

2021 APAM Conference Hot Mix Asphalt (HMA) Update



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Hot Mix Asphalt (HMA) Update

- 2020 Spec Book/Reduction of Mixes
- Verification of Bulk Specific Gravity
- Targeted Overlay Pavement Solutions
- Local Volumetric Specification
- Fine Texture Pavement Milling

2020 Spec Book

- Reduction of HMA Mixes
- Incorporation of FUSPs
- Removal of Seasonal Limitations



National Peer Review

- States have reduced or simplified the number of gyration levels



- Working towards simplifying gyration level categories

- Michigan has too many different gyrations levels



Reduction of HMA Mixes

- LVSP and E03 combined into EL
- E1 and E3 combined into EML
- E10 and E30 combined into EMH
- E50 eliminated and replaced with EH
- Gap Graded Superpave (GGSP) renamed to Stone Matrix Asphalt (SMA) to be consistent with national standards

Reduction of Mixes

- Major changes made to Tables 501.2, 501.3 and 902.6
 - New Mix Design Designations
 - Changes mostly relevant to Mix Designers
- Minor changes to Tables 501.1, 501.4 and 902.5

Table 501-3

Existing Criteria					
Superpave Gyratory Compactor (SGC) Compaction Criteria					
		Number of Gyration			
Estimated Traffic (million ESAL)	Mix Type	%Gmm at (Ni)	Ni	Nd	Nm
< 0.3	LVSP	91.50%	6	45	70
< 0.3	E03	91.50%	7	50	75
< 1.0	E1	90.50%	7	76	117
< 3.0	E3	90.50%	7	86	134
< 10	E10	89.00%	8	96	152
< 30	E30	89.00%	8	109	174
<100	E50	89.00%	9	126	204

Proposed Criteria					
Superpave Gyratory Compactor (SGC) Compaction Criteria					
		Number of Gyration			
Estimated Traffic (million ESAL)	Mix Type	%Gmm at (Ni)	Ni	Nd	Nm
≤ 0.3	EL	≤91.5%	6	50	70
>0.3 - ≤3.0	EML	≤90.5%	7	75	115
>3.0 - ≤30.0	EMH	≤89.0%	8	100	160
>30.0 - ≤100	EH	≤89.0%	9	125	205

Reduction of HMA Mixes

MICHIGAN DESIGN MANUAL ROAD DESIGN

6.03.09A1d (continued)

Hot Mix Asphalt (HMA) Mixture Selection Guidelines

North, Grand, Bay, Southwest and University Region

Mixture Type	HMA Mainline		High Stress HMA	
E30, E50, GGSP	PG 70-28P PG 64-22	Top & Leveling Course Base Course	PG 76-28P PG 64-22	Top & Leveling Course Base Course
E10	PG 64-28 PG 58-22	Top & Leveling Course Base Course	PG 70-28P PG 58-22	Top & Leveling Course Base Course
E3	PG 64-28 PG 58-22	Top & Leveling Course Base Course	PG 70-28P PG 58-22	Top & Leveling Course Base Course
LVSP, E03, E1	PG 58-28 PG 58-22	Top & Leveling Course Base Course	PG 64-28 PG 58-22	Top & Leveling Course Base Course

Superior Region

Mixture Type	HMA Mainline		High Stress HMA	
E10	PG 58-34 PG 58-28	Top & Leveling Course Base Course	PG 64-34P PG 58-28	Top & Leveling Course Base Course
LVSP, E03, E1, E3	PG 58-34 PG 58-28	Top & Leveling Course Base Course	PG 64-34P PG 58-28	Top & Leveling Course Base Course

Metro Region

Mixture Type	HMA Mainline		High Stress HMA	
E30, E50, GGSP	PG 70-22P PG 64-22	Top & Leveling Course Base Course	PG 76-22P PG 64-22	Top & Leveling Course Base Course
E10	PG 64-22 PG 58-22	Top & Leveling Course Base Course	PG 70-22P PG 58-22	Top & Leveling Course Base Course
E3	PG 64-22 PG 58-22	Top & Leveling Course Base Course	PG 70-22P PG 58-22	Top & Leveling Course Base Course
LVSP, E03, E1	PG 58-22	Top, Leveling & Base Course	PG 64-22 PG 58-22	Top & Leveling Course Base Course

NOTES:

1. For shoulders paved greater than or equal to 8 feet or in a separate operation, use PG 58-28 for all Regions.
2. For Temporary Roads, commercial and private Approaches, Wedging, Ramps and Hand Patching, use PG 64-22 for all Regions except Superior and North, use PG 58-28.

Reduction of HMA Mixes

MICHIGAN DESIGN MANUAL ROAD DESIGN

6.03.09A1d (continued)

Hot Mix Asphalt (HMA) Mixture Selection Guidelines

North, Grand, Bay, Southwest and University Region

Mixture Type	HMA Mainline and Ramps		High Stress HMA	
EH, SMA	PG 70-28P PG 64-22	Top & Leveling Course Base Course	PG 76-28P PG 64-22	Top & Leveling Course Base Course
EML, EMH	PG 64-28 PG 58-22	Top & Leveling Course Base Course	PG 70-28P PG 58-22	Top & Leveling Course Base Course
EL	PG 58-28 PG 58-22	Top & Leveling Course Base Course	PG 64-28 PG 58-22	Top & Leveling Course Base Course

Superior Region

Mixture Type	HMA Mainline and Ramps		High Stress HMA	
EL, EML, EMH	PG 58-34 PG 58-28	Top & Leveling Course Base Course	PG 64-34P PG 58-28	Top & Leveling Course Base Course

Metro Region

Mixture Type	HMA Mainline and Ramps		High Stress HMA	
EH, SMA	PG 70-22P PG 64-22	Top & Leveling Course Base Course	PG 76-22P PG 64-22	Top & Leveling Course Base Course
EML, EMH	PG 64-22 PG 58-22	Top & Leveling Course Base Course	PG 70-22P PG 58-22	Top & Leveling Course Base Course
EL	PG 58-22	Top, Leveling & Base Course	PG 64-22 PG 58-22	Top & Leveling Course Base Course

NOTES:

1. For shoulders paved greater than or equal to 8 feet or in a separate operation, use PG 58-28 for top and leveling course and PG 58-22 for base course for all Regions
2. For Temporary Roads, commercial and private Approaches, Wedging, and Hand Patching, use PG 64-22 for all Regions except Superior and North, use PG 58-28.

Removal of Seasonal Limitations

- Weather is a determining factor
- Seasonal limitations are often exceeded
- Project clauses in proposal dictate schedules
- Construction Manual Revisions will include guidance on timing of projects relative to HMA plant operations

FUSPs Incorporated Into 2020 Spec Book

- 501BB – Safety Edge
- 501FF – Low Tracking Bond Coat Emulsified Asphalt
- 501GG – Cold Milling Hot Mix Asphalt Surface
- 501L – Temporary Hot Mix Asphalt Pavement Quality and Compliance
- 501U & 501V – Some terminology from PWL FUSPs incorporated

Verification of Specific Gravity

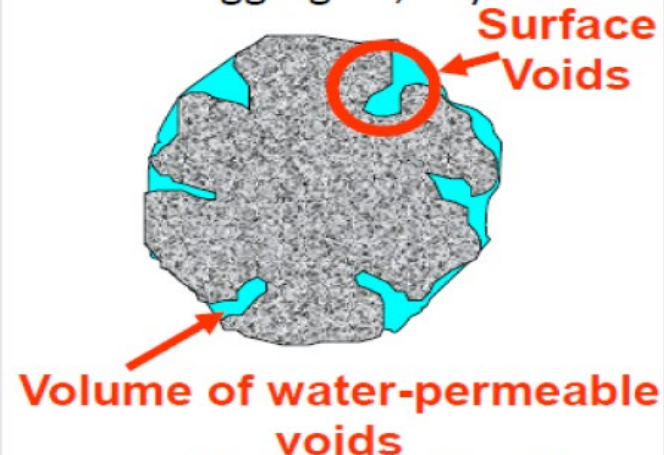
- Identified as an area of risk by FHWA/MDOT
 - \$4.25 million settlement with an Indiana construction company resolves claims of an alleged product substitution
 - Idaho highway contractors changed records hundreds of times - then received bonuses
- Incorrect Gsb values affect asphalt content and pavement performance
- Contractors are required to submit a Gsb sample with all mix designs
 - This includes express mix designs
- During production Gse will be monitored

Verification of Specific Gravity

- G_{sa} = Apparent Specific Gravity
- G_{se} = Effective Specific Gravity
- G_{sb} = Bulk Specific Gravity

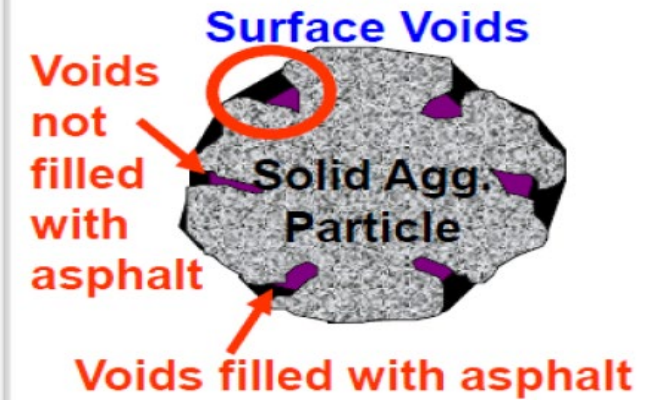
Aggregate – Specific Gravity

Bulk Specific Gravity of
Aggregate, Dry



$$G_{sb} = \frac{\text{Mass, Aggr., OvenDry}}{\text{Vol., Aggr. + Surface, Voids}}$$

Effective Specific Gravity of
Aggregate

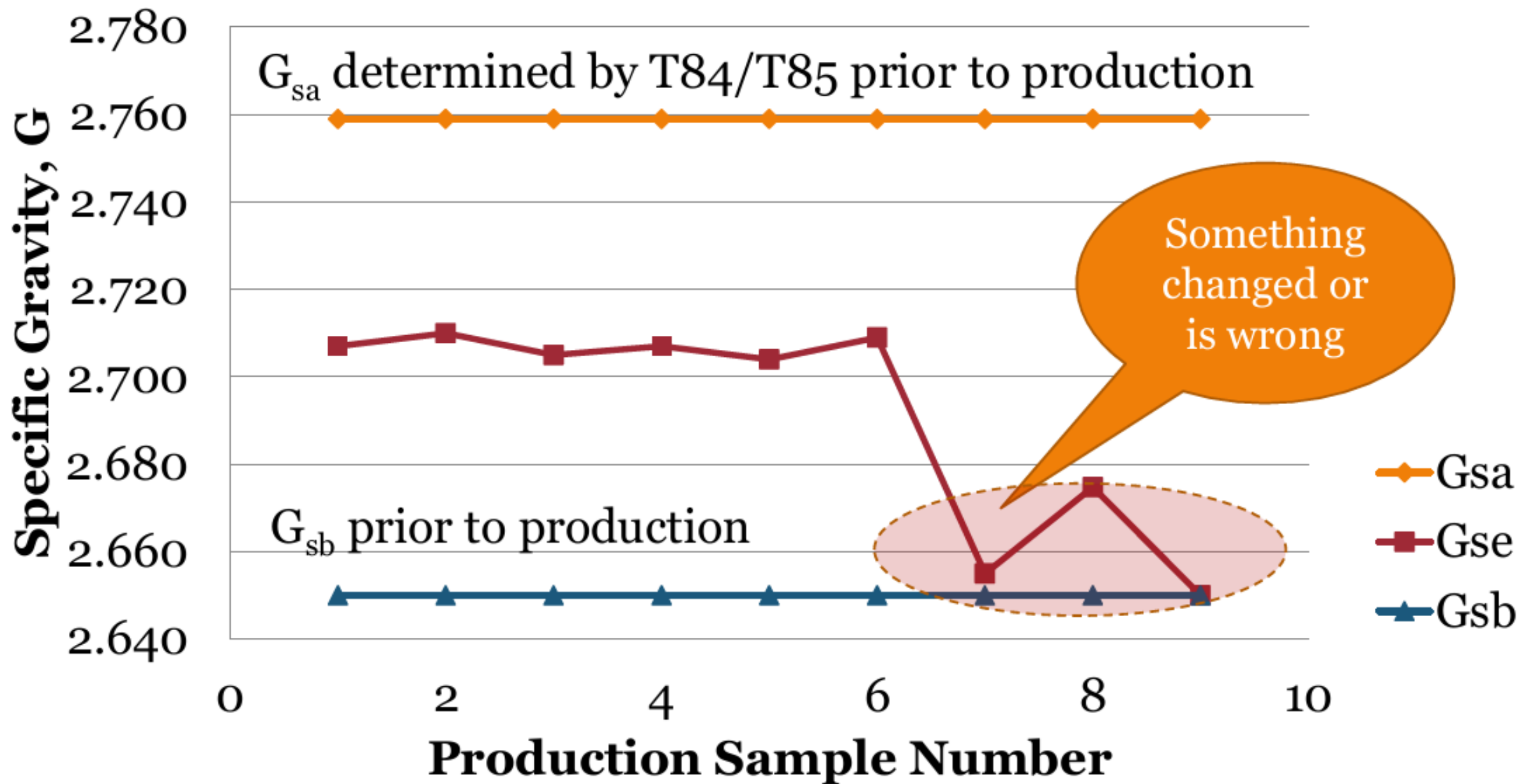


$$G_{se} = \frac{\text{Mass, Dry}}{\text{Effective, Vol.}}$$

$$G_{sa} \geq G_{se} \geq G_{sb} \text{ (ALWAYS!)}$$

Artificially High		Lower Asphalt Content (%)
G_{sb}	VMA (%)	
0.010	0.3	0.15
0.020	0.6	0.30
0.040	1.2	0.60

Aggregate Control Chart



DAILY REPORT OF CONTRACTOR'S QUALITY CONTROL TESTS

Clear Form

File 208

DISTRIBUTION: ORIGINAL – Project Engineer, COPIES – TMI

CONTROL SECTION	JOB NUMBER	PROJECT LOCATION	MIX DESIGN NUMBER	MIXTURE TYPE	DATE SAMPLED	DATE TESTED
CONTRACTOR		PLANT NO.	PLANT LOCATION		FORM 1911 DATE	
PROJECT ENGINEER		NAME OF TESTER (Please print)		NAME OF TESTER (Signature)		QUALIFICATION NUMBER
Gb	Gsb	Gse	SUBLOT SIZE	LOT NO	SUBLOT NO	SUBLOT RANDOM TONS ACCUMULATED TONS

TEST RESULTS							TEST RESULTS						
	JMF	CONTR	DEV	ACTION LIMITS*	SUSP LIMITS*	AGG		JMF	CONTR	DEV	ACTION LIMITS*	SUSP LIMITS*	
P 1-1/2" (37.5 mm)							ASPHALT %						
P 1" (25.0 mm)							Gmm						
P 3/4" (19.0 mm)							Gmb @ N DESIGN						
P 1/2" (12.5 mm)							AIR VOIDS						
P 3/8" (9.5 mm)							VMA						
P No. 4 (4.75 mm)							VFA						
P No. 8 (2.36 mm)							F/A RATIO						
P No. 16 (1.18 mm)							Gse						
P No. 30 (600 µm)								GRADE	CERTIFIED SUPPLIER / LOCATION/CERT#		% ADD		
P No. 50 (300 µm)							ASPHALT BINDER						
P No. 100 (150 µm)							Gmb WEIGHTS/COMPACTION TEMPERATURE						
P No. 200 (75 µm)							NUMBER OF SOLVENT WASHES (When using the vacuum extraction method for Asphalt %)						
CRUSH – 1 FACE													
CRUSH – 2 FACE													

REMARKS

* CIRCLE TEST RESULTS THAT ARE OUT OF LIMITS

Gse added to
1903B and 1903C

Targeted Overlay Pavement Solutions (TOPS)



- Included as part of Every Day Counts (EDC) 6.
- Enable agencies to maximize their investment and help ensure safer, longer-lasting roadways.
- The goal of TOPS is to improve performance, lessen traffic impacts, and reduce the cost of pavement ownership.
- Targeted overlays match treatments to high-priority, high need locations.

Targeted Overlay Pavement Solutions (TOPS)



- First step involves FHWA gathering status and interest in various fixes.
- Status ranges from “Not Implemented” to “Institutionalized”.
- Potential outcome to include webinars, peer exchanges, pilot specifications, etc.



Targeted Overlay Pavement Solutions (TOPS)



- Stone Matrix Asphalt – Institutionalized
- Ultra-Thin Bonded Wearing Course – Institutionalized
- Open Graded Friction Course – Not Implemented
- Crack Attenuating Mix – Not Implemented
- Asphalt Rubber Gap Graded – Not Implemented
- Highly Modified Asphalt – Interested
- Enhanced Friction Overlay – Interested
- High Performance Thin Overlay – Interested

Targeted Overlay Pavement Solutions (TOPS)



High Performance Thin Overlay

- Similar to MDOT's Ultra-Thin
- Limits RAP and Sand
- Uses Performance Tests for Cracking and Rutting
- High Volume Routes



Targeted Overlay Pavement Solutions (TOPS)



Enhanced Friction Overlay

- Calcined Bauxite (40%)
- High Asphalt Content (8%)
- Comparable Friction to High Friction Surface Treatment (HFST)
- Reduced Cost to HFST



Targeted Overlay Pavement



Solutions (TOPS)

Highly Modified Asphalt (HiMA)

- Binder Contains 7-8% Polymer
- Improves Cracking Resistance
- Possible Reduced Thickness
- Performance Testing
- Cost Concerns



E-Ticketing



- **Safety:** e-ticketing enhances data collection while reducing exposure to adjacent vehicular traffic and construction equipment for inspectors and work crews while retrieving paper tickets.
- **Time Savings:** real-time access via electronic handling of tickets, reduces processing time for quality assurance and payment, and decreases the inherent delays in paper-based project administration.
- **Quality:** project documentation is more consistent and efficient using e-ticketing platforms. Standardized data enables archiving for future reference, leading to improved design, construction, maintenance, and operations.

Local Agency Volumetric Specification

- Developed by County Road Association
- Volumetric single test acceptance of dense graded HMA mixture on Local Agency Projects
- Change in spec limits, penalties, and weighting of pay factors
- Pilots started in 2020

Local Agency Volumetric: Table 1

Quality Index Parameter	Specification Limits
Air Voids, %	Target Air Voids ± 0.50
Vma 13A and LVSP 2C and 2E 3C and 3E 4C and 4E 36A and 5E	Target Vma ± 0.60
	Vma Targets
	15.00
	2C - 12.00, 2E - 13.00
	14.00
	15.00 16.00
Binder Content	Target ± 0.30

Pay Factor for Air Voids (40%)

<u>Deviation from JMF (\pm percent)</u>	<u>PF_{AV}</u>
≤ 0.50	1.00
0.51 – 0.60	0.98
0.61 – 0.70	0.96
0.71 – 0.80	0.94
0.81 – 0.90	0.92
0.91 – 1.00	0.90
1.01 – 1.20	0.84
1.21 – 1.40	0.78
1.41 – 1.60	0.72
1.61 – 1.80	0.66
1.81 – 2.00	0.60
> 2.00	RQL

Pay Factor for Density (30%)

- **Direct Density**

<u>Deviation from JMF (\pm percent)</u>	<u>PF_D</u>
≥ 98.1	0.90
92.0 – 98.0	1.00
91.0 – 91.9	0.90
90.0 – 90.9	0.80
< 90.0	RQL

- **Roller Method:** If the established roller pattern is adhered to as documented by the Engineer, the PF_D is 1.00. If the Engineer documents issues with the roller pattern and non-adherence from the Contractor upon notification, the PF_D is 0.90. If it is necessary for the Engineer to stop production at any point during the STA sample paving due to non-adherence, the PF_D is 0.80.

Pay Factor for Binder (20%)

<u>Deviation from JMF (\pm percent)</u>	<u>PF_{Binder}</u>
≤ 0.30	1.00
0.31 – 0.50	0.90
0.51 – 0.70	0.80
0.71 – 0.90	0.60
0.91 – 1.00	0.40
> 1.00	RQL

Pay Factor for VMA (10%)

<u>Deviation from JMF (\pm percent)</u>	<u>PF_{VMA}</u>
≤ 0.60	1.00
0.61 – 1.00	0.90
1.01 – 1.50	0.70
1.51 – 2.00	0.30
> 2.00	RQL

Fine Texture Pavement Milling

- 2012 FUSP 501JJ
- Use Statement:
 - Use on all trunkline, one course, non-freeway mill and resurface projects
 - Where the integrity of the existing pavement makes it suitable to allow traffic to be maintained on a milled surface for up to 72-hours and where it is desirable to expedite the project schedule and/or increase production paving
 - Due to the 72-hour traffic restriction the specification needs to be accompanied by a liquidated damages specification

Fine Texture Pavement Milling

- Ensure the milling operation is providing an acceptable surface texture by achieving a maximum macro texture of 0.08 inches thickness according to ASTM E 965



Fine Texture Pavement Milling

- How do we accomplish texture requirements?
 - Ensure the milling machine is configured with either a 0.3-inch tooth spacing or
 - A 0.6-inch tooth spacing operated at a maximum speed of 40 feet per minute or
 - Approved equal configuration and speed capable of meeting ASTM E 965 testing requirements
- Milled area is free from gouges, continuous grooves, and ridges, and has a uniform texture





Micro Cold Milling Hot Mix Asphalt (0-3.5 Inches)

- Use Statement :
 - Use on CPM Surface Seal projects that require the removal of a previous surface seal or where improved ride quality is desired. The integrity of the pavement should be suitable to allow traffic to be maintained on the milled surface.
- Location:
 - Previously Approved Special Provisions, Division 5 - select "*Special Provisions – 2012 Previously Approved*" from the drop-down menu at the following web site:
<https://mdotjboss.state.mi.us/SpecProv/specProvHome.htm>
- This was developed for use on CPM projects.
- There is no traffic restriction written into the special provision.

Changes to Pavement/HMA Operations

- 2020
 - Pavement Operations Engineer: Curtis Bleech
 - HMA Operations Engineer: Kevin Kennedy
 - Mix Design Engineer: Nathan Maack

- 2021
 - Pavement Operations Engineer: Kevin Kennedy
 - Curtis Bleech retired November 2020
 - HMA Operations Engineer: Nathan Maack
 - Mix Design Engineer: VACANT

QUESTIONS?

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