

A world map is visible in the background, rendered in a light blue and green color scheme. The map shows the continents of North America, South America, Europe, and Africa. The background has a vertical gradient from light green at the top to light blue at the bottom.

Hot Mix Asphalt (HMA) Pavements

**Design Basic Training
2020**



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Items To Cover

- HMA Selection Guidelines
 - Current (2012 Spec Book)
 - 2020 Spec Book
- Spec Book Changes
- Fine Texture Milling
- Construction Photos

HMA Selection Guidelines

- Housed in the Road Design Manual Section 6.03.09
- We are using 100% Superpave at MDOT
- Mix Type Determined By 20 Year Design BESAL's for Rehab/Recon Projects and Present Day Two-Way Commercial for CPM Projects

Mix Type Selection (2012)

Superpave Mix Type	Design BESAL (millions)
E03/LVSP	Less than 0.3
E1	Between 0.3 and 1.0
E3	Between 1.0 and 3.0
E10	Between 3.0 and 10.0
E30	Between 10.0 and 30.0
E50	Between 30.0 and 100.0
GGSP	Between 10.0 and 100.0

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



Mix Type Selections (2020)

- 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 renamed SMA to be consistent with national standards

Mix Type Selections (2020)

Superpave Mix Type	Design BESAL (millions)
EL	Less than 0.3
EML	Between 0.3 and 3.0
EMH	Between 3.0 and 30.0
EH	Between 30.0 and 100.0
SMA	Between 10.0 and 100.0

Table 501-3

Existing Criteria

Superpave Gyratory Compactor (SGC) Compaction Criteria

Estimated Traffic (million ESAL)	Mix Type	Number of Gyration			
		%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

Table 501-3

Proposed Criteria					
Superpave Gyrotory Compactor (SGC) Compaction Criteria					
Estimated Traffic (million ESAL)	Mix Type	%Gmm at (Ni)	Number of Gyations		
			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

HMA Application Rates (2012)

Mixture #	Minimum Application	Maximum Application	Course Application
2	435 lbs/syd	550 lbs/syd	Base
3	330 lbs/syd	410 lbs/syd	Base and/or Leveling
4	220 lbs/syd	275 lbs/syd	Leveling and/or Top
5	165 lbs/syd	220 lbs/syd	Top
LVSP	220 lbs/syd	330 lbs/syd	Base
LVSP	165 lbs/syd	250 lbs/syd	Leveling and/or Top
GGSP ($\frac{3}{8}$ " Nom. Max.)	165 lbs/syd	225 lbs/syd	Top
GGSP ($\frac{1}{2}$ " Nom. Max.)	220 lbs/syd	275 lbs/syd	Top
ASCRL	255 lbs/syd	425 lbs/syd	Base

HMA Application Rates (2020)

Mixture #	Minimum Application	Maximum Application	Course Application
2	435 lbs/syd	550 lbs/syd	Base
3	330 lbs/syd	410 lbs/syd	Base and/or Leveling
4	220 lbs/syd	275 lbs/syd	Leveling and/or Top
5	165 lbs/syd	220 lbs/syd	Top
SMA ($\frac{3}{8}$ " Nom. Max.)	165 lbs/syd	225 lbs/syd	Top
SMA ($\frac{1}{2}$ " Nom. Max.)	220 lbs/syd	275 lbs/syd	Top
ASCRL	255 lbs/syd	425 lbs/syd	Base

Calculating HMA Tonnage

- 1" of HMA equals 110 lbs/syd
- To calculate the tonnage for 1 mile of HMA placed at 2" on a 12-foot-wide lane
 - $(12' * 5280' * 1\text{syd}/9\text{sq ft}) * (2" * 110\text{lbs/syd}/")$
 $\div 2000\text{lbs/ton} = 774.4 \text{ tons}$

HMA APPLICATION ESTIMATE

EX 500BASE

IDENT NO.	ITEM	RATE (LBS PER SYD)	PERFORMANCE GRADE	REMARKS	LOCATION
5E10-1	HMA, 5E10, HIGH STRESS	165	70-22P	TOP CRSE-HMA, 5E10, HIGH STRESS, AWI=260	US-12 MAINLINE
4E10	HMA, 4E10, HIGH STRESS	220	70-22P	LEVELING CRSE-HMA, 4E10, HIGH STRESS	US-12 MAINLINE
5E10-2	HMA, 5E10	VARIES	64-22	WEDGING-HMA, 5E10	US-12 MAINLINE, LIVERNOIS AVE INTERSECTION, AND SIDE STREET APPROACHES
APP-1	HMA APPROACH, HIGH STRESS	VARIES	70-22P	TOP CRSE-HMA, 5E10, HIGH STRESS @ 165 */SYD LEVELING CRSE-HMA, 4E10, HIGH STRESS @ 220 */SYD	LIVERNOIS AVE INTERSECTION
APP-2	HMA APPROACH, HIGH STRESS	VARIES	70-22P	TOP CRSE-HMA, 5E10, HIGH STRESS @ 165 */SYD	SIDE STREET APPROACHES AND DRIVEWAYS
HP	HAND PATCHING	VARIES	64-22	HMA, 5E10	AS DIRECTED BY THE ENGINEER
	* BOND COAT	0.05-0.15 GAL			

*FOR INFORMATION ONLY

HMA Binder Selection

- Designer selects binder for each mix type
- “P” denotes polymer modifier required
- Show each binder required for each HMA mix specified in the “HMA Application Estimate Table”

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.

Binder Selection (2012)

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

Binder Selection (2020)

North, Grand, Bay, Southwest, and University

Mixture Type	HMA Mainline & 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
EMH, EML	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

Binder Selection Notes

2012 NOTES:

1. For shoulders paved greater than or equal to 8 feet or in a separate operation, use PG 58-28 for all Regions. (Applies to all courses.)
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.

2020 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.

Top – Leveling - Base

The Top and Leveling courses are defined as the mixture layers within 4 inches of the surface; the base course is defined as all layers below 4 inches of the surface. For mixture layers which fall within the 4 inch threshold, the following rule should apply: If less than 25% of a mixture layer is within 4 inches of the surface, the mixture layer should be considered to be a base course.

High Stress HMA

- Areas Susceptible to Rutting
 - Signalized Intersections
 - Areas of Stop/Start Traffic
 - Commercial Turning Movements
 - Known Areas of Rutting
- High Stress HMA Pay Item

Application Guide:

- Use High Stress HMA 1000 feet on either side of the center of signalized intersections, other areas where stop/start traffic occurs, and at locations that experience high levels of commercial traffic turning movements (for quantity calculations use 1100 feet).
- Intersecting roads and commercial drives that are adjacent to the High Stress HMA mainline should use High Stress HMA Approach.
- Use High Stress HMA between signalized intersections when they are spaced 1 mile or less.

High Stress Binder Selection

- Binder Selection Tables: Section 6.03.09A1d of the Road Design Manual
- HMA Application Estimate Table
- High Stress HMA Requires High Temperature Binder Bump
- Include Applicable Specifications

Non-Mainline Paving (2012)

Design BESAL's (millions) Mainline	Shoulders $\geq 8'$ or shoulders paved in a separate operation All Courses (3)		Ramps and Temporary Roads All Courses (1)		Street Approaches and Wedging (2) (4) (5)	Hand Patching and Private Drive Approaches (6)
	Mixture Type	Application Rate	Mixture Type	Application Rate	Mixture Type	Mixture Type
≤ 10.0	LVSP/E03 Top LVSP/E03 Lev	165-220 lbs/syd 220-250 lbs/syd	LVSP/E03 Top LVSP/E03 Lev	165-220 lbs/syd 220-250 lbs/syd	Mainline Top Course	LVSP
> 10.0	5E3 Top 4E3 Top	165-220 lbs/syd 220 lbs/syd	5E3 Top 4E3 Top	165-220 lbs/syd 220 lbs/syd	Mainline Top Course	Mainline Top Course or LVSP
	4E3 Level 3E3 Level	220-275 lbs/syd 330 lbs/syd	4E3 Level 3E3 Level	220-275 lbs/syd 330 lbs/syd		
	3E3 Base 2E3 Base	330-410 lbs/syd 435-540 lbs/syd	3E3 Base 2E3 Base	330-410 lbs/syd 435-540 lbs/syd		

Non-Mainline Paving (2020)

Design BESAL's (millions) Mainline	Shoulders $\geq 8'$ or shoulders paved in a separate operation All Courses (2)		Temporary Roads All Courses		Street Approaches and Wedging (1) (3)	Hand Patching and Private Drive Approaches (4)(5)
	Mixture Type	Application Rate	Mixture Type	Application Rate	Mixture Type	Mixture Type
≤ 3.0	Mainline Mix	meet appropriate min/max application rates	5EL Top 4EL Lev	165-220 lbs/syd 220-250 lbs/syd	Mainline Top Course	EL
> 3.0	5EML Top 4EML Top	165-220 lbs/syd 220 lbs/syd	5EML Top 4EML Top	165-220 lbs/syd 220 lbs/syd	Mainline Top Course	Mainline Top Course or EL
	4EML Level 3EML Level	220-275 lbs/syd 330 lbs/syd	4EML Level 3EML Level	220-275 lbs/syd 330 lbs/syd		
	3EML Base 2EML Base	330-410 lbs/syd 435-540 lbs/syd	3EML Base 2EML Base	330-410 lbs/syd 435-540 lbs/syd		

Non-Mainline Pavement Notes (2012)

There are cases where the mainline mixture may be used on the ramps.
Example: Ramps with high traffic volume resulting in frequent periods of slow moving and standing load applications or when reducing the number of mixes on a project.

The appropriate shoulder or mainline mixture (determined from 20-year design BESAL's) may be used on driveways and low traffic volume approaches.

Shoulders paved integrally with the mainline will use the same mix as used on the mainline.

If more than one mixture and/or binder combination is required for HMA approach, it should be clearly shown in the HMA Application Estimate Table.

Show the mixture type for Hand Patching in the HMA Application Estimate Table.

When using GGSP, use 5E3 or 5E10 for hand patching.

Non-Mainline Pavement Notes (2020)

The appropriate shoulder or mainline mixture (determined from 20-year design BESAL's) may be used on driveways and low traffic volume approaches.

Shoulders paved integrally with the mainline will use the same mix as used on the mainline.

If more than one mixture and/or binder combination is required for HMA approach, it should be clearly shown in the HMA Application Estimate Table.

Show the mixture type for Hand Patching in the HMA Application Estimate Table.

When using SMA, use 5EML or 5EMH for hand patching.

CPM Projects (2012)

Commercial ADT 0 – 300	Commercial ADT 301 – 700	Commercial ADT 701 – 1000	Commercial ADT 1001 – 3400	Commercial ADT ≥ 3401
LVSP/E03	5E1	5E3	5E10	GGSP or 5E30
PG 58-28*	PG 58-28*	PG 64-28*	PG 64-28*	PG 70-28P*

Use PG 58-34 asphalt binder in the Superior Region for full depth flexible pavements.

Use PG 58-28 asphalt binder in the Superior Region for composite pavements.

CPM Projects (2020)

Commercial ADT 0 – 300	Commercial ADT 301 – 1000	Commercial ADT 1001 – 3400	Commercial ADT ≥ 3401
5EL	5EML	5EMH	SMA or 5EMH
PG 58-28*	PG 64-28*	PG 64-28*	PG 70-28P*

Use PG 58-34 asphalt binder in the Superior Region for full depth flexible pavements.

Use PG 58-28 asphalt binder in the Superior Region for composite pavements.

CPM Projects (2012)

- For shoulder paving, use a **LVSP or E03 mixture**.
- For mainline paving, the application rate is 165 lbs/syd (1½” compacted thickness) for all mixes unless approved by the CPM Engineer. For shoulder paving the maximum application rate is 330 lbs/syd (3” compacted thickness).
- For hand patching, use the appropriate mainline mixture. Use a PG 58-28 binder for all regions.
- When using GGSP, use **5E3 or 5E10** for hand patching.

CPM Projects (2020)

- For shoulder paving, use a **EL** mixture.
- For mainline paving, the application rate is 165 lbs/syd (1½” compacted thickness) for all mixes unless approved by the CPM Engineer. For shoulder paving the maximum application rate is 330 lbs/syd (3” compacted thickness).
- For hand patching, use the appropriate mainline mixture. Use a PG 58-28 binder for all regions.
- When using **SMA**, use **5EML** or **5EMH** for hand patching.

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

2020 Spec Book

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

Fine Texture Pavement Milling

- 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





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
- This was developed for use on CPM projects.
- There is no traffic restriction written into the special provision.



















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