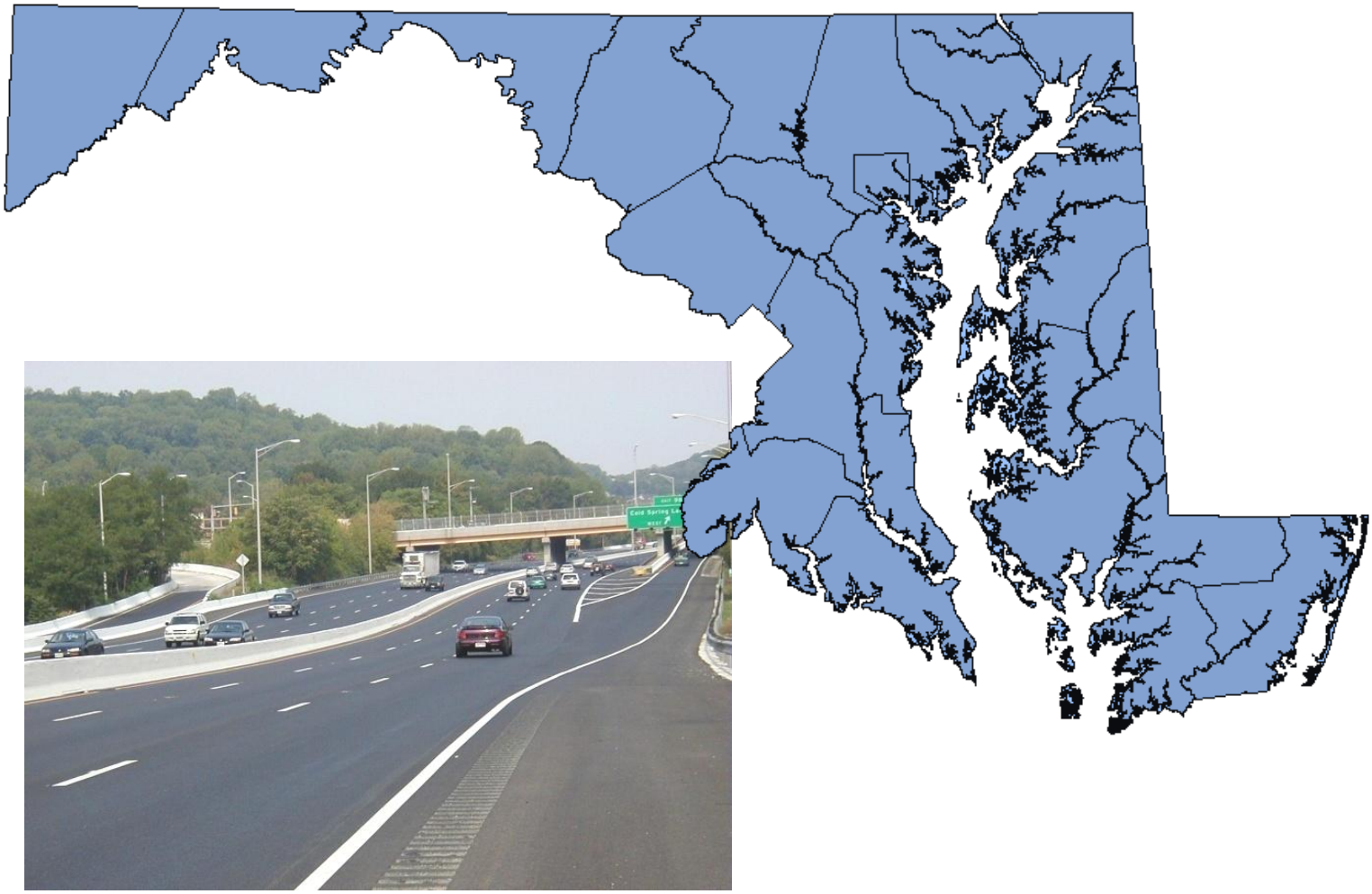
MDSHA Guide to Pavement Preservation

Maryland State Highway Administration



Prepared by the Pavement and Geotechnical Division of the Office of Materials Technology
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SHA State Highway Administration *Driven to Excel*
Maryland Department of Transportation

SHA MT

MDSHA Guide to Pavement Preservation

This agreement between the Maryland State Highway Administration (MDSHA) and the DelMar Division of the Federal Highway Administration (FHWA) is intended to implement the use of Federal-aid Highway Funding for Pavement Preservation activities on pavements selected under Fund 77 – System Preservation.

The criteria used to develop this agreement are based on the FHWA guidance issued by FHWA on September 12, 2005 (Pavement Preservation Definitions) and the Pavement Preservation Technical Appraisal issued for Maryland in May 2007 issued by the National Center for Pavement Preservation (NCPP) and FHWA.

This agreement is limited to Fund 77 activities on Roadways that are Federal-Aid eligible. It does not cover activities on Structures. Specific Fund 77 activities are listed in Table 5: Pavement Fixes, in the document "MDSHA Integrating Pavement Preservation into Fund 77 Guide".

By signing this agreement, MDSHA and the FHWA incorporate by reference the laws, regulations, policies, standards and procedures which govern or are applicable to Federal-Aid projects.

Nothing in this agreement shall be construed to relieve MDSHA from ultimate accountability for compliance with Federal Laws and regulations with respect to the expenditure of Federal-Aid highway funds for System Preservation activities in the State of Maryland, including those funds used for local government projects.

This agreement shall become effective on projects selected after acceptance of this Guide. This agreement may be cancelled or modified at any time by either MDSHA or the FHWA given 90 days notices.

Maryland State Highway Administration

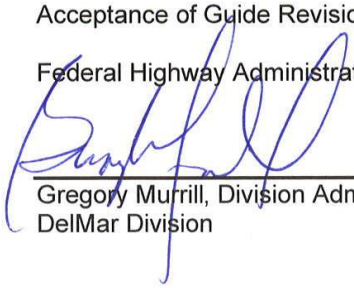
Signature on file	3-2-11
Gregory Welker, Deputy Administrator/ Chief Engineer for Operations	Date

Federal Highway Administration

Signature on file	5-5-11
Hassan Raza, Division Administrator DelMar Division	Date

Acceptance of Guide Revisions:

Federal Highway Administration



Gregory Murrill, Division Administrator
DelMar Division

11/26/12
Date

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Preface

Historically, the Maryland State Highway Administration (MDSHA) has relied almost exclusively upon rehabilitation strategies to maintain their pavement system. While rehabilitation is a valid strategy, it is not necessarily the most cost-effective strategy; quite often, the more cost-effective treatments to maintain the pavement system are pavement preservation and preventive maintenance treatments. However, there was virtually no documentation available within MDSHA on these. Now, pavement preservation is an important facet of maintaining MDSHA's roadways.

The purpose of this document is to provide general guidance on the selection of pavement rehabilitation, preservation and maintenance treatments. This guide is intended to be used by MDSHA pavement and geotechnical engineers and by District personnel (Project Development Teams, Maintenance and Construction Sections).

This guide will assist in determining "the right fix for the right road at the right time" when used in conjunction with network-level and project-specific data. Step-by-step instructions on determining treatment options are provided through the use of flow charts, decision trees and treatment tables. At the end of the step-by-step process there will be many treatment options available. One or a combination of treatment options may be selected, depending on project-specific conditions. It is not the intent of this guide to provide a final treatment option(s). This guide will provide a series of options for preliminary consideration by District Offices and the Office of Materials Technology (OMT). It is anticipated that further project specific review, analysis and design will be required. Therefore, the final treatment option(s) should be determined in coordination with the Pavement and Geotechnical Division (PAGD) of OMT.

The treatment options noted in this guide are comprised of alternate treatments, some of which have not been commonly practiced at MDSHA. Many of the treatments previously unfamiliar to MDSHA are being utilized by other State DOTs and both county and local agencies throughout the country. It is our goal to incorporate the use of these treatments in MDSHA projects using this guide as a tool to locate candidate projects. Currently, MDSHA does not have specifications for many of these treatments, and is in the process of updating/developing specifications for those treatments, addressing material, construction and quality assurance requirements.

In addition to the step-by-step instructions noted above, various treatment options are defined, along with information regarding treatment cost, advantages and disadvantages.

Any questions or comments concerning this guide should be directed to the individual below.

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Determining Pavement Type:

There are different types of pavement within the MDSHA roadway network. Pavement deterioration, and therefore, treatment options for those pavements are directly influenced by the composition of the pavement. The following table contains brief descriptions of those pavement types:

Table A – Pavement Types

Pavement Type	Description
Flexible*	Hot Mix Asphalt (HMA) over Aggregate, stone sub-base or soil borrow material.
Composite*	HMA over concrete pavement over aggregate, stone sub-base or soil borrow material.
Rigid	Concrete pavement (PCC) over aggregate, stone sub-base or soil borrow material.

* This pavement type may have a surface treatment such as slurry seal, chip seal, micro-surfacing.

Flexible and Composite (Asphalt-Surfaced) Pavements:

Users will need access to the following network-level information for Asphalt-Surfaced Pavements. This information will be used to determine a pool of appropriate treatments for a given project:

Table B – Initial Roadway Data for Asphalt-Surfaced Pavements

Information	Source
Pavement Type	PM Base system[1]
Average Daily Traffic (ADT)	Highway Location Reference (HLR)[2]
International Roughness Index (IRI)	PM Base system[1]
Functional Cracking Index (FCI)	PM Base system[1]
Structural Cracking Index (SCI)	PM Base system[1]
Skid	PM Base system[1]
Average Rutting (in.)	PM Base system[1]

1. http://170.93.42.173/omt/pmbase/query.asp
2. www.marylandroads.com/KeepingCurrent/performTrafficStudies/dataAndStats/hwyLocationRef/oppe/hlr.asp

Obtaining IRI, CI, Skid and Rutting (in.) Data:

Use the following criteria to determine the severity level for rutting:

Table C. Criteria for Rut Depth

Average Rutting	Severity
1/4" to < 1/2"	Low (L)
1/2" to 1"	Medium (M)
>1"	High (H)

Obtain the most recent year IRI, CI, Skid and Rutting data available from the PM Base system. Also, it is a good idea to review multiple years' worth of data to determine the trend of the roadway's performance and to ensure the most recent years' data is reasonable.

After obtaining the Pavement Type, ADT, and IRI, use Figure 1 to find the appropriate Treatment Table for asphalt-surfaced pavements.

If the pavement condition information is not available from the Pavement Management System (PMS), a field visit will be necessary to visually identify the presence of cracking/distress. Distresses should be categorized into "Load-Related" and/or "Non Load-Related" as listed in Table D below. Even if FCI and SCI is available in the PMS, A field visit should be performed to validate the information.

Table D. Cracking/Distress Categories

Load-Related (Structural)	Non Load-Related (Functional)
Alligator (Fatigue) Cracking	Bleeding
Depression	Block Cracking
Edge Cracking	Bumps and Sags
Longitudinal Cracking	Corrugation
Patching	Joint Reflective Cracking
Potholes	Lane/Shoulder Drop-off
	Polished Aggregate
	Slippage Cracking
	Transverse Cracking
	Weathering and Raveling

Note: Refer to the Asphalt Distress Paver Manual of the U.S. Army Corps of Engineers for definitions of distresses.

Use CI, Skid, Rutting (in.), in conjunction with cracking/distress category to determine viable Treatment Options. Each Treatment Table contains the Treatment Group and the Treatment number shown in parentheses. The Treatment Groups, Treatment numbers and the Treatments are listed in Table E. Refer to Appendix A for a definition of each Treatment.

One or a combination of Treatment Options may be selected, depending on project-specific conditions. The final Treatment Option(s) should be determined in coordination with the Pavement and Geotechnical Division (PAGD).

Once the final Treatment Option(s) is established, it will be necessary to develop contracts or use existing contracts for project implementation. Since it is not practical or desirable to have a contract for each treatment, Table E offers suggested grouping of treatments into various compatible Areawide contracts. There are some treatments, due to their more extensive scope of work, such as Heavy (Major) Rehabilitation and Reconstruction that are not compatible with Areawide contracts and would likely require Single Advertised contracts.

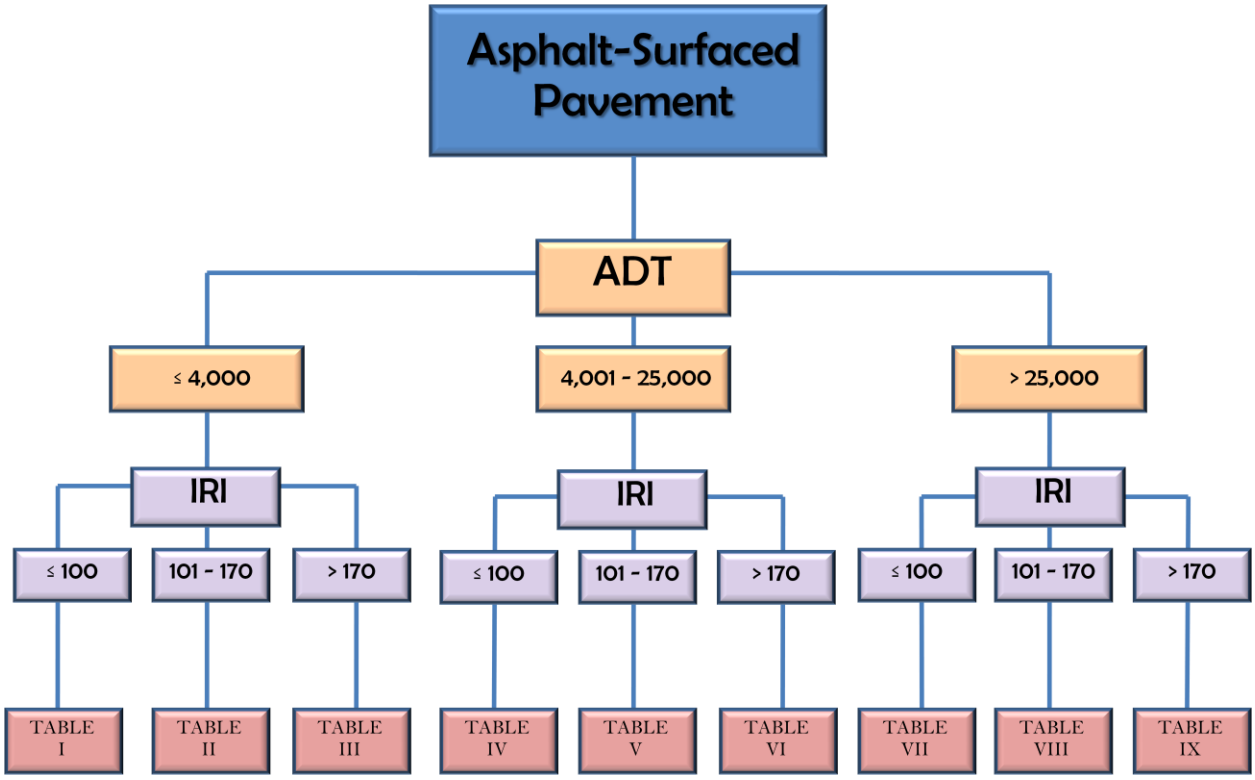

Figure 1 Decision Tree for Asphalt-Surfaced Pavements

Rigid (Concrete-Surfaced) Pavements:

A field visit is required to determine the percent patching required within the project limits for rigid pavements. Use Figure 2 to identify the appropriate Treatment Options.

The Treatment Groups, Treatment numbers and the Treatments are listed in Table E. Refer to Appendix A for a definition of each Treatment.

One or a combination of Treatment Options may be selected, depending on project-specific conditions. The final Treatment Option(s) should be determined in coordination with the PAGD.

Once the final Treatment Option(s) is established, it will be necessary to develop contracts or use existing contracts for project implementation. Since it is not practical or desirable to have a contract for each treatment, Table E offers suggested grouping of treatments into various compatible Areawide contracts. There are some treatments, due to their more extensive scope of work, such as Reconstruction that is not compatible with Areawide contracts and would likely require Single Advertised contracts.

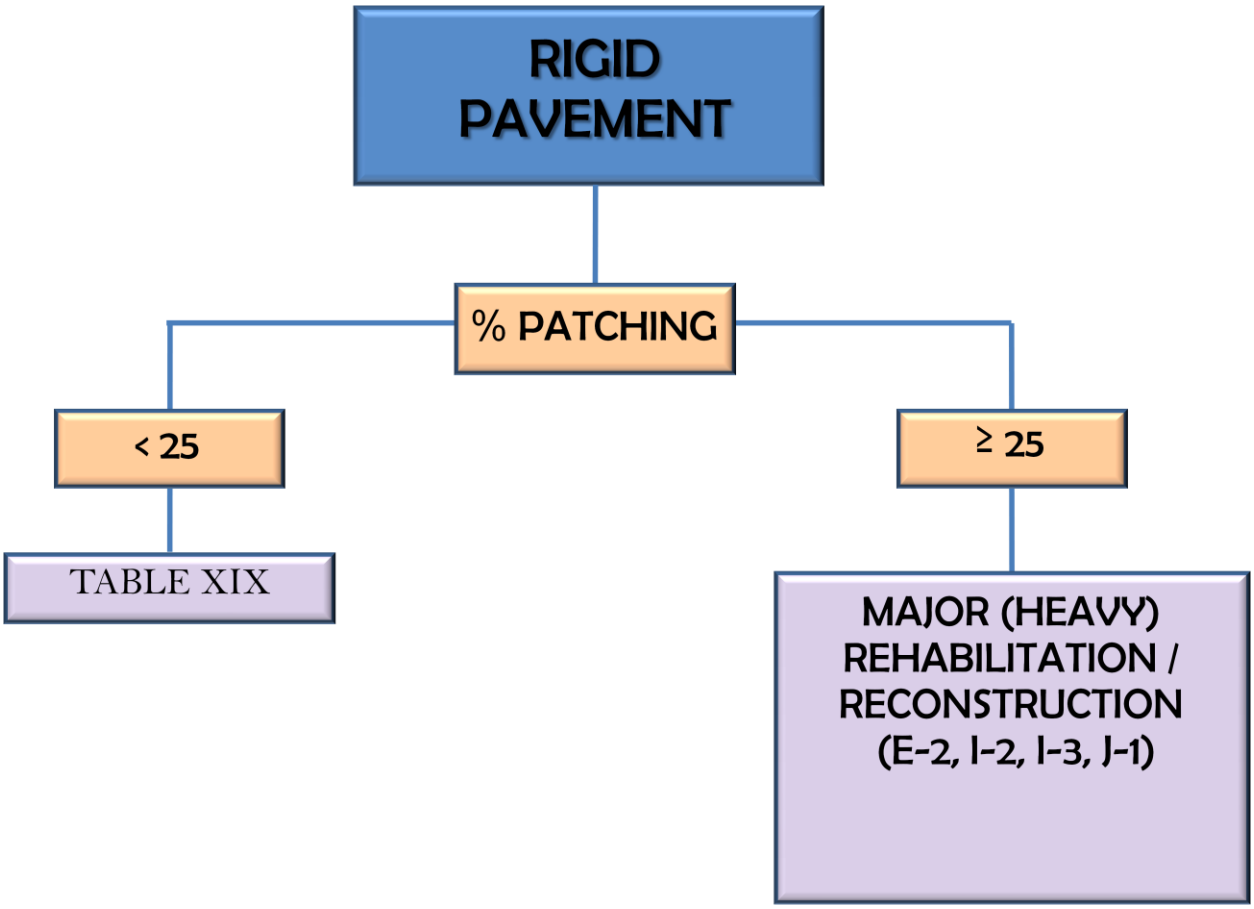

Figure 2 Decision Tree for Rigid Pavements

Table E. List of Treatment Options

Treatment Group	Treatment Number	Treatment	Compatible Contract
A. Crack/Joint Seals	A-1	Crack Fill & Crack Seal (Asphalt)	Crack and Joint Seals
	A-2	Crack Seal (PCC Surface)	Crack and Joint Seals
	A-3	Joint Sealing (and Resealing)	Crack and Joint Seals
	A-4	Saw and Seal	Crack and Joint Seals
B. Asphalt Sealers / Rejuvenators	B-1	Fog Seal	Asphalt Emulsion Seals
	B-2	Rejuvenators	Asphalt Emulsion Seals
C. Aggregate Seals	C-1	Cape Seal	Asphalt Emulsion Seals
	C-2	Chip Seal (Modified)	Asphalt Emulsion Seals
	C-3	High Friction Surface	High Friction Surface
	C-4	Sand Seal	Asphalt Emulsion Seals
	C-5	Sandwich Seal	Asphalt Emulsion Seals
	C-6	Scrub Seal	Asphalt Emulsion Seals
	C-7	Slurry Seal	Asphalt Emulsion Seals
	C-8	Micro-surfacing	Asphalt Emulsion Seals
D. HMA Overlay	D-1	Thin Overlay	Grind, Patch and Resurface
	D-2	Grind & Overlay	Grind, Patch and Resurface
	D-3	Overlay	Grind, Patch and Resurface
	D-4	Wedge/Level & Overlay	Grind, Patch and Resurface
	D-5	Hot-In-Place HMA Recycling (HIR)	Hot In-Place Recycling
E. PCC Overlay	E-1	PCC Overlay - Unbonded	Portland Cement Concrete Resurfacing
	E-2	PCC Overlay - Bonded	Portland Cement Concrete Resurfacing
F. Patch	F-1	HMA Patch	Grind, Patch and Resurface
	F-2	Partial-Depth Patch (Spall Repair) (Rigid Pavements)	Concrete Pavement Restoration
	F-3	Full-Depth Patch (Rigid Pavements)	Concrete Pavement Restoration
G. Joint Treatments	G-1	Cross-Stitching	Concrete Pavement Restoration
	G-2	Dowel Bar Retrofit	Concrete Pavement Restoration
	G-3	Undersealing/Slab Stabilization	Concrete Pavement Restoration
H. Surface Texturizing	H-1	HMA Diamond Grinding	Grind, Patch and Resurface
	H-2	PCC Diamond Grinding	Grind, Patch and Resurface
	H-3	Surface Carbide Grinding	Grind, Patch and Resurface
	H-4	Diamond Grooving	Grind, Patch and Resurface
	H-5	Surface Abrasion	Grind, Patch and Resurface
I. Major (Heavy) Rehabilitation	I-1	Cold-In-Place HMA Recycling (CIR)	Cold-In-Place Recycling
	I-2	Break/Crack & Seat and HMA Overlay	Single Advertised
	I-3	Rubbilization and HMA Overlay	Single Advertised
J. Reconstruction	J-1	Reconstruction	Single Advertised
	J-2	Full-Depth Reclamation (FDR)	Single Advertised

Table I				Pavement Type: Asphalt Surface ADT: 0 to ≤ 4,000 IRI: 0 to ≤ 100								
SCI	**FCI**	**Skid**	**Rutting (in.)**	**A. Crack/ Joint Seal**	**B. Asphalt Rejuvenator**	**C. Aggregate Seals**	**D. HMA Overlay**	**E. PCC Overlay**	**F. Patch**	**H. Surface Texturizing**	**I. Major Rehab**	**J. Reconstruction**
≤ 50	> 75	>40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
	≤ 75	>40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
51 to ≤ 75	> 75	>40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
		≤ 40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
	≤ 75	>40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
		≤ 40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
> 75	> 75	>40	< ½"	A-1	B-1, B-2	C-1 thru C-7	D1, D-3		F-1			
			½" to 1"	A-1	B-1, B-2	C-8	D-3, D-4		F-1	H-1		
			>1"	A-1	B-1, B-2		D-2, D-3, D-4		F-1	H-1		
		≤ 40	< ½"	A-1		C-1 thru C-7	D1, D-3		F-1	H-5		
			½" to 1"	A-1		C-8	D-3, D-4		F-1	H-1		
			>1"	A-1			D-2, D-3, D-4		F-1	H-1		
	≤ 75	>40	< ½"	A-1	B-1, B-2	C-1 thru C-7	D1, D-3					
			½" to 1"	A-1	B-1, B-2	C-8	D-3, D-4			H-1		
			>1"	A-1	B-1, B-2		D-2, D-3, D-4			H-1		
		≤ 40	< ½"	A-1		C-1 thru C-7	D1, D-3			H-5		
			½" to 1"	A-1		C-8	D-3, D-4			H-1		
			>1"	A-1			D-2, D-3, D-4			H-1		

Note: See Table E for Treatment Activities. *I-2 and I-3 apply to composite pavements only.

Table II				Pavement Type: Asphalt Surface ADT: 0 to ≤ 4,000 IRI: 101 to ≤ 170								
SCI	**FCI**	**Skid**	**Rutting (in.)**	**A. Crack/ Joint Seal**	**B. Asphalt Rejuvenator**	**C. Aggregate Seals**	**D. HMA Overlay**	**E. PCC Overlay**	**F. Patch**	**H. Surface Texturizing**	**I. Major Rehab**	**J. Reconstruction**
≤ 50	> 75	>40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
	≤ 75	>40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
51 to ≤ 75	> 75	>40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
		≤ 40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
	≤ 75	>40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
		≤ 40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
> 75	> 75	>40	< ½"			C-6, C-7, C-8	D1, D-3		F-1			
			½" to 1"			C-6, C-7, C-8	D-3, D-4		F-1	H-1		
			>1"			C-6, C-7, C-8	D-2, D-3, D-4		F-1	H-1		
		≤ 40	< ½"			C-3, C-6, C-7, C-8	D1, D-3		F-1	H-5		
			½" to 1"			C-3, C-6, C-7, C-8	D-3, D-4		F-1	H-1		
			>1"			C-3, C-6, C-7, C-8	D-2, D-3, D-4		F-1	H-1		
	≤ 75	>40	< ½"			C-6, C-7, C-8	D1, D-3					
			½" to 1"			C-6, C-7, C-8	D-3, D-4			H-1		
			>1"			C-6, C-7, C-8	D-2, D-3, D-4			H-1		
		≤ 40	< ½"			C-3, C-6, C-7, C-8	D1, D-3			H-5		
			½" to 1"			C-3, C-6, C-7, C-8	D-3, D-4			H-1		
			>1"			C-3, C-6, C-7, C-8	D-2, D-3, D-4			H-1		

Note: See Table E for Treatment Activities. *I-2 and I-3 apply to composite pavements only.

Table III				Pavement Type: Asphalt Surface ADT: 0 to ≤ 4,000 IRI: > 170								
SCI	**FCI**	**Skid**	**Rutting (in.)**	**A. Crack/ Joint Seal**	**B. Asphalt Rejuvenator**	**C. Aggregate Seals**	**D. HMA Overlay**	**E. PCC Overlay**	**F. Patch**	**H. Surface Texturizing**	**I. Major Rehab**	**J. Reconstruction**
≤ 50	> 75	>40	< ½"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
	≤ 75	>40	< ½"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
51 to ≤ 75	> 75	>40	< ½"				D-2, D-4				I-1	
			½" to 1"				D-2, D-4				I-1	
			>1"				D-2, D-4				I-1	
		≤ 40	< ½"				D-2, D-4				I-1	
			½" to 1"				D-2, D-4				I-1	
			>1"				D-2, D-4				I-1	
	≤ 75	>40	< ½"				D-2, D-4				I-1	
			½" to 1"				D-2, D-4				I-1	
			>1"				D-2, D-4				I-1	
		≤ 40	< ½"				D-2, D-4				I-1	
			½" to 1"				D-2, D-4				I-1	
			>1"				D-2, D-4				I-1	
> 75	> 75	>40	< ½"				D-2, D-4					
			½" to 1"				D-2, D-4			H-1		
			>1"				D-2, D-4			H-1		
		≤ 40	< ½"				D-2, D-4			H-5		
			½" to 1"				D-2, D-4			H-1		
			>1"				D-2, D-4			H-1		
	≤ 75	>40	< ½"				D-2, D-4					
			½" to 1"				D-2, D-4			H-1		
			>1"				D-2, D-4			H-1		
		≤ 40	< ½"				D-2, D-4			H-5		
			½" to 1"				D-2, D-4			H-1		
			>1"				D-2, D-4			H-1		

Note: See Table E for Treatment Activities. *I-2 and I-3 apply to composite pavements only.

Table IV				Pavement Type: Asphalt Surface ADT: 4,000 to ≤ 25,000 IRI: 0 to ≤ 100								
SCI	**FCI**	**Skid**	**Rutting (in.)**	**A. Crack/ Joint Seal**	**B. Asphalt Rejuvenator**	**C. Aggregate Seals**	**D. HMA Overlay**	**E. PCC Overlay**	**F. Patch**	**H. Surface Texturizing**	**I. Major Rehab**	**J. Reconstruction**
≤ 50	> 75	>40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
	≤ 75	>40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
51 to ≤ 75	> 75	>40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
		≤ 40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
	≤ 75	>40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
		≤ 40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
> 75	> 75	>40	< ½"	A-1	B-1, B-2	C-1, C-3, C-7	D1, D-3		F-1			
			½" to 1"	A-1	B-1, B-2	C-8	D-3, D-4		F-1	H-1		
			>1"	A-1	B-1, B-2		D-2, D-3, D-4		F-1	H-1		
		≤ 40	< ½"	A-1		C-1, C-3, C-7	D1, D-3		F-1	H-5		
			½" to 1"	A-1		C-8	D-3, D-4		F-1	H-1		
			>1"	A-1			D-2, D-3, D-4		F-1	H-1		
	≤ 75	>40	< ½"	A-1	B-1, B-2	C-1, C-3, C-7	D1, D-3					
			½" to 1"	A-1	B-1, B-2	C-8	D-3, D-4			H-1		
			>1"	A-1	B-1, B-2		D-2, D-3, D-4			H-1		
		≤ 40	< ½"	A-1		C-1, C-3, C-7	D1, D-3			H-5		
			½" to 1"	A-1		C-8	D-3, D-4			H-1		
			>1"	A-1			D-2, D-3, D-4			H-1		

Note: See Table E for Treatment Activities. *I-2 and I-3 apply to composite pavements only.

Table V				Pavement Type: Asphalt Surface ADT: 4,000 to ≤ 25,000 IRI: 101 to ≤ 170								
SCI	**FCI**	**Skid**	**Rutting (in.)**	**A. Crack/ Joint Seal**	**B. Asphalt Rejuvenator**	**C. Aggregate Seals**	**D. HMA Overlay**	**E. PCC Overlay**	**F. Patch**	**H. Surface Texturizing**	**I. Major Rehab**	**J. Reconstruction**
≤ 50	> 75	>40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
	≤ 75	>40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-3				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4				I-1, I-2*, I-3*	J-1, J-2
51 to ≤ 75	> 75	>40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
		≤ 40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
	≤ 75	>40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
		≤ 40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5				I-1	
> 75	> 75	>40	< ½"			C-7, C-8	D1, D-3		F-1			
			½" to 1"			C-7, C-8	D-3, D-4		F-1	H-1		
			>1"			C-7, C-8	D-2, D-3, D-4		F-1	H-1		
		≤ 40	< ½"			C-3, C-7, C-8	D1, D-3		F-1	H-5		
			½" to 1"			C-3, C-7, C-8	D-3, D-4		F-1	H-1		
			>1"			C-3, C-7, C-8	D-2, D-3, D-4		F-1	H-1		
	≤ 75	>40	< ½"			C-7, C-8	D1, D-3					
			½" to 1"			C-7, C-8	D-3, D-4			H-1		
			>1"			C-7, C-8	D-2, D-3, D-4			H-1		
		≤ 40	< ½"			C-3, C-7, C-8	D1, D-3			H-5		
			½" to 1"			C-3, C-7, C-8	D-3, D-4			H-1		
			>1"			C-3, C-7, C-8	D-2, D-3, D-4			H-1		

Note: See Table E for Treatment Activities. *I-2 and I-3 apply to composite pavements only.

Table VI

Pavement Type: Asphalt Surface
ADT: 4,000 to ≤ 25,000
IRI: > 170

SCI	FCI	Skid	Rutting (in.)	A. Crack/ Joint Seal	B. Asphalt Rejuvenator	C. Aggregate Seals	D. HMA Overlay	E. PCC Overlay	F. Patch	H. Surface Texturizing	I. Major Rehab	J. Reconstruction
≤ 50	> 75	>40	< ½"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
	≤ 75	>40	< ½"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-4				I-1, I-2*, I-3*	J-1, J-2
51 to ≤ 75	> 75	>40	< ½"				D-2, D-4				I-1	
			½" to 1"				D-2, D-4				I-1	
			>1"				D-2, D-4				I-1	
		≤ 40	< ½"				D-2, D-4				I-1	
			½" to 1"				D-2, D-4				I-1	
			>1"				D-2, D-4				I-1	
	≤ 75	>40	< ½"				D-2, D-4				I-1	
			½" to 1"				D-2, D-4				I-1	
			>1"				D-2, D-4				I-1	
		≤ 40	< ½"				D-2, D-4				I-1	
			½" to 1"				D-2, D-4				I-1	
			>1"				D-2, D-4				I-1	
> 75	> 75	>40	< ½"				D-2, D-4					
			½" to 1"				D-2, D-4			H-1		
			>1"				D-2, D-4			H-1		
		≤ 40	< ½"				D-2, D-4			H-5		
			½" to 1"				D-2, D-4			H-1		
			>1"				D-2, D-4			H-1		
	≤ 75	>40	< ½"				D-2, D-4					
			½" to 1"				D-2, D-4			H-1		
			>1"				D-2, D-4			H-1		
		≤ 40	< ½"				D-2, D-4			H-5		
			½" to 1"				D-2, D-4			H-1		
			>1"				D-2, D-4			H-1		

Note: See Table E for Treatment Activities. *I-2 and I-3 apply to composite pavements only.

Table VII

Pavement Type: Asphalt Surface
ADT: > 25,000
IRI: 0 to ≤ 100

SCI	FCI	Skid	Rutting (in.)	A. Crack/ Joint Seal	B. Asphalt Rejuvenator	C. Aggregate Seals	D. HMA Overlay	E. PCC Overlay	F. Patch	H. Surface Texturizing	I. Major Rehab	J. Reconstruction
≤ 50	> 75	>40	< ½"				D-3	E-1			I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-3	E-1			I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
	≤ 75	>40	< ½"				D-3	E-1			I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-3	E-1			I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
51 to ≤ 75	> 75	>40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5	E-2			I-1	
		≤ 40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5	E-2			I-1	
	≤ 75	>40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5	E-2			I-1	
		≤ 40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5	E-2			I-1	
> 75	> 75	>40	< ½"	A-1			D1, D-3		F-1			
			½" to 1"	A-1			D-3, D-4		F-1	H-1		
			>1"	A-1			D-2, D-3, D-4	E-2	F-1	H-1		
		≤ 40	< ½"	A-1			D1, D-3		F-1	H-5		
			½" to 1"	A-1			D-3, D-4		F-1	H-1		
			>1"	A-1			D-2, D-3, D-4	E-2	F-1	H-1		
	≤ 75	>40	< ½"	A-1			D1, D-3					
			½" to 1"	A-1			D-3, D-4			H-1		
			>1"	A-1			D-2, D-3, D-4	E-2		H-1		
		≤ 40	< ½"	A-1			D1, D-3			H-5		
			½" to 1"	A-1			D-3, D-4			H-1		
			>1"	A-1			D-2, D-3, D-4	E-2		H-1		

Note: See Table E for Treatment Activities. *I-2 and I-3 apply to composite pavements only.

Table VIII

Pavement Type: Asphalt Surface
ADT: > 25,000
IRI: 101 to ≤ 170

SCI	FCI	Skid	Rutting (in.)	A. Crack/ Joint Seal	B. Asphalt Rejuvenator	C. Aggregate Seals	D. HMA Overlay	E. PCC Overlay	F. Patch	H. Surface Texturizing	I. Major Rehab	J. Reconstruction
≤ 50	> 75	>40	< ½"				D-3	E-1			I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-3	E-1			I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
	≤ 75	>40	< ½"				D-3	E-1			I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-3	E-1			I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-3, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
51 to ≤ 75	> 75	>40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5	E-2			I-1	
		≤ 40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5	E-2			I-1	
	≤ 75	>40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5	E-2			I-1	
		≤ 40	< ½"				D-3, D-5				I-1	
			½" to 1"				D-3, D-4, D-5				I-1	
			>1"				D-2 thru D-5	E-2			I-1	
> 75	> 75	>40	< ½"			C-8	D1, D-3		F-1			
			½" to 1"			C-8	D-3, D-4		F-1	H-1		
			>1"			C-8	D-2, D-3, D-4	E-2	F-1	H-1		
		≤ 40	< ½"			C-3,C-8	D1, D-3		F-1	H-5		
			½" to 1"			C-3,C-8	D-3, D-4		F-1	H-1		
			>1"			C-3,C-8	D-2, D-3, D-4	E-2	F-1	H-1		
	≤ 75	>40	< ½"			C-8	D1, D-3					
			½" to 1"			C-8	D-3, D-4			H-1		
			>1"			C-8	D-2, D-3, D-4	E-2		H-1		
		≤ 40	< ½"			C-3,C-8	D1, D-3			H-5		
			½" to 1"			C-3,C-8	D-3, D-4			H-1		
			>1"			C-3,C-8	D-2, D-3, D-4	E-2		H-1		

Note: See Table E for Treatment Activities. *I-2 and I-3 apply to composite pavements only.

Table IX

Pavement Type: Asphalt Surface
ADT: > 25,000
IRI: > 170

SCI	FCI	Skid	Rutting (in.)	A. Crack/ Joint Seal	B. Asphalt Rejuvenator	C. Aggregate Seals	D. HMA Overlay	E. PCC Overlay	F. Patch	H. Surface Texturizing	I. Major Rehab	J. Reconstruction
≤ 50	> 75	>40	< ½"				D-2, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-2, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-2, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-2, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
	≤ 75	>40	< ½"				D-2, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-2, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
		≤ 40	< ½"				D-2, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			½" to 1"				D-2, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
			>1"				D-2, D-4	E-1			I-1, I-2*, I-3*	J-1, J-2
51 to ≤ 75	> 75	>40	< ½"				D-2, D-4				I-1	
			½" to 1"				D-2, D-4				I-1	
			>1"				D-2, D-4	E-2			I-1	
		≤ 40	< ½"				D-2, D-4				I-1	
			½" to 1"				D-2, D-4				I-1	
			>1"				D-2, D-4	E-2			I-1	
	≤ 75	>40	< ½"				D-2, D-4				I-1	
			½" to 1"				D-2, D-4				I-1	
			>1"				D-2, D-4	E-2			I-1	
		≤ 40	< ½"				D-2, D-4				I-1	
			½" to 1"				D-2, D-4				I-1	
			>1"				D-2, D-4	E-2			I-1	
> 75	> 75	>40	< ½"				D-2, D-4					
			½" to 1"				D-2, D-4			H-1		
			>1"				D-2, D-4	E-2		H-1		
		≤ 40	< ½"				D-2, D-4			H-5		
			½" to 1"				D-2, D-4			H-1		
			>1"				D-2, D-4	E-2		H-1		
	≤ 75	>40	< ½"				D-2, D-4					
			½" to 1"				D-2, D-4			H-1		
			>1"				D-2, D-4	E-2		H-1		
		≤ 40	< ½"				D-2, D-4			H-5		
			½" to 1"				D-2, D-4			H-1		
			>1"				D-2, D-4	E-2		H-1		

Note: See Table E for Treatment Activities. *I-2 and I-3 apply to composite pavements only.

Table X	Pavement Surface: Concrete Patching < 25%			
Structural Distress	**Cracking (≥ 5% of slabs)**	**Pumping (≥ 5% of slabs)**	**Joint/Crack Deterioration (including Faulting) (≥ 8% of slabs)**	**Punchouts (≥ 5/mile)**
Punchouts (≥ 5/mile)	Crack/Joint Seal (A-2, A-3) Patch (F-3) Joint Treatments (G-1, G-2)	Patch (F-3) Joint Treatments (G-2, G-3) Drainage Improvements	Crack/Joint Seal (A-2, A-3, A-4) HMA Overlay (D-3) PCC Overlay (E-1, E-2) Patch (F-2, F-3)	Patch (F-3)
Joint/Crack Deterioration (including Faulting) (≥ 8% of slabs)	Crack/Joint Seal (A-2, A-3, A-4) HMA Overlay (D-3) PCC Overlay (E-1, E-2) Patch (F-2, F-3) Joint Treatments (G-1, G-2, G-3)	Crack/Joint Seal (A-3, A-4) HMA Overlay (D-3) PCC Overlay (E-1, E-2) Patch (F-2, F-3) Joint Treatments (G-2, G-3) Drainage Improvements	Crack/Joint Seal (A-2, A-3, A-4) HMA Overlay (D-3) PCC Overlay (E-1, E-2) Patch (F-2, F-3) Joint Treatments (G-1, G-2, G-3)	
Pumping (≥ 5% of slabs)	Crack/Joint Seal (A-2, A-3) Patch (F-3) Joint Treatments (G-1, G-2, G-3) Drainage Improvements	Patch (F-3) Joint Treatments (G-2, G-3) Drainage Improvements		
Cracking (≥ 5% of slabs)	Crack/Joint Seal (A-2) Patch (F-2, F-3) Joint Treatments (G-1, G-2)			

Notes:

1. Refer to the Concrete Distress Paver Manual of the U.S. Army Corps of Engineers for definitions of distresses.
2. If functional distresses (scaling, popouts, shrinkage cracks, etc.) are present, consider Grind (H-2) or Surface Abrasion (H-5) .
3. If shallow durability problems such as "D" cracking, and Alkali Silica Reactivity (ASR) are present, consider Grind (H-2) and Overlay (D-3, E-2). It should be noted that this strategy does not address the systemic problems associated with "D" cracking and ASR, and are only temporary solutions to the durability problems. Coordinate with PAGD to determine a permanent solution.

Routine Maintenance for PCC Pavement with Sealed Joints, regardless of condition:
Drainage outlets should be inspected every 2 years and maintained as needed.

Years 10-12: Reseal joints.
Year 20: Reseal joints.

Year 25: If no treatments (aside from joint resealing) have yet been scheduled as a result of network-level condition assessments, this should be the time to make a project-level assessment as per Table X to determine treatment needs.

Year 25 and beyond: For the years of 25 and beyond, it is suggested that a project-level assessment be made as per Table X to determine treatment needs every 5 years.

Routine Maintenance for PCC Pavement with Unsealed Joints, regardless of condition:

The current design for concrete pavements in the State of Maryland specifies the following: Joints shall be single 1/8" saw-cut to a depth of 2" as per Section 520 of the Specifications and shall not be sealed. Unsealed joints require increased frequency of drainage outlet inspection and maintenance. Unsealed joints allow for the possibility of more water to enter the system; therefore, proper drainage must be maintained or base materials may become soft and erode, creating structural issues. A yearly inspection should be conducted without fail. Plugged drains should be cleared. If joint spalling develops due to the unsealed condition, provisions to seal the joints should be made as per Table X. The following maintenance schedule is recommended for all pavements with no joint seal.

Drainage outlets should be inspected every year and maintained as needed.

Year 25: If no treatments have yet been scheduled as a result of network-level condition assessments, this should be the time to make a project-level assessment as per Table X to determine treatment needs.

Year 25 and beyond: For the years of 25 and beyond, it is suggested that a project-level assessment be made as per Table X to determine treatment needs every 5 years.

Appendix A: Definitions

A. Crack / Joint Seals:

A-1: Crack Fill and Crack Seal (Asphalt-Surfaced pavements)

A-1a: Crack Fill is a process that consists of placing a generally bituminous material into "**non-working**" cracks to substantially reduce water infiltration and reinforce adjacent top-down cracks. Non-working cracks are cracks that have vertical or horizontal movement of less than 2.5mm (0.1"), and are typically diagonal or longitudinal cracks.

A-1b: Crack Seal is a process of placing higher-quality material into or on top of "**working**" cracks in order to reduce water infiltration into a pavement. Working cracks are cracks that have vertical or horizontal movement of at least 2.5mm (0.1"), and are typically transverse and reflective cracks.

In contrast with crack **filling**, crack **sealing** requires more crack preparation procedures and uses higher-quality sealant materials.

A-2: Crack Seal (Concrete-Surfaced pavements)

An operation involving thorough crack preparation and placement of high quality material into or over candidate cracks to significantly reduce moisture infiltration and to retard the rate of crack deterioration. Sealed candidates in the concrete pavements deteriorate less and contribute less to the deterioration of the pavements. Concrete cracks are typically sealed with thermosetting bituminous material.

A-3: Joint Sealing (and Resealing)

Sealing (and Resealing) transverse joints in concrete pavements is intended to minimize the infiltration of surface water into the underlying pavement structure and to prevent the intrusion of incompressibles into the joints. A range of materials from bitumen to silicone to neoprene is used in design configurations. Neoprene is rarely if ever used on resealing projects.

A-4: Saw and Seal

A method of controlling reflective cracking in HMA overlays that involves sawing joints in the new overlay exactly over the joints in the existing pavement.

B. Asphalt Sealers / Rejuvenators:

B-1: Fog Seal

Very light applications of a diluted asphalt emulsion (1 part emulsion + 1 part water) placed directly on the pavement surface with no aggregate. Typical application rates range from 0.05 to 0.1 gallon per square yard.

B-2: Rejuvenators

Specialized emulsions of maltenes (2 parts maltene + 1 part water) that are sprayed on an existing asphalt surface with the intent of softening the existing binder, enriching the oxidized pavement, thereby reducing thermal cracking and

inhibiting raveling. The emulsions used are typically mixtures of asphalt, polymer latex, and other additives, such as softening agents. An asphalt binder consists of maltenes and asphaltenes. Asphaltenes are unaffected by the environment. Maltenes are affected by the environment, and their loss causes brittleness in the asphalt leading to weathering/raveling. The function of fog seals/rejuvenators is to restore maltenes to the asphalt binder.

C. Aggregate Seals:

C-1: Cape Seal

A surface treatment that involves the application of a slurry seal or micro-surfacing to a newly constructed chip seal. Cape seals are used to provide a dense water proof surface with improved skid resistance and smoother ride.

C-2a: Chip Seal

Asphalt (commonly as emulsion) is applied directly to the pavement surface followed by the application of aggregate chips, which are then immediately rolled to embed chips. Application rates depend upon surface condition, aggregate gradation and maximum size. Chip seal can be applied in multiple layers (i.e., double chip seals). In addition, there are high-performance chip seals and modified chip seals in use. Use of stone obtained as a by-product from SMA is ideal, as it provides a uniform single-sized stone.

C-2b: Modified Chip Seal

When the asphalt emulsion is modified with a blend of ground tire or latex rubber or polymer modifiers to enhance the elasticity and adhesion characteristics, it is called a modified chip seal.

C-2c: High-performance Chip Seal

A synchronized continuous application of ultra fast polymer asphalt emulsion and single-size durable aggregate.

C-3: High Friction Surface

An ultrathin, uniformly graded friction improvement course bonded to existing pavement with epoxy. The aggregate material is typically calcined bauxite. The epoxy bonds well to both HMA and PCC surfaces. A variety of colors are available for traffic calming purposes. Significantly improves skid resistance. Typically used for spot treatments to address wet accident locations, tight curves, or heavy braking locations.

C-4: Sand Seal

A thin asphalt surface treatment constructed by spraying a non-diluted emulsion, spreading a thin layer of fine aggregate (i.e. sand), and rolling. Sand seals are typically 0.1” to 0.2” thick. The primary purpose of a sand seal is to increase surface friction; however, in some cases, sand seals are used to "lock" the aggregates in a chip seal.

C-5: Sandwich Seal

An application of a one-layer course of aggregate particles, followed by an application of an emulsion, followed by a second course of smaller aggregates to fill the voids. The term sandwich is derived from the fact that the asphalt

application is placed between the two layers of the aggregate. There is a possible placement of emulsion before the coarse aggregate.

C-6: Scrub Seal
A thin asphalt surface treatment constructed by spraying a polymer-modified emulsion onto an existing pavement, dragging a broom across the surface to scrub the emulsified asphalt into the surface cracks, immediately spreading a thin fine aggregate (i.e. sand or screenings) over the emulsified asphalt, dragging another broom over the surface to scrub the fine aggregate into the emulsion and the surface cracks, and rolling the surface with a pneumatic tire roller. Thicknesses generally range from 0.4" to 0.75".

C-7: Slurry Seal
Similar to micro-surfacing, slurry seals are mixtures of well-graded aggregate (fine sand and mineral filler) and asphalt emulsion spread over the entire pavement surface with either a squeegee or spreader box attached to the back of a truck. Slurry seals are effective in sealing low-severity surface cracks, waterproofing the pavement surface, and improving skid resistance at speeds below 30 mph. Thickness is generally < 0.4". They are not effective where the underlying pavement experiences vertical movement due to load. Placement requirements are fairly stringent and include limitations on temperature, traffic, and moisture.

C-8: Micro-surfacing (aka in MDSHA as Latex-Modified Slurry Seal)
Micro-surfacing is a mixture of polymer-modified asphalt emulsion, crushed dense graded aggregate, mineral filler, additives, and water. Micro-surfacing provides thin resurfacing of 10 to 20 mm (3/8" to ¾") to the pavement and returns traffic use in one hour under average conditions. Materials selection and mixture design make it possible for micro-surfacing to be applied in multiple applications and provide minor re-profiling. The product can fill wheel ruts up to 40 mm (1.5") in depth in one pass and produces high surface friction values. Micro-surfacing is suitable for use on limited access, high-speed highways as well as residential streets, arterials and roadways.

A double application of Micro-Surfacing may be recommended on older pavements that have become severely oxidized and have lost surface fines causing larger aggregate to be lost. An example would be on Open Graded Friction Courses.

A double coat of Micro-Surfacing should be used for filling minor rutting (Generally a Type III aggregate to fill the ruts followed by a Type II aggregate for the surface).

D. HMA Overlay:

D-1: Thin Overlay

D-1a: Ultrathin Bonded Wearing Course (Asphalt)
A gap-graded or open-graded ultra thin Hot-Mix specialized membrane for bonding using innovative equipment, over a thick polymer modified asphalt

emulsion membrane. Lift thickness ranges from 5/8” to 1”. Can be applied on asphalt and concrete pavement surfaces.

D-1b: HMA Overlay – Open Graded Friction Course
Open Graded Friction Course is a surface course with an aggregate gradation that provides an open void structure as compared with conventional dense graded asphalt concrete. Air void content typically ranges from 15-25%, resulting in a highly permeable mixture relative to conventional HMA, which is typically impermeable.

D-1c: HMA Overlay – Ultrathin (<1.5”)
Plant Mix Combinations of Asphalt Cement and Aggregate applied to pavement in thicknesses between 0.75" to 1.5". Dense graded, open graded, and stone matrix mixes are all used. Like all overlays, a tack coat is required before placement of the overlay. Polymer modification should be specified for binders in thin wearing surfaces. (0.75” or less).

D-1d: HMA Overlay – Ultrathin (<1.5”) (High Performance Thin Overlay)
Plant Mix Combinations of Asphalt Cement and Aggregate applied to pavement in thicknesses between 0.75" to 1.5". This typically includes a high percentage of polymer-modified binder, resulting in a more crack-resistant wearing course than a dense-graded mix.

D-2a: Grind and HMA Overlay
This activity is a combination of grinding the existing pavement surface up to 4” and overlaying with Hot-Mix Asphalt.

D-2b: Deep Grind and Thick Overlay
Removal of several layers of existing pavement, followed by placement of at least 4” HMA or PCC overlay. At least a portion of the base layer is left in place, and the subgrade is not disturbed. This is usually done in cases where the grade must be maintained or lowered and additional structure is needed, and the way to achieve that is to essentially substitute unbound aggregate with stronger HMA or PCC. This fix is considered a Major Rehabilitation.

D-3: HMA Overlay
This activity consists of resurfacing the existing pavement with Hot-Mix Asphalt.

D-4: Wedge/Level and HMA Overlay
This activity is a combination of placing a Wedge/level layer on the existing pavement surface and resurfacing with Hot-Mix Asphalt. Wedge/level is a layer of variable HMA thickness used for grade or cross-slope adjustments, as a structural layer, and to improve ride quality.

D-5: Hot In-Place HMA Recycling (HIR)
A process which consists of softening the existing asphalt surface with heat, mechanically removing the softened surface material (typically 1” to 2”), mixing the material with a recycling agent, adding virgin asphalt and aggregate to the material (if required), and then replacing the material on the pavement.

E. PCC Overlay:

E-1a: PCC Overlay – Unbonded (Asphalt pavements)

Unbonded overlays are basically new pavements constructed on an existing stable platform. It is a 4" - 11" PCC layer as applied on an existing flexible or composite pavement. It is generally unbonded, but may be partially bonded to the existing HMA to increase the load carrying capacity.

E-1b: PCC Overlay – Unbonded (PCC-Surfaced pavements)

Placement of a PCC overlay on a rigid pavement. Prior to placement of a PCC overlay, a bond breaker is placed to isolate the two PCC layers. The bond breaker is typically a 1"-2" HMA overlay directly on the old PCC pavement prior to the placement of the new PCC overlay. The bond breaker is designed to allow the two PCC layers to move independently and limit the amount of reflective cracking. Typical thickness ranges from 6" - 10". Thicknesses as low as 4" have been placed.

E-2: PCC Overlay – Bonded

Placement of a PCC overlay on a rigid/flexible pavement. Additional care and construction practices are taken to ensure a good bond between underlying pavement and new overlay. Typical thickness ranges from 2" - 5".

F. Patch:

F-1: HMA Patch

This consists of the removal of areas of unsound pavement material for a portion or the full thickness of the pavement material and replacement with HMA. The pavement thickness is defined as the thickness of all bound materials in the pavement structure, including HMA, PCC and any other asphalt or cement modified materials.

F-2: PCC Partial-Depth (Spall Repair)

Partial depth repairs are defined as the removal of small, shallow (less than 1/3 of the thickness of the concrete pavement) areas of deteriorated PCC that are then replaced with a suitable material. These repairs restore structural integrity and improve ride quality, thereby extending the service life of the pavements that have spalled or distressed joints.

F-3: PCC Full-Depth Repair

Full-Depth Repairs (FDR) are cast in-place PCC repairs that extend through the full thickness of the existing PCC slab. The technique involves the full-depth removal and replacement of a full or half lane width areas of an existing deteriorated PCC pavement. The minimum specified repair length is typically six feet. However, it may be more cost effective and reliable to replace a large area rather than placing a series of short repairs.

Note: HMA material shall not be used to patch concrete pavements.

G. Joint Treatments:

G-1: Cross-stitching

A **longitudinal** crack and joint repair technique that consists of grouting tie bars in holes drilled across non-working longitudinal cracks/joints at an angle to the pavement surface. Cross-stitching prevents horizontal and vertical crack movements.

G-2: Dowel Bar Retrofit

Placement of load transfer devices across joints or cracks in an existing jointed concrete pavement to restore load transfer at the joints. Poor load transfer can lead to pumping, faulting and corner breaks. Slots are cut, concrete removed, dowel bars inserted, backfill material filled, the surface finished, cured, and most often diamond ground.

G-3: Undersealing /Slab Stabilization

The pressure insertion of flowable material beneath the concrete slab to fill voids between the slab and the base, thereby reducing the deflections and consequently, deflection-related distresses such as pumping or faulting. It is most often performed at areas where pumping or loss of support occur, such as beneath transverse joints and deteriorated cracks. The voids being filled by this technique are generally less than 3mm (0.12") thick.

H. Surface Texturizing:

H-1: Diamond Grinding – Asphalt-Surfaced Pavements

The removal of a thin layer of HMA, generally about 1/16" to 0.25", from the surface of the pavement using special equipment outfitted with a series of closely spaced diamond saw blades.

H-2: Diamond Grinding – Concrete-Surfaced Pavements

It is the removal of a thin layer of concrete, generally about 3/16" to 0.25", from the surface of the pavement using special equipment outfitted with a series of closely spaced diamond saw blades.

H-3: Surface Carbide Grinding

Grinding an existing pavement with carbide tipped grinding teeth resulting in a pavement surface with a transverse pattern of 0.2” center to center of each strike area and with a difference of high and low of the matted surface not exceeding 1/16”. This is different from milling, which maintains a tolerance of ±1/8”.

H-4: Diamond Grooving

A surface restoration procedure which can be performed on both PCC and HMA pavements. This procedure involves the use of diamond saw blades, with a typical spacing of 3/4" on center, to cut parallel grooves into the pavement surface. It can be performed in both longitudinal and transverse directions. Diamond grooving should be applied to pavements with sound structural and functional characteristics. The purpose of diamond grooving is to improve wet weather pavement/tire interaction.

H-5: Surface Abrasion
A surface restoration procedure which involves abrading the surface by utilizing a high-impact method to shoot steel abrasive material onto the pavement, then collecting and recycling the steel material so that no cleanup is required. Surface abrasision significantly restores wet weather skid resistance.

I. Major (Heavy) Rehabilitation:

I-1: Cold In-Place HMA Recycling
A process in which a portion of an existing bituminous pavement is pulverized or milled, and then the reclaimed material is mixed with new emulsified or foamed neat 64-22 asphalt binder and, when needed, virgin aggregates, lime or cement. The binder used most often is emulsified asphalt with or without a softening agent. The resultant blend is placed as a base for a subsequent overlay or surface treatment.

I-2: Break/Crack & Seat and HMA Overlay
Placement of a HMA overlay on a jointed concrete pavement (JCP) that has been altered via break/crack and seat. The break/crack and seat method differs from rubblization in that a large percentage of the structural integrity of a rigid pavement remains following a break/crack and seat operation. The break/crack and seat operation involves breaking the existing slab in much shorter slabs followed by compaction of those smaller slabs to "seat" them. This operation is designed to limit the potential for reflective cracking while maintaining a majority of the structural capacity of the rigid pavement.

The Break and Seat technique is applied to Jointed **Reinforced** Concrete Pavements (JRCP), while Crack and Seat technique is applied to Jointed **Plain** Concrete Pavements (JPCP). Break and Seat involves breaking the concrete to pieces of 1 to 2 ft^2 in size, and Crack and Seal involves breaking the concrete to pieces of 1 to 3 ft^2 in size. For Break and Seat, the reinforcing steel must be ruptured, or the bond must be broken.

I-3: Rubbilization and HMA Overlay
Placement of an HMA overlay on a rigid pavement that has been structurally altered via rubblization. Rubblization involves breaking the PCC layer into smaller pieces of less than 6" in diameter. This effectively creates a cement treated aggregate base from the rigid pavement. Rubblization is generally completed to eliminate the potential for reflective cracking. Rubblization is generally completed on rigid pavements that are beyond their structural life, or are experiencing materials or construction problems that can not otherwise be addressed.

J. Reconstruction:

J-1: Reconstruction

Complete reconstruction of the existing pavement type with a flexible or rigid pavement design, choosing from a variety of subgrade and base types.

J-2: Full-Depth Reclamation (FDR)

Technique in which the full thickness of the asphalt pavement and a predetermined portion of the underlying material (base, subbase and/or subgrade) is uniformly pulverized and blended to provide an upgraded, homogeneous base material. FDR is performed on the roadway without the addition of heat, similar to CIR. Treatment depths vary depending on the thickness of the existing pavement structure, but generally range between 4" to 12". FDR consists of pulverization/reclamation of the existing pavement materials, adding more materials (when necessary), mixing, initial shaping of the resultant mix, compaction, final shaping or "tight blading", and application of a bituminous surface or wearing course.

Appendix B: Supplemental Treatment Information

Table B.1		SUPPLEMENTAL INFORMATION FOR TREATMENT A-1	
		A-1a. Crack Fill (Asphalt Surface)	**A-1b. Crack Seal (Asphalt Surface)**
This treatment is intended to improve:	**IRI**		
	FCI	**Yes**	**Yes**
	SCI		
	Rut		
	Skid		
	Aging	**Yes**	**Yes**
Treatment Advantages		1. Slows/ Reduces Moisture Damage 2. Slows/Reduces Cracking and Rutting 3. Performs well in all climatic conditions 4. Performance is not significantly affected by varying ADT or truck levels 5. Prevents incompressibles from entering cracks.	1. Slows/ Reduces Moisture Damage 2. Slows/Reduces Cracking and Rutting 3. Performs well in all climatic conditions 4. Performance is not significantly affected by varying ADT or truck levels 5. Prevents incompressibles from entering crack joints
Treatment Disadvantages		1. Adds no structural benefit. 2. Damages the aesthetic look of the pavement 3. May reduce friction if used extensively in wheel paths 4. Applicable only for non-working cracks	1. Requires more substantial crack preparation compared to crack filling. 2. Applicable only for "working" cracks. 3. May reduce friction if used extensively in wheel paths 4. Damages the aesthetic look of the pavement 5. Adds no structural benefit.
Cost Clarification	**Small Quantity Cost**	> $0.30 per linear feet per NHI > $2.50 per linear feet per MD Price Index	> $0.60 - $1.00 per linear feet per NHI
	Medium Quantity Cost	$0.30 per linear feet per NHI $2.50 per linear feet per MD Price Index	$0.60 - $1.00 per linear feet per NHI
	High Quantity Cost	$0.30 per linear feet per NHI $2.50 per linear feet per MD Price Index	$0.60 - $1.00 per linear feet per NHI
	Items Included	Minimal crack preparation, low-quality thermoplastic sealant materials	Crack preparation procedures, high-quality thermoplastc sealant materials
	Items Excluded	Marking Removal	Marking Removal
Typical Life Extension		2-4 years	2-10 years
MOT Considerations / Cure time		1. Traffic passing over a hot applied sealed or filled crack is usually not an issue. However, traffic control during the application of the treatment should be in effect long enough to allow for adequate curing of the product and prevent tracking. 2. Hot applied rubber modified sealants, especially asphalt rubber, have excellent adhesion and do not require the application of a thin sand coating prior to trafficking. Emulsions must be sand coated prior to being trafficked.	1. Traffic passing over a hot applied sealed or filled crack is usually not an issue. However, traffic control during the application of the treatment should be in effect long enough to allow for adequate curing of the product and prevent tracking. 2. Hot applied rubber modified sealants, especially asphalt rubber, have excellent adhesion and do not require the application of a thin sand coating prior to trafficking. Emulsions must be sand coated prior to being trafficked.

Table B.2		SUPPLEMENTAL INFORMATION FOR TREATMENTS A-2, A-3	
		A-2. Crack Seal (Concrete Surface)	**A-3. Joint Sealing (and Resealing)**
This treatment is intended to improve:	**IRI**		
	FCI	**Yes**	**Yes**
	SCI		
	Rut		
	Skid		
	Aging	**Yes**	**Yes**
Treatment Advantages		1. Reduces or delays moisture damage, further crack deterioration and roughness. 2. Performance is not significantly affected by varying ADT or truck levels	1. Helps keep moisture and incompressibles out of the joints resulting in less cracking, pumping, spalling and faulting.
Treatment Disadvantages		1. Roughness may increase as a result of the sealing process. 2. Transverse cracking should not be sealed in CRCP.	1. Before joints can be sealed, joints must be cleaned to remove incompressible materials such as saw-cut swarf, soil, sand, or gravel. Cleaning can be accomplished by water or air blasting. 2. Performance is mostly dependent on preparation. 3. Poured joint sealants do not adhere to the pavement when the joint face is not clean, the shape is not correct, or the face is too moist when the sealant is placed. 4. Hot-poured liquid sealant does not adhere because of overheating or under heating. 5. Backer rod may trap moisture if installed improperly or not maintained.
Cost Clarification	**Small Quantity Cost**	$1.50 - $2.00 / LF for hot-pour rubberized materials.	$1.00 - $1.50 / LF for poured asphalt sealant, $2.00 - $2.50 / LF for silicone sealant.
	Medium Quantity Cost	$0.75 - $1.25 / LF for hot-pour rubberized materials.	$0.75 - $1.25 / LF for poured asphalt sealant, $2.00 - $2.25 / LF for silicone sealant.
	High Quantity Cost	$0.75 - $1.25 / LF for hot-pour rubberized materials.	$0.75 - $1.25 / LF for poured asphalt sealant, $1 - $2 / LF for silicone sealant.
	Items Included	Crack refacing, cleaning, backer rod installation and application of sealant.	Routing, sealant removal, joint refacing, reservoir cleaning, backer rod installation and sealant installation.
	Items Excluded		Marking Removal
Typical Life Extension		2-10 years	6-8 years for hot-poured asphalt sealant, approximately 8 years for silicone sealant, 3-5 years for asphalt rubber sealant.
MOT Considerations / Cure time		1. Traffic passing over a hot applied sealed or filled crack is usually not an issue. However, traffic control during the application of the treatment should be in effect long enough to allow for adequate curing of the product and prevent tracking. 2. Hot applied rubber modified sealants, especially asphalt rubber, have excellent adhesion and do not require the application of a thin sand coating prior to trafficking. Emulsions must be sand coated prior to being trafficked.	1. Traffic passing over a hot applied sealed or filled joint is usually not an issue. However, traffic control during the application of the treatment should be in effect long enough to allow for adequate curing of the product and prevent tracking. 2. Hot applied rubber modified sealants, especially asphalt rubber, have excellent adhesion and do not require the application of a thin sand coating prior to trafficking. Emulsions must be sand coated prior to being trafficked.

Table B.3		SUPPLEMENTAL INFORMATION FOR TREATMENT A-4 A-4. Saw and Seal
This treatment is intended to improve:	IRI	
	FCI	Yes
	SCI	
	Rut	
	Skid	
	Aging	Yes
Treatment Advantages		1. Prevents joint reflective cracking and spalling. 2. Provides maintainable joints. 3. Relatively inexpensive compared to other joint reflective crack mitigation techniques such as Reflective Crack Relief Interlayer (RCRI).
Treatment Disadvantages		1. It is crucial to saw-cut at the location of the PCC joints to achieve the desired performance. 2. It is difficult to identify the location of joints after the placement of the asphalt overlay
Cost Clarification	Small Quantity Cost	$1.25 - $1.50 / LF
	Medium Quantity Cost	
	High Quantity Cost	
	Items Included	Saw and Seal, Joint Filling, and all preparation work.
	Items Excluded	HMA Overlay Cost
Typical Life Extension		Depends on the thickness of the overlay placed.
MOT Considerations / Cure time		See "A-1. Crack Filling" and "A-3. Joint Sealing (and Resealing)" for cure times

Table B.4		SUPPLEMENTAL INFORMATION FOR TREATMENTS B-1, B-2	
		B-1. Fog Seal	**B-2. Rejuvenators**
This treatment is intended to improve:	**IRI**		
	FCI	**Yes**	**Yes**
	SCI		
	Rut		
	Skid		
	Aging	**Yes**	**Yes**
Treatment Advantages		1. Performs well in all climatic conditions 2. Inexpensive treatment 3. Improves sealing or waterproofing 4. Facilitates aggregate retention in chip seal applications or weathered/raveled pavements	1. Slows/reduces raveling and roughness and may slow rate of thermal cracking 2. Used in some surface recycling process. 3. Improves flexibility of asphalt binder. 4. Good for treating existing rumble strips
Treatment Disadvantages		1. Increased ADT or truck levels can increase surface wear, particularly when studded tires are used. 2. Typically, a slow setting emulsion is used which requires time to "break". Hence, the pavement is sometimes closed for several hours for curing before being re-opened to traffic. 3. Can have a negative impact on friction and stripping	1. Allow time for adequate surface friction to be restored. 2. May not be appropriate for rubberized asphalt concrete or polymer modified mixes. 3. Not appropriate for pavements with inadequate friction
Cost Clarification	**Small Quantity Cost**	$0.06 - $0.36 / SY	$0.15 - $0.65 / SY
	Medium Quantity Cost	$0.06 - $0.36 / SY	$0.15 - $0.65 / SY
	High Quantity Cost	$0.06 - $0.36 / SY	$0.15 - $0.65 / SY
	Items Included	See Defintion	See Definition
	Items Excluded	Marking Removal	Marking Removal
Typical Life Extension		1-4 years	3-5 years
MOT Considerations / Cure time		At least two hours and until acceptable skid test values are achieved.	At least two hours and until acceptable skid test values are achieved.

Table B.5		SUPPLEMENTAL INFORMATION FOR TREATMENTS C-1, C-2	
		C-1. Cape Seal	**C-2. Chip Seal (Modified)**
This treatment is intended to improve:	**IRI**	**Yes**	
	FCI	**Yes**	**Yes**
	SCI		
	Rut		
	Skid	**Yes**	**Yes**
	Aging	**Yes**	**Yes**
Treatment Advantages		1. Low cost 2. Flexibility of Chip Seal 3. Smoothness of Slurry Seal	1. Low cost 2. Reduced overspray 3. Improves friction
Treatment Disadvantages		1. Cannot be opened to traffic until several hours after the operations are complete.	1. Cannot be opened to traffic several hours after the operations are complete. 2. Aggregate chips cracking windshields 3. Potential snow plow problems 4. Not bicycle compatible
Cost Clarification	**Small Quantity Cost**	Approx. $5 / SY	Single Chip Seal: $0.80 - $1.75 / SY Double Chip Seal: $1.20 to $2.50 / SY
	Medium Quantity Cost		
	High Quantity Cost		
	Items Included	Chip Seal, Micro-surfacing	See Definition
	Items Excluded	Marking Removal	Marking Removal
Typical Life Extension		2-5 years	4-6 years for Single, 5-7 years for Double
MOT Considerations / Cure time		Cure time contingent on placement of chip seal followed by slurry seal/micro-surfacing. Refer to chip seal, slurry seal and micro-surfacing for individual cure times.	Cure time generally varies from 1 to 4 hours before sweeping to dislodge loose aggregate

Table B.6		SUPPLEMENTAL INFORMATION FOR TREATMENTS C-3, C-4	
		C-3. High Friction Surface	**C-4.Sand Seal**
This treatment is intended to improve:	**IRI**		
	FCI		**Yes**
	SCI		
	Rut		
	Skid	**Yes**	**Yes**
	Aging		**Yes**
Treatment Advantages		1. Results in extremely high skid numbers. 2. Compatible with closed sections because it is extremely thin (about 1/4") 3. Available in several colors for traffic calming purposes. 4. Can be applied to asphalt or concrete surfaces.	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.
Treatment Disadvantages		1. Cures about an hour after epoxy is poured, so aggregate needs to be placed immediately, to facilitate appropriate bond. 2. Expensive, because it is an emerging technology. Costs may come down with increased usage. 3. Some colors will wear in the wheel paths.	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 F 4. To ensure good bond, existing pavement must be clean and dry.
Cost Clarification	**Small Quantity Cost**	$25 - $40 / SY	$0.33 to $0.66/SY
	Medium Quantity Cost		$0.33 to $0.66/SY
	High Quantity Cost		$0.33 to $0.66/SY
	Items Included	Epoxy, aggregate and placement	See Description
	Items Excluded	MOT, Marking Removal	Marking Removal
Typical Life Extension		Anticipated to be 10-15 years	3-4 years
MOT Considerations / Cure time		Cure time is generally 1 hour after placement.	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.

Table B.7		SUPPLEMENTAL INFORMATION FOR TREATMENTS C-5, C-6	
		C-5.Sandwich Seal	**C-6.Scrub Seal**
This treatment is intended to improve:	**IRI**		
	FCI	**Yes**	**Yes**
	SCI		
	Rut		
	Skid	**Yes**	**Yes**
	Aging	**Yes**	**Yes**
Treatment Advantages		1. Unlike the double chip seal, only one application of emulsion is required. 2. Same service life as the double chip seal 3. Provides a smoother surface than chip seal	1. Prevents/delays moisture damage. 2. Rejuvenates hardened/oxidized asphalt. 3. Improves poor friction. 4. Reduces the severity of cracking, raveling and possibly roughness and rutting.
Treatment Disadvantages		1. Clean aggregate required. 2. Aggregate chips may crack windshields. 3. Must be placed on structurally sound pavements.	1. Can accelerate the development of stripping. 2. Limited to lower volume traffic conditions (AADT < 1,500) with a low percentage of trucks, and roadway grades flatter than 8%. 3. May be susceptible to snow plow damage. 4. Must be placed on a clean dry surface at a temperature of at least 50 deg F. 5. Must be placed on structurally sound pavements.
Cost Clarification	**Small Quantity Cost**	$1 - $2 / SY	$0.50 - $2.15 /SY
	Medium Quantity Cost		$0.50 - $2.15 /SY
	High Quantity Cost		$0.50 - $2.15 /SY
	Items Included	See Definition	Unknown
	Items Excluded	Marking Removal	Unknown
Typical Life Extension		5-7 years	2-6 years
MOT Considerations / Cure time		Cure time generally varies from 1 to 4 hours before sweeping to dislodge loose aggregate	Controlled traffic may be permitted as soon as the final layer is applied and rolled, and sufficiently cooled to withstand traffic without damage.

Table B.8		SUPPLEMENTAL INFORMATION FOR TREATMENTS C-7, C-8	
		C-7. Slurry Seal	**C-8. Micro-surfacing**
This treatment is intended to improve:	**IRI**		
	FCI	**Yes**	**Yes**
	SCI		
	Rut		**Yes**
	Skid	**Yes**	**Yes**
	Aging	**Yes**	**Yes**
Treatment Advantages		1. Prevents/delays oxidation of the pavement surface. 2. Seals the pavement surface. 3. Temporarily seals small cracks and surface imperfections, waterproof the surface, and protects the pavement structure of both asphalt and concrete pavements. 4. Should be used on projects with sound and well drained bases, surfaces, and shoulders.	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.
Treatment Disadvantages		1. Can accelerate the development of stripping. 2. Performance in terms of surface wear is affected by increasing ADT and truck levels. 3. Potential to add splash/spray and ponding (if there are surface irregularities) 4. Must be placed on structurally sound pavements.	1. Can accelerate the development of stripping. 2. It will not prevent working cracks from penetrating through the pavement surface. 3. Placement in cool weather may lead to early raveling. 4. Requires special equipment for placement. 5. Must be placed on structurally sound pavements. Crack sealing and patching are highly recommended.
Cost Clarification	**Small Quantity Cost**	$ 0.75 - $2.60 /SY	$1.25 - $3/SY
	Medium Quantity Cost	$ 0.75 - $2.60 /SY	$1.25 - $3/SY
	High Quantity Cost	$ 0.75 - $2.60 /SY	$1.25 - $3/SY
	Items Included	See Definition	See Definition
	Items Excluded	Marking Removal	Marking Removal
Typical Life Extension		3-6 years	4-10 years
MOT Considerations / Cure time		Cure time depends on emulsion properties, generally a few hours. Two hours as per MD Standard Specifications. Require warm temperatures and direct sunlight to break and cure effectively.	Cure time depends on emulsion properties, generally a few hours. One hour as per MD Standard Specifications

Table B.9		SUPPLEMENTAL INFORMATION FOR TREATMENTS D-1a, D-1b	
		D-1a. Ultra-Thin Bonded Wearing Course	**D-1b. Open Graded Friction Course (OGFC)**
This treatment is intended to improve:	**IRI**	**Yes**	**Yes**
	FCI	**Yes**	**Yes**
	SCI		
	Rut		
	Skid	**Yes**	**Yes**
	Aging		
Treatment Advantages		1. A very good bond due to the heavy tack coat. 2. Can be used on projects where there are grade restrictions 3. Eliminates the need for utility adjustment. 4. Minimal traffic disruption, requires a single lane closure. 5. Noise Reduction. 6. Increases driver visibility due to reduction in splash/spray. 7. Less Fumes	1. Reduces splash and spray 2. Increases skid resistance 3. Reduce tire noise
Treatment Disadvantages		1. Costly 2. Handwork is necessary sometimes. 3. Must be placed at temperatures above 50 deg F	1. Need a wedge/level or grade adjustments before placement of OGFC. 2. Cannot be used on unstable pavements, which includes pavements with substantial cracking, bleeding, rutting and depressions. 3. Do not use in snow or icy areas where tire chains, studded tires or snow plows will affect the aggregate and binder which will result in stripping of the aggregate, contribute to raveling and pavement deterioration. 4. Fails Rapidly once failure is eminent. 5. Should not be used in areas where there are severe turning movements. 6. Should not be placed adjacent to curb and gutter because of the bath tub effect 7. Do not use in muddy areas 8. Should NOT be used in fuel or oil spill areas. 9. Resulting surface drainage impacts must be considered 10. To maintain permeability, regular cleaning should be done.
Cost Clarification	**Small Quantity Cost**	$9 - $14 / SY	$20 / SY
	Medium Quantity Cost		
	High Quantity Cost		
	Items Included	Cost is for one-pass only.	See Definition
	Items Excluded	Multiple Passes	Marking Removal
Typical Life Extension		6-12 years	4-6 years

Table B.10		SUPPLEMENTAL INFORMATION FOR TREATMENTS D-1c, D-1d	
		D-1c. HMA Overlay - Ultrathin (<1.5")	**D-1d. HMA Overlay - Ultrathin (<1.5") (High Performance Thin Overlay)**
This treatment is intended to improve:	**IRI**	**Yes**	**Yes**
	FCI	**Yes**	**Yes**
	SCI		
	Rut	**Yes**	**Yes**
	Skid		
	Aging		
Treatment Advantages		1. Improves skid, ride, minor rutting, minor surface defects, bleeding and reduces raveling. 2. Slows / reduces cracking and moisture damage. 3. Performs well in all climatic conditions. 4. No traffic restrictions.	1. Longer lasting than typical ultrathin asphalt mixes. 2. Higher asphalt content results in better crack resistance. 3. More appropriate for projects with joint reflective cracking.
Treatment Disadvantages		1. Negatively affects stripping 2. Does not correct structural distresses. 3. Needs to be compacted more rapidly than a conventional HMA mix.	1. Higher Asphalt Content results in higher costs.
Cost Clarification	**Small Quantity Cost**	$1.25 to $2.90 per square yard	Anticipated to be similar to Gap-Graded SMA prices.
	Medium Quantity Cost		
	High Quantity Cost		
	Items Included	See Definition	Unknown
	Items Excluded	Marking Removal	Marking Removal
Typical Life Extension		5-10 years	8-15 years

Table B.11		SUPPLEMENTAL INFORMATION FOR TREATMENTS D-2a, D-2b	
		D-2a. Grind and HMA Overlay	**D-2b. Deep Grind and Thick Overlay**
This treatment is intended to improve:	**IRI**	**Yes**	**Yes**
	FCI	**Yes**	**Yes**
	SCI		**Yes**
	Rut	**Yes**	**Yes**
	Skid	**Yes**	**Yes**
	Aging		
Treatment Advantages		1. Removes surface distresses 2. Facilitates better bonding of the new overlay with the existing overlay. 3. Improves skid. 4. PCI (post-grinding) can be significantly higher. 5. Restores functional and structural service lives. 6. No specialized skill necessary.	1. Subgrade is not disturbed, resulting in no E&S or other SWM requirements. 2. Allows for a lower profile grade when required, while maintaining adequate pavement structure. 3. Cheaper than reconstruction.
Treatment Disadvantages		1. Reduced Structural Capacity reduces design life, overlay needs to be placed ASAP. 2. Rough Ride and loose debris if open to traffic, overlay needs to be placed ASAP. 3. Costlier compared to just overlay or wedge/level 4. Potential for debonding / separation with the existing surface. 5. May be more expensive than a preventive or a reactive maintenance technique.	1. Less aggregate base available for drainage. 2. Existing "Top of Subgrade" elevation can be difficult to define if variable subbase and bound pavement thicknesses exist.
Cost Clarification	**Small Quantity Cost**	Cost of Grinding: $5.7 / S.Y Cost of Overlay: <1000 tons: $125	Use current prices for 10" of Class I excavation and 6" of HMA or PCC resurfacing.
	Medium Quantity Cost	Cost of Grinding: $2.4 / SY Cost of Overlay: >1000 and <5000 tons: $75	
	High Quantity Cost	Cost of Grinding: $1.5 / SY Cost of Overlay: >5000 tons: $70	
	Items Included	Material costs, including hauling and equipment	Materials and Construciton
	Items Excluded	Unknown	MOT, Markings, Barriers
Typical Life Extension		8-20 years	8-25 years

Table B.12		SUPPLEMENTAL INFORMATION FOR TREATMENTS D-3, D-4	
		D-3. HMA Overlay	**D-4. Wedge/Level and HMA Overlay**
This treatment is intended to improve:	**IRI**	**Yes**	**Yes**
	FCI	**Yes**	**Yes**
	SCI	**Yes**	**Yes**
	Rut		**Yes**
	Skid	**Yes**	**Yes**
	Aging		
Treatment Advantages		1. Restores functional and structural service lives. 2. No specialized skill necessary. 3. Restores skid 4. Adds structure to pavement.	1. Alternative to grinding, while providing minor structural improvements. 2. Provides a smooth pre-overlay surface. 3. Restores functional and structural service lives. 4. No specialized skill necessary.
Treatment Disadvantages		1. Potential for de-bonding / separation with the existing surface. 2. May be more expensive than a preventive or a reactive maintenance technique.	1. May increase profile grade. 2. Potential for de-bonding / separation with the existing surface. 3. May be more expensive than a preventive or a reactive maintenance technique.
Cost Clarification	**Small Quantity Cost**	Cost of Overlay: <1000 tons: $125	Cost of Wedge/Level: $130 / ton Cost of Overlay: <1000 tons: $125
	Medium Quantity Cost	Cost of Overlay: >1000 and <5000 tons: $75	Cost of Wedge/Level: $80 / ton Cost of Overlay: >1000 and <5000 tons: $75
	High Quantity Cost	Cost of Overlay: >5000 tons: $70	Cost of Wedge/Level: $75 / ton Cost of Overlay: >5000 tons: $70
	Items Included	Material costs, including hauling and equipment	Material costs, including hauling and equipment
	Items Excluded	Unknown	Unknown
Typical Life Extension		8-25 years	8-25 years

Table B.13		SUPPLEMENTAL INFORMATION FOR TREATMENT D-5 D-5. Hot In-Place Recycling (HIR)
This treatment is intended to improve:	IRI	Yes
	FCI	Yes
	SCI	
	Rut	Yes
	Skid	
	Aging	
Treatment Advantages		1. Can be done on-site 2. Reduced Material Costs 3. Less Waste
Treatment Disadvantages		1. Not recommended for heavily oxidized material 2. Requires good surface materials 3. Limited to 3" in depth 4. Requires Specialized Equipment 5. Crack sealant should be removed to reduce risk of fires or blue smoke
Cost Clarification	Small Quantity Cost	$.75/SY - $3.25/SY. Cost depends on whether the material is re-mixed, re-paved, or heater scarified.
	Medium Quantity Cost	
	High Quantity Cost	
	Items Included	See Definition
	Items Excluded	Unknown
Typical Life Extension		4-15 years

Table B.14		SUPPLEMENTAL INFORMATION FOR TREATMENTS E-1a, E-1b	
		E-1a. PCC Overlay – Unbonded (HMA Surface)	**E-1b. PCC Overlay – Unbonded (PCC Surface)**
This treatment is intended to improve:	**IRI**	**Yes**	**Yes**
	FCI	**Yes**	**Yes**
	SCI	**Yes**	**Yes**
	Rut	**Yes**	**Yes**
	Skid	**Yes**	**Yes**
	Aging		
Treatment Advantages		1. Reduces urban heat island effect by increasing the pavement surface albedo 2. No excavation or removal required. 3. Equivalent to a new pavement. 4. Improves surface friction, noise and rideability. 5. Increases load-carrying capacity	1. A shorter joint spacing will reduce the curling and warping stresses. 2. It is not crucial to match or mismatch overlay joints with the underlying joints. 3. No excavation or removal required. 4. Equivalent to a new pavement. 5. Improves surface friction, noise and rideability.
Treatment Disadvantages		1. Milling of existing asphalt may be required to eliminate surface distortions of 2" or more. 2. If less than 6" of asphalt remains after milling, 6" or greater unbonded overlay (or a thinner bonded overlay) should be considered. 3. Full-depth repairs should be considered to restore structural integrity in isolated areas 4. Has a typically short joint sawing window. 5. If the surface temperature of existing asphalt is greater than 120 deg F, surface watering must be performed prior to the placement of overlay, to help reduce the temperature and minimize the chance of early-age cracking. 6. May increase profile grade.	1. Faulting of more than 0.38" in the existing concrete pavement can be a concern. 2. Full-depth repairs should be considered to restore structural integrity in isolated areas. 3. Has a typically short joint sawing window. 4. Concrete patches may require a bond breaker.
Cost Clarification	**Small Quantity Cost**	Anticipated to be the same as a regular PCC surface (around $45-$65/SY, depending on volume and thickness).	Anticipated to be the same as a regular PCC surface (around $45-$65/SY, depending on volume and thickness).
	Medium Quantity Cost		
	High Quantity Cost		
	Items Included	All items included with conventional PCC paving	All items included with conventional PCC paving
	Items Excluded	MOT, Bond Breaker	MOT, Bond Breaker
Typical Life Extension		15-30+ years	15-30+ years

Table B.15		SUPPLEMENTAL INFORMATION FOR TREATMENT E-2 E-2. PCC Overlay – Bonded
This treatment is intended to improve:	IRI	Yes
	FCI	Yes
	SCI	Yes
	Rut	Yes
	Skid	Yes
	Aging	
Treatment Advantages		1. Addresses surface-related distresses. 2. Effective in areas where there are restrictions on vertical clearance, flood zones and grades. 3. Increases load-carrying capacity.
Treatment Disadvantages		1. Application of curing compound or other curing methods must be timely and thorough, especially at the edges. 2. Caution should be used with conventional AASHTO design procedures. 3. Working cracks should be repaired prior to performing this activity, or matched in the overlay. 4. Must be applied to pavements in good structural condition. 5. Transverse joints must be cut full depth plus ½".
Cost Clarification	Small Quantity Cost	$20-$40/SY depending on volume and thickness
	Medium Quantity Cost	
	High Quantity Cost	
	Items Included	Surface preparation, concrete placement, jointing, texturing and curing
	Items Excluded	MOT
Typical Life Extension		15-30+ years

Table B.16		SUPPLEMENTAL INFORMATION FOR TREATMENT F-1 F-1. HMA Patch
This treatment is intended to improve:	IRI	
	FCI	
	SCI	Yes
	Rut	
	Skid	
	Aging	
Treatment Advantages		1. Common knowledge. 2. No specialized equipment or contractors are required. 3. Readily available.
Treatment Disadvantages		1. MOT can be an issue.
Cost Clarification	Small Quantity Cost	<500 SY: $110 <500 tons: $170
	Medium Quantity Cost	>500 and <2000 SY: $70 >500 and <1500 tons: $150
	High Quantity Cost	>2000 SY: $50 >1500 tons: $150
	Items Included	Material, Placement and Hauling, Removal of existing material.
	Items Excluded	MOT Costs
Typical Life Extension		2-8 years

Table B.17		SUPPLEMENTAL INFORMATION FOR TREATMENTS F-2, F-3	
		F-2. PCC Partial-Depth Patch (Spall Repair)	**F-3. PCC Full-Depth Patch**
This treatment is intended to improve:	**IRI**		
	FCI		
	SCI	**Yes**	**Yes**
	Rut		
	Skid		
	Aging		
Treatment Advantages		1. Longer service life compared to asphalt patch 2. Corrects joint spalling and surface distresses 3. Can be cost-effective compared to minimum size full-depth repair for individual spalls.	1. Longer service life compared to asphalt patch 2. Effective in correcting most ~~all~~ slab distresses.
Treatment Disadvantages		1. Expensive 2. Curing time required 3. MOT can be an issue.	1. Expensive compared to temporary repair. 2. Curing time required 3. MOT can be an issue.
Cost Clarification	**Small Quantity Cost**	<100 SY: $ 450	<500 SY: $ 280
	Medium Quantity Cost	>100 and <500 SY: $400	>500 and <1500 SY: $245
	High Quantity Cost	>500 SY: $350	>1500 SY: $220
	Items Included	Removal, preparing the repair boundaries, material, curing, finishing, texturizing.	Removal of the existing slab, subgrade and base preparation as needed, preparing the repair boundaries, material, curing, finishing, texturizing.
	Items Excluded	Unknown	May not include Load Transfer Provisions unless needed
Typical Life Extension		5-15 years	>10 years

Table B.18		SUPPLEMENTAL INFORMATION FOR TREATMENTS G-1, G-2	
		G-1. Cross-Stitching	**G-2. Dowel Bar Retrofit**
This treatment is intended to improve:	**IRI**		**Yes**
	FCI	**Yes**	
	SCI	**Yes**	
	Rut		
	Skid		
	Aging		
Treatment Advantages		1. Strengthening and tying longitudinal cracks in slabs to prevent slab migration and to maintain aggregate interlock. 2. Mitigating the issue of tie-bars being omitted from longitudinal contraction joints (due to construction error) 3. Tying roadway lanes or shoulders that are separating or causing maintenance problems. 4. Tying centerline longitudinal joints that are starting to fault.	1. Can be used in all climatic regions 2. Relatively low life-cycle cost.
Treatment Disadvantages		1. Potential damage to concrete during drilling. Care must be taken.	1. Labor Intensive 2. Usually requires Diamond Grinding for smooth surface.
Cost Clarification	**Small Quantity Cost**	$11 - $17 / bar	$50 per dowel.
	Medium Quantity Cost		$35 per dowel.
	High Quantity Cost		$25 per dowel.
	Items Included	Drilling of holes, epoxy grout insertion, bar insertion, final grouting and crack sealing if called for.	Slot creation and material removal, sand blasting and cleaning, caulking the joint crack, dowel bar placement, repair material placement, and may include diamond grinding and joint sealing.
	Items Excluded	MOT	MOT
Typical Life Extension		10-15 years	9-10 years (depending on the type of bar being used). However, 7-33 years of pavement life extension have been observed.

Table B.19		SUPPLEMENTAL INFORMATION FOR TREATMENT G-3 G-3. Undersealing / Slab Stabilization
This treatment is intended to improve:	IRI	Yes
	FCI	
	SCI	
	Rut	
	Skid	
	Aging	
Treatment Advantages		See Definition
Treatment Disadvantages		1. Overfilling voids may lead to worse problems than leaving them unfilled. Slab lift must be closely monitored to avoid damaging the slabs.
Cost Clarification	Small Quantity Cost	Cement Fly-Ash Grout Undersealing: $0.90 - $1 / SY Asphalt Undersealing: $0.45 - 0.50 / SY Comment: This is usually bid by the ton. Costs vary widely. These numbers are low.
	Medium Quantity Cost	
	High Quantity Cost	
	Items Included	1. Cost depends on the material used, the extent and size of the voids and the size of the project. 2. Drilling Injection holes, injection of material and plugging holes.
	Items Excluded	1. FWD testing to detect voids. 2. MOT
Typical Life Extension		Extremely variable performance

Table B.20		SUPPLEMENTAL INFORMATION FOR TREATMENTS H-1, H-2	
		H-1. Diamond Grinding – Asphalt Surface	**H-2. Diamond Grinding – Concrete Surface**
This treatment is intended to improve:	**IRI**	**Yes**	**Yes**
	FCI		
	SCI		
	Rut	**Yes**	
	Skid	**Yes**	**Yes**
	Aging		
Treatment Advantages		1. Improves friction	1. Reduces noise 2. Improves friction 3. Cost effective 4. Eliminates the need for taper which is required with overlay alternatives. 5. Removal of permanent slab warping at joints. 6. Improvement of transverse slope to improve surface drainage.
Treatment Disadvantages		1. Increases noise. 2. Diamond blades can get clogged during operation.	1. Less desirable to use on softer aggregate 2. Faulting of the pavement joints will mostly reoccur if the load transfer is deficient. 3. Reduces pavement thickness which could affect fatigue performance. 4. Not recommended for pavement thickness less than 9", because of insufficient structural capacity to support heavy vehicle loadings. 5. Not to be used for "D" cracking, reactive aggregate, freeze-thaw damage.
Cost Clarification	**Small Quantity Cost**	$1.70 - $6.70 / SY	$4 - $8 / SY
	Medium Quantity Cost		
	High Quantity Cost		
	Items Included	Unknown	All labor, equipment and materials necessary to complete the work, including hauling and disposal of grinding residue.
	Items Excluded	Unknown	MOT
Typical Life Extension		2-5 years	10-20 years

Table B.21		SUPPLEMENTAL INFORMATION FOR TREATMENTS H-3, H-4	
		H-3. Surface Carbide Grinding	**H-4. Diamond Grooving**
This treatment is intended to improve:	**IRI**		
	FCI		
	SCI		
	Rut		
	Skid	**Yes**	**Yes**
	Aging		
Treatment Advantages		1. Remove surface distresses 2. Facilitates better bonding of the new overlay with the existing overlay. 3. This technique can be used independently to improve friction. 4. PCI (post-grinding) can be significantly higher.	1. Provides surface with excellent braking traction, therefore reducing wet weather accidents.
Treatment Disadvantages		1. Reduced structural capacity reduces design life, overlay needs to be placed ASAP. 2. Rough ride and loose debris if open to traffic, overlay needs to be placed ASAP. 3. Costlier compared to just overlay or wedge/level	1. Limitation of Longitudinal grooving is the "wiggle" (small lateral movement) that small vehicles and motorcycles may encounter. This may be mitigated by limiting the groove spacing to 3/4" and using 0.125" wide grooves.
Cost Clarification	**Small Quantity Cost**	$5.7 / SY	$1.25 - $3 / SY in 1998
	Medium Quantity Cost	$2.4 / SY	
	High Quantity Cost	$1.5 / SY	
	Items Included	See Definition	Unknown
	Items Excluded	See Definition	Unknown
Typical Life Extension		N/A	Information on performance is not readily available; however, treatment lives are expected to be greater than the 10-20 years noted for diamond grinding.

Table B.22		SUPPLEMENTAL INFORMATION FOR TREATMENT H-5 H-5. Surface Abrasion
This treatment is intended to improve:	IRI	
	FCI	
	SCI	
	Rut	
	Skid	Yes
	Aging	
Treatment Advantages		1. Significantly improves skid resistance 2. Can open to traffic immediately after treatment 3. No new materials required 4. “Green" - less energy
Treatment Disadvantages		1. Requires specialized equipment
Cost Clarification	Small Quantity Cost	$1 / SY
	Medium Quantity Cost	
	High Quantity Cost	
	Items Included	Unknown
	Items Excluded	Unknown
Typical Life Extension		8-15 years

Table B.23		SUPPLEMENTAL INFORMATION FOR TREATMENT I-1 I-1. Cold-in-Place HMA Recycling
This treatment is intended to improve:	IRI	Yes
	FCI	Yes
	SCI	Yes
	Rut	Yes
	Skid	Yes
	Aging	
Treatment Advantages		1. Can be done on-site 2. Reduced material costs 3. Less waste 4. Excavation and placement concurrent 5. "Green" - less energy (ambient placement) 6. "Green" - uses all recycled material 7. No "Cure" time if using Foamed Asphalt.
Treatment Disadvantages		1. Requires specialized equipment 2. Lengthy cure time during construction if using emulsified asphalt - MOT problem 3. Requires resurfacing 4. Requires 10-14 days cure before placing an HMA overlay
Cost Clarification	Small Quantity Cost	$4 / SY
	Medium Quantity Cost	$3 / SY
	High Quantity Cost	$1.7 / SY
	Items Included	See Definition
	Items Excluded	HMA Surface
Typical Life Extension		15-25 years

Table B.24		SUPPLEMENTAL INFORMATION FOR TREATMENTS I-2, I-3	
		I-2. Break/Crack & Seat and HMA Overlay	**I-3. Rubbilization and HMA Overlay**
This treatment is intended to improve:	**IRI**	**Yes**	**Yes**
	FCI	**Yes**	**Yes**
	SCI	**Yes**	**Yes**
	Rut		
	Skid		
	Aging		
Treatment Advantages		1. Significant (12-15 years) achieved. 2. Limits the potential for reflective cracking while maintaining the majority of the structural capacity of the rigid pavement.	1. No excavation Cost 2. Recycling the existing PCC. 3. Cost-effective alternative. 4. Reduces potential for Joint Reflective Cracking.
Treatment Disadvantages		1. Removal of any pre-existing AC overlay is required. 2. May result in grade increase.	1. Results in grade increase 2. Environmental Issues (Dust and Noise) 3. A minimum subgrade strength of 7,500 psi is required. 4. Need to perform subgrade strength tests like GPR.
Cost Clarification	**Small Quantity Cost**	No information	$ 4.50 per SY (2001) (See MD 404 CO323)
	Medium Quantity Cost		
	High Quantity Cost		
	Items Included	Break and Seat	PCC Rubbilization including HMA removal prior to rubbilization
	Items Excluded	HMA Overlay	See Definition
Typical Life Extension		15-25 years	15-25 years

Table B.25		SUPPLEMENTAL INFORMATION FOR TREATMENTS J-1, J-2	
		J-1. Reconstruction	**J-2. Full-Depth Reclamation (FDR)**
This treatment is intended to improve:	**IRI**	**Yes**	**Yes**
	FCI	**Yes**	**Yes**
	SCI	**Yes**	**Yes**
	Rut	**Yes**	**Yes**
	Skid		
	Aging		
Treatment Advantages		1. Significant structural improvement achieved. 2. Reduces potential to rut. 3. Relatively lower maintenance requirements. 4. Our most durable pavement option 5. Longer design life	1. Conservation of non-renewable resources 2. Energy conservation compared to other reconstruction methods 3. Few pieces of equipment are required 4. Elimination of bumps, dips, rutting, potholes, patches and cracks 5. Subgrade deficiencies can be corrected by stabilization.
Treatment Disadvantages		1. Noise 2. Expensive future rehab 3. MOT	1. Project may result in variable conditions if existing HMA and Base thickness vary significantly. 2. MOT will be required for both stabilization and overlay. MOT is significantly higher if emulsion is used as a stabilization agent (1-2 weeks), and up to 1-2 days if foamed asphalt is used as a stabilization agent.
Cost Clarification	**Small Quantity Cost**	$70 / SY	$3.50 to 4.50 per SY
	Medium Quantity Cost		
	High Quantity Cost		
	Items Included	Unknown	Excavation and mixing, placement of all materials
	Items Excluded	Unknown	MOT, Markings and Resurfacing
Typical Life Extension		25 years	12-20 years

Appendix C – List of Acronyms

ASR	Alkali Silica Reactivity	HMA	Hot-Mix Asphalt
ADT	Average Daily Traffic	IRI	International Roughness Index
CSAB	Cement Stabilized Aggregate Base	JPCP	Jointed Plain Concrete Pavement
CIR	Cold In-Place Recycling	JRCP	Jointed Reinforced Concrete Pavement
CRCP	Continuously Reinforced Concrete Pavement	LKD	Lime Kiln Dust
CI	Cracking Index	MOT	Maintenance of Traffic
DOT	Department of Transportation	MDSHA	Maryland State Highway Administration
FCI	Functional Cracking Index	OMT	Office of Materials Technology
FWD	Falling Weight Deflectometer	OGFC	Open Graded Friction Course
FDR	Full-Depth Reclamation	PAGD	Pavement and Geotechnical Division
GAP - SMA	Gap Graded Stone Matrix Asphalt	PM Base	Pavement Management Database
GAB	Graded Aggregate Base	PCC	Portland Cement Concrete
GPR	Ground Penetrating Radar	RCC	Roller Compacted Concrete
HPV (8PV)	High Polish Value	SCI	Structural Cracking Index
HLR	Highway Location Reference	W/L	Wedge and Level
HIR	Hot In-Place Recycling		

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