulsibility w/50 mL, 0.10N CaCl <sub>2</sub> , %, min.	T 59			75		75						25+	25+
Oil Distillate by Distillation, mL/100 g Emul <sup>(3)</sup>	T 59	4.0	4.0	4.0	3.0	4.0	4.0	4.0	7.0	7.0	3.0	3.0	3.0
Residue by Distillation, %, min.	T 59	68	68	68	65 <sup>(5)</sup>	54	27	57	68	60	30		
Residue by Distillation, % max.	T 59					62	35			65			
Sieve Test, %, max.	T 59	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Penetrating Ability, mm, min.	902.02(w)										6		
Stone Coating Test, %	902.02(t)3a			90					90	90			
Settlement, %, max.	T 59	5	5	5									
Storage Stability, %, max.	T 59				1								
Asphalt Content by Distillation at 204°C, %, min.												54	45
Asphalt Content by Distillation at 204°C, %, max.												62	
Tests on Residue													

Penetration (0.1 mm) at 25°C, 100g, 5 s, min. <sup>(4)</sup>	T 49	100	100	100	90	50	40	40				50	300+
Penetration (0.1 mm) at 25°C, 100g, 5 s, max. <sup>(4)</sup>	T 49	200	200	200	150	200	90	90				200	
Penetration (0.1 mm) at 25°C, 50g, 5 s, min. <sup>(4)</sup>	T 49								100	100			
Penetration (0.1 mm) at 25°C, 50g, 5 s, max. <sup>(4)</sup>	T 49								300	300			
Ductility at 25°C, mm, min.	T 51	400	400	400		400		400					
Solubility in Org. Sol., %, min.	T 44	97.5	97.5	97.5	97.5	97.5	97.5	97.5	97.5	97.5	97.5	97.5	97.5
Float Test at 50°C, s, max. <sup>(4)</sup>	T 50												
Float Test at 60°C, s, min. <sup>(4)</sup>	T 50		1200	1200	1200	1200			1200	1200			
Force Ratio	T 300				0.3								
Elastic Recovery, at 4°C	T 301				58								
Polymer Content by Infrared												1.5+	1.5+
Notes: (1) Broken samples or samples more than 10 days old will not be tested. (2) Combined percentage of the residue and oil distillate by distillation shall be at least 70% (note the different units – ml for oil and % for residue). (3) Oil distillate shall be in accordance with ASTM D 396, table 1, grade no. 1 (4) The Engineer may waive the test. (5) Maximum temperature to be held for 15 minutes 200 ± 5°C. (6) Asphalt shall be polymerized prior to emulsification.													