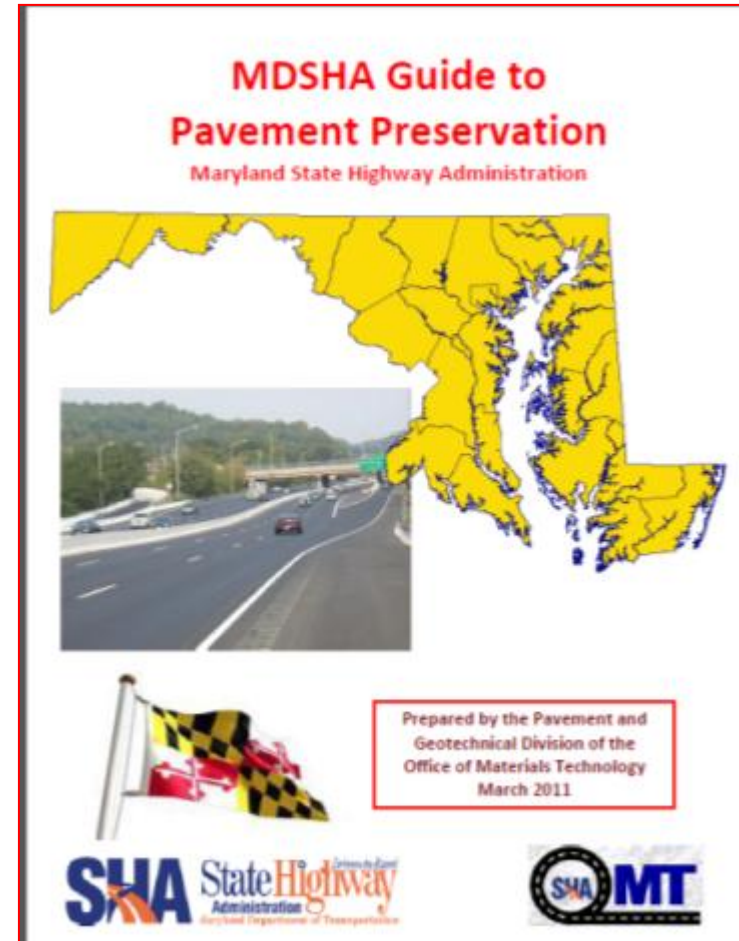


Guidelines for Pavement Preservation

Geoff Hall, P.E.
**Pavement & Geotechnical
Division Chief,
Maryland SHA**

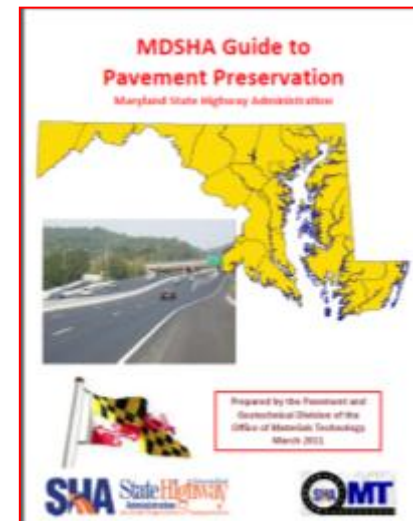


August 29, 2012

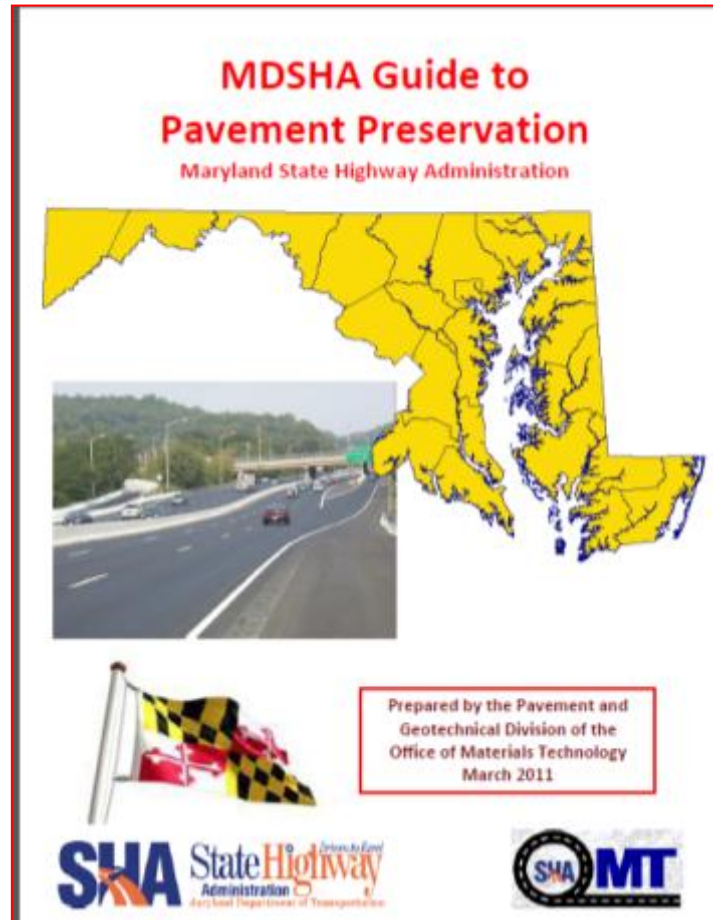


Agenda

- Background and Current Issues
 - Why we created the Guide
- Pavement Preservation Guide
 - Contents
 - Example Project



Background and Current Issues



Background

**Pavement Preservation
Technical Appraisal**

N CPP

**Maryland
State Highway Administration
May 2007
Baltimore, Maryland**

- Pavement Management/
Project Selection/
System Preservation
assessment in 2007

- Several useful
recommendations
provided



Background

Pavement Preservation
Technical Appraisal

NCPP

Maryland
State Highway Administration
May 2007
Baltimore, Maryland

*Continue to move toward
a more proactive
philosophy, avoiding
reactive approaches,
particularly "worst first".*

**Target: Balanced selection of roads in all
condition states**



Background

- *Currently, each district has own ideas as to what constitutes appropriate treatment.*

- *Develop guidelines for use on statewide basis*

- *Guidelines should have expected life extensions of treatments*

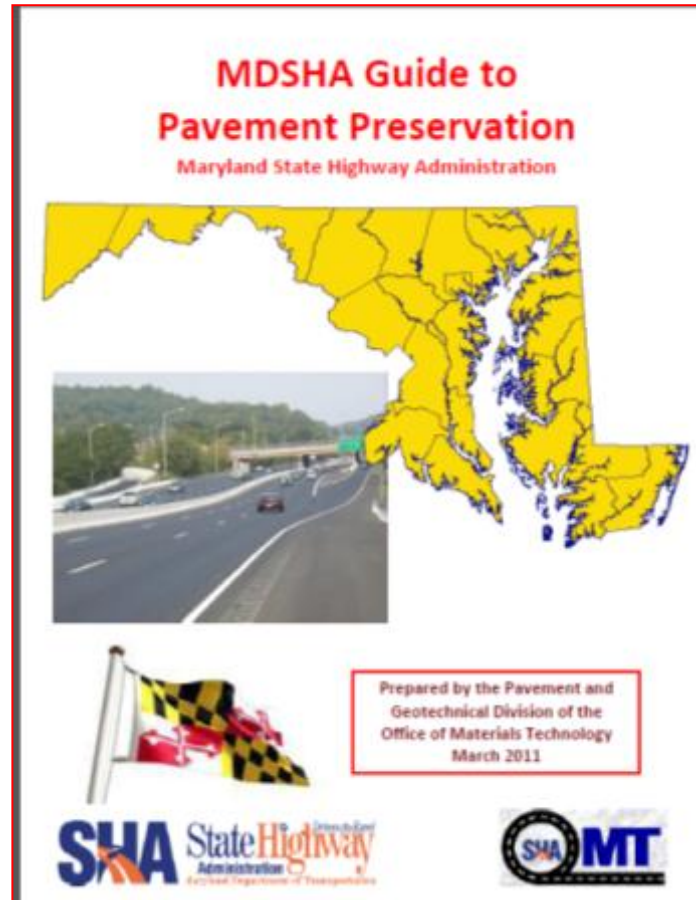
Pavement Preservation
Technical Appraisal

N CPP

Maryland
State Highway Administration
May 2007
Baltimore, Maryland



Pavement Preservation Guide - Contents



Preservation Guide

Three Main Sections:

1. Treatment Tables & Matrices
2. Definitions of Treatments
3. Supplemental Treatment Information



Treatment Tables

Type of Activity	Specific Fixes (Including but not limited to)	
Major (Heavy) Rehabilitation	<ul style="list-style-type: none"> • Cold In-Place HMA Recycling (CIR) • Break & Seat and Overlay • Crack & Seat and Overlay • Deep Grind and Thick Overlay • Rubblization & Overlay 	
Structural Overlay	<ul style="list-style-type: none"> • Overlay or grind/overlay combination where grade increases more than 1.5" • Greater than 5% of project area has fatigue distresses needing patching • Any concrete overlay 	
Minor (Light) Rehabilitation	<ul style="list-style-type: none"> • Grade increase due to overlay or mill/overlay thickness is no more than 1.5", and the project receives less than 5% patching for structural distress. 	
Preventive Maintenance	Asphalt-surfaced Pavements	<ul style="list-style-type: none"> • Cape seal • Chip seal • Crack filling • Crack seal • Diamond grinding • Fog seal • High-friction surface • Hot In-Place Recycling (HIR) • Modified chip seal • Patching • Rejuvenators • Sand seal • Sandwich seal • Scrub seal • Slurry seal • Thin and ultra-thin hot-mix



Treatment Tables

Treatment Group	Treatment Number	Treatment
A. Crack/Joint Seals	A-1	Crack Filling
	A-2	Crack Sealing
	A-3	Joint Sealing (and Resealing)
	A-4	Saw and Seal
B. Asphalt Sealers / Rejuvenators	B-1	Asphalt Sealers
	B-2	Fog Seals / Rejuvenators
C. Aggregate Seals	C-1	Cape Seal
	C-2	Chip Seal (Modified)
	C-3	High Friction Surface
	C-4	Sand Seal
	C-5	Sandwich Seal
	C-6	Scrub Seal
	C-7	Slurry Seal
	C-8	Microsurfacing
D. Ultrathin HMA	D-1	Ultrathin Bonded Wearing Course (A



Treatment Decision Tree

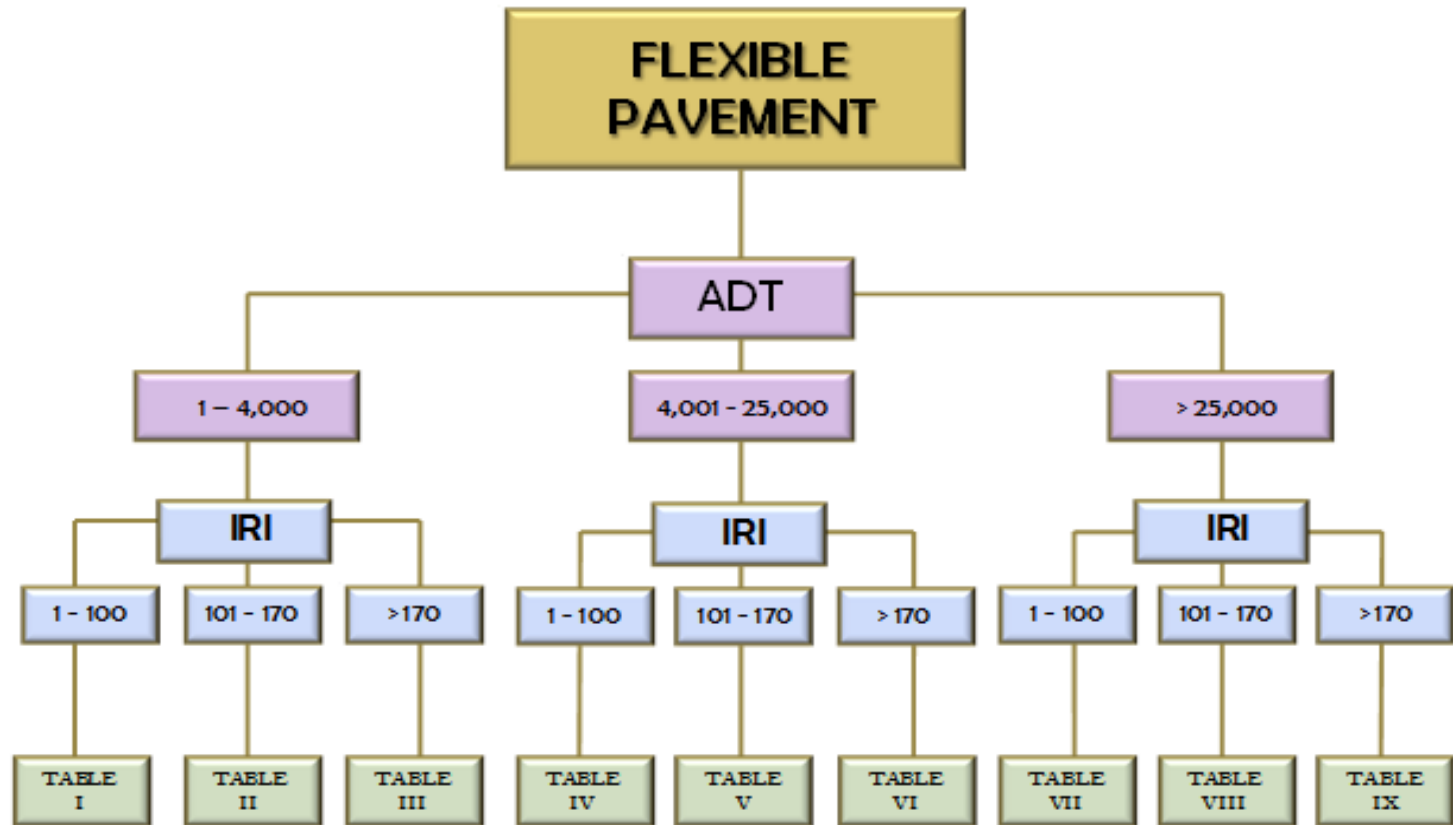


Figure 1 Decision Tree for Flexible Pavements



Treatment Matrix

Table IV				Pavement ADT				
CI	Friction	Cracking	Rutting (in.)	A. Crack/Joint Seals	B. Asphalt Sealers / Rejuvenators	C. Aggregate Seals	D. Ultrathin HMA	E. Overlay
76-100	>40	Load-Related	M	A-1, A-2	B-1, B-2	C-3, C-7, C-8		E-5, E-8, E-15
			H	A-1, A-2	B-1, B-2	C-3, C-7, C-8		E-5, E-8, E-15
		Non Load-Related	L	A-1, A-2	B-1, B-2	C-3, C-7		E-5
			M	A-1, A-2	B-1, B-2	C-3, C-7, C-8		E-5, E-8, E-15
			H	A-1, A-2	B-1, B-2	C-3, C-7, C-8		E-5, E-8, E-15
	≤ 40	Load-Related	L	A-1, A-2	B-1, B-2	C-3, C-7	D-1	E-5
			M	A-1, A-2	B-1, B-2	C-3, C-7, C-8	D-1	E-5, E-8, E-15
			H	A-1, A-2	B-1, B-2	C-3, C-7, C-8	D-1	E-5, E-8, E-15
		Non Load-Related	L	A-1, A-2	B-1, B-2	C-3, C-7	D-1	E-5
			M	A-1, A-2	B-1, B-2	C-3, C-7, C-8	D-1	E-5, E-8, E-15
			H	A-1, A-2	B-1, B-2	C-3, C-7, C-8	D-1	E-5, E-8, E-15

Note: See Table E for Treatment Activities



Treatment Definitions

Appendix A: Definitions

and to prevent the intrusion of incompressibles into materials from bitumen to silicone to neoprene is used. Neoprene is rarely if ever used on resealing projects.

A-4: Saw and Seal

A method of controlling reflective cracking in HMA over joints in the new overlay exactly over the joints in the existing

B. Asphalt Sealers / Rejuvenators:

B-1: Asphalt Sealers


Very light applications of a diluted asphalt emulsion (water) placed directly on the pavement surface with application rates range from 0.05 to 0.1 gal per SY.

B-2: Fog Seals / Rejuvenators

Specialized emulsions of maltenes (2 parts maltene sprayed on an existing asphalt surface with the intent



Supplement Treatment Info

Table B.3	SUPPL	
	C-4.Sand Seal	C-5.Sand
 <p>Treatment Advantages</p>	<ol style="list-style-type: none"> 1. Prevents/delays oxidation of the pavement surface. 2. Seals the pavement surface (including temporary sealing low severity fatigue cracking) 3. Successful on both low- and high- volume roadways. 4. Corrects poor friction. 5. Slows/reduces severity of moisture damage, cracking, raveling and possibly roughness and rutting. 	<ol style="list-style-type: none"> 1. Unlike the doubt one application of required. 2. Same service li chip seal 3. Provides a smc than chip seal



Supplement Treatment Info

Table B.3	SUPPL	
	C-4.Sand Seal	C-5.Sand
Treatment Disadvantages	<ol style="list-style-type: none">1. Negatively affects stripping.2. Limited to lower volume traffic conditions with a low percentage of trucks, and roadway grades flatter than 8%.3. Should be constructed when surface is dry and the temperature is at least 50 deg F4. To ensure good bond, existing pavement must be clean and dry.	<ol style="list-style-type: none">1. Clean aggregate2. Aggregate chip windshields.3. Must be placed on sound pavements



Supplement Treatment Info

Table B.3		SUPPLE	
		C-4.Sand Seal	C-5.Sandw
Cost Clarification	Small Quantity Cost	\$0.33 to \$0.66/SY	\$1 - \$2
	Medium Quantity Cost	\$0.33 to \$0.66/SY	
	High Quantity Cost	\$0.33 to \$0.66/SY	
	Items Included	See Description	See Defi
	Items Excluded	Marking Removal	Marking R



Supplement Treatment Info

Table B.3	SUPPLEMENT	
	C-4.Sand Seal	C-5.Sandw
Typical Service Life	3-4 years	5-7 ye
Considerations Cure time	Controlled traffic may be permitted as soon as the final layer is applied and rolled, and sufficiently cooled to withstand traffic without damage. A recommended maximum speed of 30 km/h, (20 mph), should be maintained for a period of two (2) hours.	Cure time generally 4 hours before swee loose aggregate



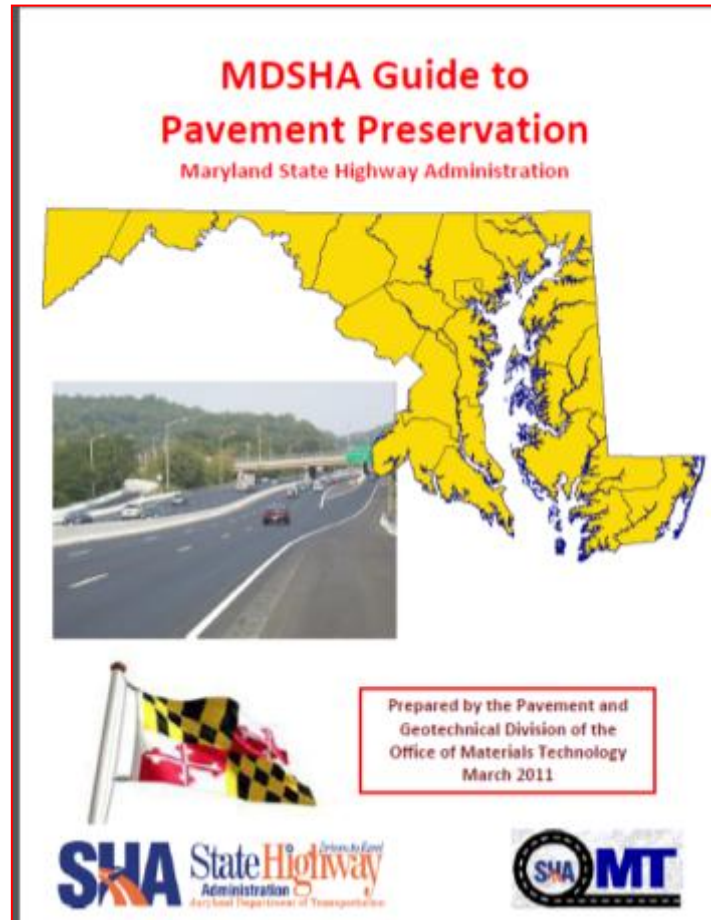
Using the Guide – What fixes are most appropriate?

Two Steps:

1. Using network-level data, go through appropriate matrix to identify viable treatments
2. Then use project-level data, treatment advantages/disadvantages, cost/benefit to select final treatment choice



Pavement Preservation Guide – Example Project



Historically...

- Very few options in toolbox of fixes
 - Even fewer that are non-HMA-overlay “pavement preservation”



Example Project – Historically

02 AA MD 170 110 3.092 2009-12-17



Flexible Pavement

15 years old

ADT = 22,000

IRI < 100

Crack Index > 75

Friction < 35

What is a good fix?



How we used to do it –

What fixes are available?

Circa 2007...

- Option 1: Thin HMA OL
- Option 2: Thick HMA OL
- Option 3: Wait until next year



How we are supposed to do it now –

What fixes are available?

Crack Filling	Cold In Place HMA Recycling (CIR)	Diamond Grinding
Crack Sealing	Grind and HMA Overlay - GAP-SMA	Surface Course Grinding
Joint Sealing (and Resealing)	Grind and HMA Overlay - 76-22, Dense, 8PV	Diamond Grooving
Saw and Seal	HMA Overlay - 64-22/28, w/ or w/o 8PV	Cold In Place HMA Recycling (CIR) using Emulsified Asphalt
Asphalt Sealers	HMA Overlay - GAP-SMA	
Fog Seals / Rejuvenators	HMA Overlay - 76-22, Dense, 8PV	Cold In Place HMA Recycling (CIR) using Foamed Asphalt
	Wedge/Level and HMA Overlay - 64-22/28, w/ or w/o 8PV	
Cape Seal	Wedge/Level and HMA Overlay - GAP-SMA	Deep Grind and Thick Overlay
Chip Seal (Modified)		Break/Grind & Seal and HMA Overlay
High Friction Surface	Wedge/Level and HMA Overlay - 76-22, Dense, 8PV	Rubblization and HMA Overlay
Sand Seal	PCC Overlay - Unbonded	Reconstruction using Cement Stabilized Aggregate Base
Sandwich Seal	PCC Overlay - Bonded	
Scrub Seal	Partial-Depth Patch (Flexible Pavements)	Reconstruction using Emulsified Asphalt Base
Slurry Seal	Full-Depth Patch (Flexible Pavements)	Reconstruction using GAB & HMA
Microsurfacing	Partial-Depth Patch (Spall Repair) (Rigid Pavements)	Reconstruction using Lime-Stabilized Subgrade
Ultrathin Bonded Wearing Course (Asphalt)	Full-Depth Patch (Rigid Pavements)	Reconstruction using PCC
HMA Overlay - Open Graded Friction Course	Partial-Depth Patch (Composite Pavements)	Reconstruction using Precast PCC Slabs
HMA Overlay - Ultrathin (<1.5")	Full-Depth Patch (Composite Pavements)	Reconstruction using Soil-Cement Base Course
HMA Overlay - Ultrathin (<1.5") (High Performance Thin Overlay)		Reconstruction using Roller Compacted Concrete
Grind and HMA Overlay - 64-22/28, w/ or w/o 8PV	Cross-Stitching	Reconstruction using Foamed Asphalt Base
	Dowel Bar Retrofit	Reconstruction using Lime Stabilized Base Course
	Undersealing/Slab Stabilization	Full-Depth Reclamation (FDR)

Now: Over 50 options!

Earlier example...Step #1

02 AA MD 170 110 3.092 2009-12-17



Flexible Pavement

15 years old

ADT = 22,000

IRI < 100

Crack Index > 75

Friction < 35

What is a good fix?



Right Fix: Step #1

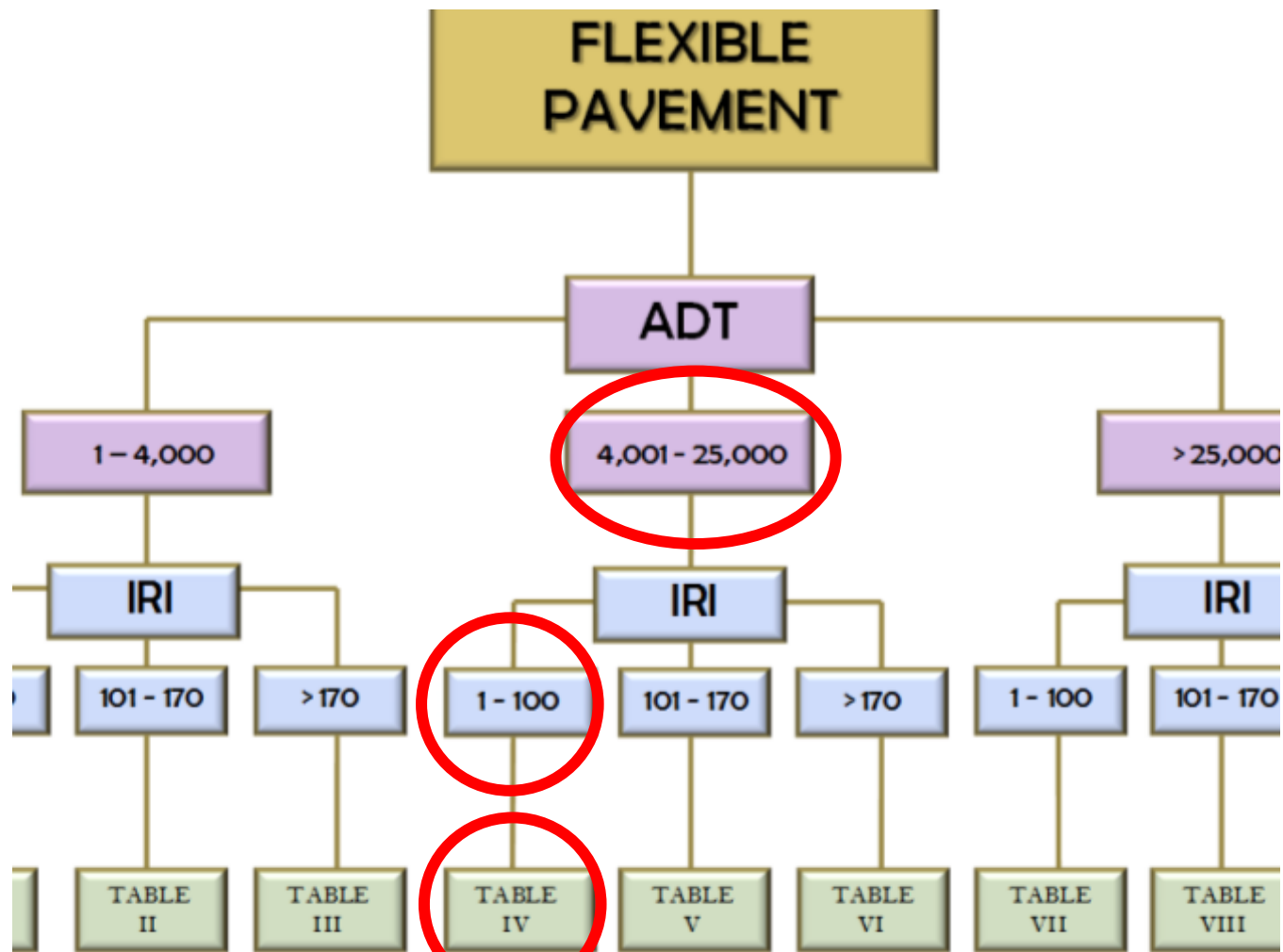


Figure 1 Decision Tree for Flexible Pavements



Right Fix: Step #1

Table IV				Pavement ADT				
CI	Friction	Cracking	Rutting (in.)	A. Crack/Joint Seals	B. Asphalt Sealers / Rejuvenators	C. Aggregate Seals	D. Ultrathin HMA	E. Overlay
76-100	>40	Load-Related	M	A-1, A-2	B-1, B-2	C-3, C-7, C-8		E-5, E-8, E-15
			H	A-1, A-2	B-1, B-2	C-3, C-7, C-8		E-5, E-8, E-15
		Non Load-Related	L	A-1, A-2	B-1, B-2	C-3, C-7		E-5
			M	A-1, A-2	B-1, B-2	C-3, C-7, C-8		E-5, E-8, E-15
			H	A-1, A-2	B-1, B-2	C-3, C-7, C-8		E-5, E-8, E-15
	≤ 40	Load-Related	L	A-1, A-2	B-1, B-2	C-3, C-7	D-1	E-5
			M	A-1, A-2	B-1, B-2	C-3, C-7, C-8	D-1	E-5, E-8, E-15
			H	A-1, A-2	B-1, B-2	C-3, C-7, C-8	D-1	E-5, E-8, E-15
		Non Load-Related	L	A-1, A-2	B-1, B-2	C-3, C-7	D-1	E-5
			M	A-1, A-2	B-1, B-2	C-3, C-7, C-8	D-1	E-5, E-8, E-15
H	A-1, A-2	B-1, B-2	C-3, C-7, C-8	D-1	E-5, E-8, E-15			

Note: See Table E for Treatment Activities



Right Fix: Step #1

Table IV				Treatment Type: Flexible Traffic: 4,001 - 25,000 IRI: 0 - 100						
CI	Friction	Cracking	Rutting (in.)	F. Patch	G. Joint Treatments	H. Grinding/ Grooving	I. Major (Heavy) Rehabilitation	J. Reconstruction	Do Nothing	
76-100	>40	Load-Related	L	F-1, F-2					X	
			M	F-1, F-2		H-1, H-2				
			H	F-1, F-2		H-1, H-2				
		Non Load-Related	L	F-1, F-2						X
			M	F-1, F-2		H-1, H-2				
			H	F-1, F-2		H-1, H-2				
	≤ 40	Load-Related	L	F-1, F-2			H-3			X
			M	F-1, F-2		H-1, H-2, H-3				
			H	F-1, F-2		H-1, H-2, H-3				
		Non Load-Related	L	F-1, F-2			H-3			X
			M	F-1, F-2		H-1, H-2, H-3				
			H	F-1, F-2		H-1, H-2, H-3				

Note: See Table E for Treatment Activity



Treatment Tables

Treatment Group	Treatment Number	Treatment
A. Crack/Joint Seals	A-1	Crack Filling
	A-2	Crack Sealing
	A-3	Joint Sealing (and Resealing)
	A-4	Saw and Seal
B. Asphalt Sealers / Rejuvenators	B-1	Asphalt Sealers
	B-2	Fog Seals / Rejuvenators
C. Aggregate Seals	C-1	Cape Seal
	C-2	Chip Seal (Modified)
	C-3	High Friction Surface
	C-4	Sand Seal
	C-5	Sandwich Seal
	C-6	Scrub Seal
	C-7	Slurry Seal
	C-8	Microsurfacing
D. Ultrathin HMA	D-1	Ultrathin Bonded Wearing Course (A



Right Fix: Step #1

Viabile Treatments:

- Crack Fill/Seal
- Asphalt Sealer
- Fog Seal/
Rejuvenator
- High Friction Surf.
- **Slurry Seal**
- **Micro-surface**
- Ultrathin Bonded Wearing Course
- Hot-in-place recycling
- HMA Overlay
- Bonded PCC Overlay
- Patch only
- Grind only



Right Fix: Step #1

12 viable treatments were identified.

How do we identify which one should be the final choice???



Right Fix: Step #2

Investigate project-level details:

- Project-level conditions,
- Geometrics,
- MOT restrictions,
- Contract/contractor considerations,
- Etc.



Right Fix: Step #2

Consider treatments:

- Advantages and disadvantages,
 - Time until open to traffic,
 - Expected cost,
 - Expected life extension
- These items available in Appendices A & B.



Right Fix: Step #2

Viable Treatments:

- Crack Fill/Seal
- Asphalt Sealer
- Fog Seal/
Rejuvenator
- High Friction Surf.
- **Slurry Seal**
- **Micro-surface**

Consider Further?

No - Doesn't help friction

No - Doesn't help friction

No - Doesn't help friction

No – for spot locations

Yes

Yes



Right Fix: Step #2

Viable Treatments:

Consider Further?

- Ultrathin Bonded Wearing Course
- Hot-in-place recycling
- HMA Overlay

Yes

Yes

Yes



Right Fix: Step #2

Viable Treatments:

- Bonded PCC Overlay
- Patch only
- Grind only

Consider Further?

No – Rutting not bad enough

No - Doesn't help friction

No – For short areas only



Right Fix: Step #3

Now down to **5** Viable

Treatments:

- ~~• Crack Fill/Seal~~
- ~~• Asphalt Sealer~~
- ~~• Fog Seal/
Rejuvenator~~
- ~~• High Friction Surf.~~
- **Slurry Seal**
- **Micro-surface**

- **Ultrathin Bonded
Wearing Course**

- **Hot-in-place
recycling**

- **HMA Overlay**

- ~~• Bonded PCC
Overlay~~

- ~~• Patch only~~

- **Grind only**

**Time for
Benefit/Cost
Analysis!**



Right Fix: Cost

Treatments:	Cost (\$/LM):
Slurry Seal	\$14k ✓
Micro-surface	\$20k
Ultrathin Bonded Wearing Course	\$80k
Hot-in-place recycling	\$30k
1.5" HMA Overlay	\$50k



Right Fix: Benefit

Treatments:	Benefit:
Slurry Seal	4 Years
Micro-surface	8 Years
Ultrathin Bonded Wearing Course	10 Years
Hot-in-place recycling	8 Years
1.5" HMA Overlay	12 Years ✓



Right Fix: Benefit/Cost

Treatments:	Benefit/Cost (\$/LMY):
Slurry Seal	\$3.5k
Micro-surface	\$2.5k ✓
Ultrathin Bonded Wearing Course	\$8k
Hot-in-place recycling	\$3.75k
1.5" HMA Overlay	\$4.2k



Right Fix: Step #3

Final Decision:

- Made by District, with input/support from Pavement Engineer.
- Pavement Engineer determines what treatment life will be.



Summary

There are **several** fixes (besides HMA overlay) that can work.

This Guide provide the tools to find the

Right Fix

for the **Right Road**

at the **Right Time**



Questions?

Geoff Hall, P.E.

Chief, Pavement & Geotechnical Division

Maryland State Highway Administration

443-572-5067

ghall1@sha.state.md.us

7450 Traffic Drive,

Hanover, MD 21076

