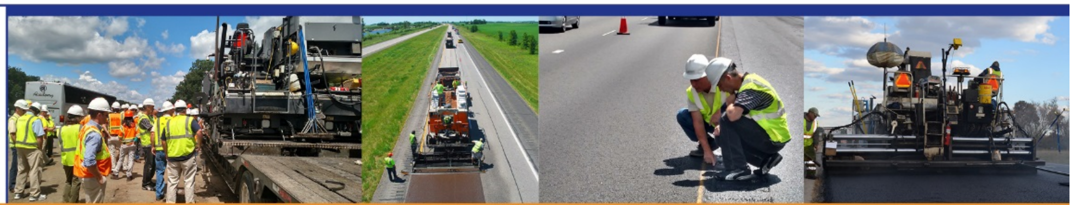
SHRP2 SOLUTIONS
STRATEGIC HIGHWAY RESEARCH PROGRAM



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Case Study from the Rhode Island Department of Transportation

Guidelines for the Preservation of High-Traffic-Volume Roadways (R26)

Background

Stretching the time between major rehabilitation projects can save transportation agencies money, reduce congestion, and improve safety. For years, transportation agencies have successfully extended the life of lower-volume roadways by applying pavement preservation strategies. Achieving the same results on high-traffic roadways requires employing a systematic approach that considers a variety of road conditions and proper timing of treatments to control risk and reduce traffic impacts.

Since 2011, 14 state highway agencies have partnered with the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO) to implement the concepts of *Guidelines for the Preservation of High-Traffic-Volume Roadways* (R26 or the *Guidelines*) through the Implementation Assistance Program (IAP). The **Rhode Island Department of Transportation (RIDOT)** is an IAP Lead Adopter state.

Using the *Guidelines* produced during the second Strategic Highway Research Program (SHRP2) research phase, in 2014 RIDOT began testing four different processes in four different settings around the state. This case study highlights RIDOT's previous experience with pavement preservation, discusses its approach to implementing the *Guidelines*, and documents the lessons learned from the process to further the practice of pavement preservation on high volume roads.

What are the *Guidelines*?

Many conventional preservation techniques—and some new ones—can be used to extend the life of high-traffic roadways without major reconstruction and traffic disruption.

Guidelines for the Preservation of High-Traffic-Volume Roadways (R26) were developed through the second Strategic Highway Research Program (SHRP2). The *Guidelines* offer the technical background and decision-making framework needed to bring preservation strategies widely into play for high-traffic roads.

The *Guidelines* are the first systematic and comprehensive resources designed to expand the use of pavement preservation on high-traffic roads. The guidance is based on the findings from a comprehensive survey of 40 state highway agencies, seven Canadian provinces, and three U.S. cities, as well as a review of existing successful preservation techniques. The *Guidelines* include a selection process and matrices that enable quick identification of treatment options by various categories, such as rural or urban roads, climate zones, work zone duration restrictions, traffic volumes, and

Rhode Island's Pavement Preservation Experience

RIDOT developed broad experience with pavement preservation treatments during the past two decades. Environmental factors cause most distresses for Rhode Island's pavements through freeze-thaw cycles and frost heave. Cracking is the primary pavement distress on RIDOT's hot-mix asphalt (HMA) surfaced pavements, while rutting is not a significant concern for the agency.

In the mid-1990s, RIDOT developed a pavement evaluation process and began placing experimental preservation projects in 1998. Early deployments emphasized crack sealing, because the agency found that crack sealing reduced the number of potholes that formed. Multiple strategies were attempted over time, and performance was monitored to build upon the successes of previous years. Some early experimental treatments performed well, and some chip seals provided satisfactory performance for more than 17 years.

As experience developed with placing the treatments, RIDOT relied on staff knowledge and judgment for treatment selection, supplementing recommendations from the pavement management system. Staff from multiple functional areas assisted in developing treatment strategies (e.g., Roadway Design, Materials, Maintenance, and Construction). Some treatments performed well, while others, such as microsurfacing, cape seal (chip seal followed by a microsurface application), and ultrathin-bonded overlay, were not determined to be cost effective. Crack sealing, rubber modified chip seals, stress-absorbing membrane interlayers (SAMIs), and thin HMA overlays became the go-to treatments for RIDOT.

RIDOT developed a unique pavement index to rate pavement structural health. The Pavement Structural Health Index (PSHI) relied on crack density (e.g., block, fatigue, transverse), smoothness, and rutting to indicate the relative roadway condition. As treatment performance was confirmed, PSHI threshold values were assigned to aid in pavement preservation treatment selection. In addition, "time since last treatment" was used to begin considering treatment application. Crack sealing was considered after 3 years of surface age, while chip seals were considered beginning at 7 years in service.

The RIDOT selection matrix is shown in Figure 1 and includes treatment customizations adapted by RIDOT because of their cost-effectiveness and success. The following specialized treatments were deployed: fiber-reinforced crack sealant materials; hot-applied, asphalt rubber-modified chip seals (ARCS); and RIDOT's polymer-modified thin HMA overlay as a Paver-Placed Elastomeric Surface Treatment (PPEST).

RIDOT has introduced several innovative specification changes for its preservation treatments. The agency is a proponent of ground tire-rubber modifier (30 mesh), using it in a binder for chip seals and elastomeric surface treatments. Chip seals were enhanced by requiring that cubical-shaped, single-size aggregate be precoated with 0.8 percent asphalt. This tactic aids chip retention and reduces the likelihood of public complaints and damage claims. Contract-sweeping requirements were also increased to reduce the likelihood that chips would cause damage to cars or carpets, ending up in driveways and carried into homes attached to shoes. Sweeping and removal operations are required during the project, 2 weeks following project completion, in late November, and after winter ends. The RIDOT thin overlay specification was also enhanced by adding an intelligent compaction equipment requirement.

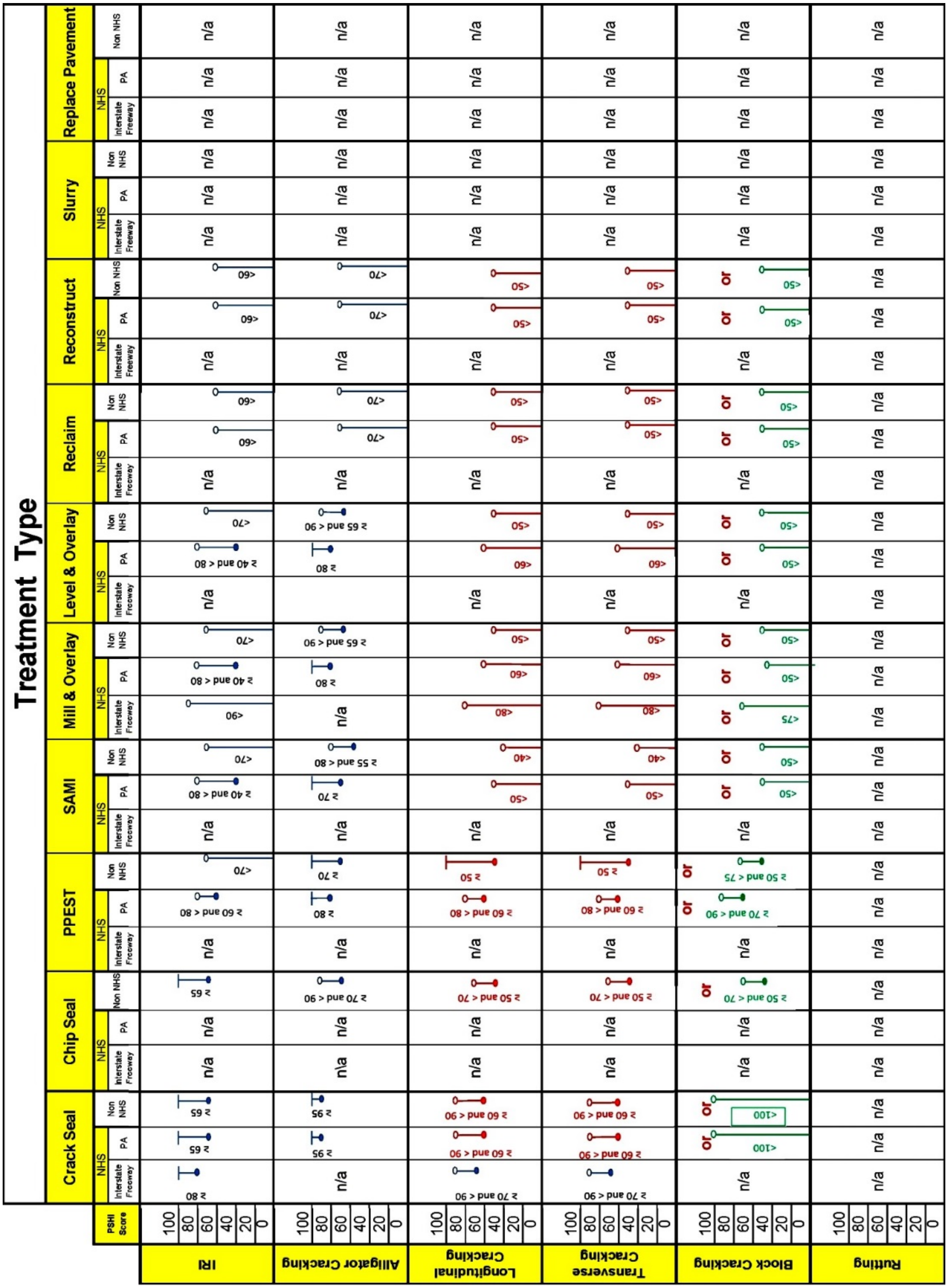

Figure 1. RIDOT Preservation Treatment Selection Matrix

RIDOT's Approach to Implementation

When the *Guidelines* were published, Jose Lima, RIDOT Principal Civil Engineer, said, "It's like we are reading our own manual." The *Guidelines*, however, recommended higher traffic levels for treatments than RIDOT had considered as standard practice. Understanding that the *Guidelines* were developed based on experiences from other agencies, RIDOT was encouraged to stretch its current practices to apply the treatments that worked within the state on higher-volume roads. The *Guidelines* were used to develop the demonstration projects shown in Table 1. The table depicts pavement surface age, traffic volumes, RIDOT PSHI values, and the observed distresses in the roadway segments.

Table 1. Descriptions of RIDOT Demonstration Projects

Road Segment	Pavement Surface Age (Years)	Average Daily Traffic (ADT)	PSHI Value	Distresses Observed	Treatment Selection
I-95	4	23,100	93.7	Medium-severity reflective transverse cracks	Rubber-modified asphalt crack seal with fibers
RI 102	10	10,200	84.3	Medium-severity longitudinal and transverse cracking; localized medium-severity rutting, low-severity flushing	ARCS
RI 3	21	16,200	63.5	Medium-severity block cracking	Micro mill pavement 1.5-inch; place 3/8 in 20 percent ARCS with 100 percent precoated aggregate; 1-inch thick polymer modified asphalt thin overlay
RI 114	30	10,900	62.9	High-severity longitudinal, transverse, and block cracking	Micro-mill pavement 1 inch deep, localized HMA leveling to restore profile, place 1-inch-thick polymer modified thin overlay

ADT average daily traffic
ARCS asphalt rubber-modified chip seal
HMA hot-mix asphalt
I-95 Interstate 95
PSHI pavement structural health index
RI Rhode Island route

The *Guidelines* treatment feasibility tables, shown in Tables 2 and 3, are complementary to the RIDOT PSHI thresholds. Treatments were selected by combining roadway characteristics with threshold values from each table. Table 2 lists treatments that have successfully mitigated common preexisting distresses on high-volume roads, and Table 3 identifies the climatic regions and relative costs for each recommended treatment. Rhode Island experiences numerous freeze-thaw cycles and frost heave and should, therefore, be considered a part of the deep-freeze climatic zone.

Table 2. Feasibility Matrix for Preliminary Identification of Candidate Preservation Treatments for HMA-Surfaced Pavements (Peshkin et al., 2011)

Preservation Treatment	Window Of Opportunity		Distress Types and Severity Levels (L=Low Severity, M=Medium Severity, H=High Severity)														Surface Characteristics Issues		
			Surface Distress					Cracking Distress					Deformation Distress						
			Ravel/ Weather	Bleed/ Flush	Polish	Segre-gation	Water Bleed/ Pump[a]	Fatigue/ Long WP/ Slippage	Block	Trans Therm	Joint Reflect	Long/ Edge	Wear/ Stable Rutting [b]	Corrug/ Shove [c]	Bumps/ Sags	Patches	Ride Quality	Friction	Noise
	PCI/ PCR	Age, yrs	L/M/H	—	—	L/M/H	—	L/M/H	L/M/H	L/M/H	L/M/H	L/M/H	L/M/H	L/M/H	L/M/H	L/M/H	—	—	—
Crack Fill	75-90	3-6 [d]						✖✖✖	⦿○✖	○✖✖	○✖✖	●⦿○							
Crack Seal	80-95	2-5 [d]						✖✖✖	⦿○✖	●⦿○	●⦿○	○✖✖							
Slurry Seal (Type III)	70-85	5-8	⦿●⦿	✖	⦿	⦿○✖	⦿	⦿○✖	●⦿○	⦿○✖	⦿○✖	⦿○✖	○✖✖	✖✖✖	✖✖✖	⦿○✖	✖	⦿	⦿
Microsurfacing-Single	70-85	5-8	⦿●⦿	✖	⦿	●⦿○	⦿	⦿○✖	●⦿○	⦿○✖	⦿○✖	⦿○✖	⦿○✖	○✖✖	○✖✖	⦿○✖	○	●	⦿
Microsurfacing-Double	70-85	5-8	⦿●⦿	✖	⦿	●⦿○	○	⦿○✖	●⦿○	●⦿○	●⦿○	●⦿○	●⦿○	○○✖	○○✖	●⦿○	⦿	●	⦿
Chip Seal-Single																			
Conventional	70-85	5-8	⦿●⦿	○	●	●⦿○	⦿	⦿✖✖	●⦿○	●⦿○	●⦿○	⦿⦿○	⦿○✖	○○✖	○○✖	⦿⦿○	○	●	✖
Polymer-modified	70-85	5-8	○⦿⦿	✖	●	⦿⦿○	○	⦿○✖	●⦿⦿	●⦿⦿	●⦿⦿	⦿○✖	⦿○✖	○○✖	○○✖	⦿⦿○	○	●	✖
Chip Seal-Double																			
Conventional	70-85	5-8	○⦿⦿	✖	⦿	⦿⦿○	✖	⦿○✖	●⦿⦿	●⦿⦿	●⦿⦿	●⦿⦿	●⦿○	⦿○✖	⦿○✖	●⦿⦿	⦿	⦿	○
Polymer-modified	70-85	5-8	○○⦿	✖	⦿	○⦿○	✖	●⦿○	●●⦿	●●⦿	●●⦿	●⦿⦿	●⦿○	⦿○✖	⦿○✖	●⦿⦿	⦿	⦿	○
Ultra-Thin Bonded Wearing Course	65-85	5-10	⦿●⦿	✖	●	⦿⦿○	○	⦿○✖	⦿⦿○	⦿⦿○	⦿⦿○	⦿⦿○	⦿○✖	⦿○✖	⦿○✖	⦿⦿○	⦿	●	⦿
Ultra-Thin HMAOL	65-85	5-10	⦿●⦿	✖	●	⦿⦿○	○	⦿○✖	⦿⦿○	⦿⦿✖	⦿⦿✖	⦿⦿✖	⦿○✖	⦿○✖	⦿○✖	⦿⦿○	⦿	●	●
Thin HMAOL	60-80	6-12	⦿●⦿	○	●	⦿⦿○	○	●⦿○	●●⦿	⦿●⦿	⦿●⦿	⦿⦿●	⦿●⦿	●⦿○	●⦿○	●●⦿	●	●	●
Cold Milling and Thin HMAOL	60-75	7-12	○⦿●	○	○	⦿●⦿	✖	⦿⦿○	○⦿⦿	⦿⦿●	⦿⦿●	○⦿●	⦿●⦿	●⦿⦿	●⦿○	●●⦿	●	⦿	○
Hot In-place Recycling																			
Surf Recycle/HMAOL	70-85	5-8	○⦿●	○	○	⦿●⦿	○	⦿⦿○	●⦿○	○⦿●	○⦿●	⦿⦿○	⦿●⦿	⦿⦿○	⦿⦿○	⦿⦿○	⦿	⦿	○
Remixing/HMAOL	60-75	7-12	✖○○	○	⦿	✖○⦿	✖	⦿●⦿	⦿●⦿	⦿●⦿	⦿●⦿	⦿●⦿	⦿●●	⦿●●	○⦿●	○⦿⦿	●	⦿	○
Repaving	60-75	7-12	✖○○	○	⦿	✖○⦿	✖	⦿●⦿	⦿●⦿	⦿●⦿	⦿●⦿	⦿●⦿	⦿●●	⦿●●	○⦿●	○⦿⦿	●	⦿	○
Cold In-place Recycling and HMAOL	60-75	7-12	✖✖○	○	○	✖○⦿	✖	⦿●⦿	⦿●⦿	⦿●⦿	⦿●⦿	⦿●⦿	⦿●●	⦿●●	○⦿●	○⦿⦿	●	⦿	○
Profile Milling	80-90	3-6	○⦿⦿	⦿	○	✖○○	✖	✖✖✖	✖✖✖	✖✖✖	✖✖✖	✖✖✖	●⦿○	○✖✖	⦿⦿○[d]	⦿⦿○[d]	⦿	○	✖
Ultra-Thin Whitetopping	60-80	6-12	✖✖○	○	⦿	✖○⦿	✖	○⦿⦿	○⦿⦿	○⦿⦿	○⦿⦿	○⦿●	○⦿⦿	○⦿⦿	✖○○	○⦿⦿	⦿	○	✖

● Highly Recommended ⦿ Generally Recommended ○ Provisionally Recommended ✖ Not Recommended

[a] Porous surface mix problem.

[b] Rutting primarily confined to HMA surface layer and largely continuous in extent.

[c] Corrugation and shoving primarily HMA surface-layer mix problem and frequent in extent.

[d] For composite AC/PCC pavements, a more probable window of opportunity is 2 to 4 years for crack filling and 1 to 3 years for crack sealing.

[e] Localized application in the case of bumps.

Table 3. Feasibility Matrix for Final Identification of Candidate Preservation Treatments for HMA-Surfaced Pavements (Peshkin et al., 2011)

Preservation Treatment	Treatment Durability								Work Zone Duration Restrictions			Expected Performance on High Volume Facility, yrs	Relative Cost
	Rural Roads				Urban Roads				Overnight or Single-Shift	Weekend	Longer		
	High Traffic ADT > 5,000 vpd	Climatic Zone			High Traffic ADT > 10,000 vpd	Climatic Zone							
		Deep-Freeze	Moderate-Freeze	Non-Freeze		Deep-Freeze	Moderate-Freeze	Non-Freeze					
Crack Fill	●	●	●	●	●	●	●	●	●			2-3	$
Crack Seal	●	●	●	●	●	●	●	●	●			2-6	$
Slurry Seal (Type III)	○	×	⦿	⦿	○	×	⦿	⦿	●			3-5	$$
Microsurfacing-Single	⦿	⦿	●	⦿	⦿	⦿	●	⦿	●			3-5	$$
Microsurfacing-Double	⦿	⦿	●	⦿	⦿	⦿	●	⦿	●			4-6	$$/$$$
Chip Seal-Single Conventional Polymer-modified	⦿	●	⦿	⦿	⦿	⦿	⦿	⦿	●			4-6	$$ $$$
Chip Seal-Double Conventional Polymer-modified	⦿	●	⦿	⦿	⦿	⦿	⦿	⦿	●			6-8	$$/$$$ $$$
Ultra-Thin Bonded Wearing Course	⦿	⦿	●	⦿	⦿	⦿	●	⦿	●			5-8	$$$
Ultra-Thin HMAOL	○	○	⦿	×	⦿	⦿	●	○	●			4-7	$$
Thin HMAOL	●	●	●	⦿	●	●	●	⦿	●			5-10	$$$
Cold Milling and Thin HMAOL	●	●	●	⦿	●	●	●	●	●			6-11	$$$
Hot In-place Recycling Surf Recycle and HMAOL Remixing and HMAOL Repaving	○	○	○	×	○	○	⦿	○	●			5-8 6-12 6-12	$$$ $$$ $$$
Cold In-place Recycling and HMAOL	⦿	⦿	⦿	○	⦿	⦿	⦿	⦿	●			5-11	$$$
Profile Milling	⦿	○	⦿	⦿	⦿	○	●	⦿	●			2-4	$
Ultra-Thin Whitetopping	○	○	○	○	○	○	⦿	○	×	○	⦿	NA	$$$$

● Highly Recommended ⦿ Generally Recommended ○ Provisionally Recommended × Not Recommended
$ (lowest relative cost) ↔ $$$$ (highest relative cost)

I-95 Crack Seal Project

The condition survey performed by RIDOT on Interstate 95 (I-95), a rural four-lane interstate in Washington County, revealed an overall PSHI value of 93.7, with medium-severity reflective transverse cracking values of 75 to 80 throughout most of the project. The gap-graded HMA surface had been placed 4 years previously on the composite pavement. The optimum treatment was selected using the following two steps in a simplified example:

1. Review the treatment feasibility matrix (Table 2) to identify candidate treatments applicable for the conditions present. Figure 2, shown below, indicates treatments recommended for distresses identified (medium-severity reflective cracking) on the section of I-95.
2. Follow results from step 1 with analysis of climate and cost considerations in final treatment matrix (Table 3) to determine the lowest-cost viable treatment.

Completing step 1 using Figure 2 below, treatments “generally” or “highly” recommended for I-95 were crack sealing, double microsurfacing, single- and double-layer chip seals, thin HMA overlays (with or without milling), ultra-thin whitetopping, and cold and hot recycling. Figure 3 demonstrates the review of climate and cost data to select the optimum treatment for the location. Notice that slurry seals were not recommended in deep-freeze zones. Comparing the relative cost column, crack sealing was selected as the most economical treatment at this time.

Using the RIDOT threshold matrix similarly in Figure 4, chip seal was the recommended treatment for the freeway and distress levels indicated. As noted previously, the material used for the crack seal is a fiber-reinforced, rubber-modified asphalt, which RIDOT has specified since 2008.

Preservation Treatment	Window Of Opportunity		Distress Types and Severity Levels (L=Low Severity, M=Medium Severity, H=High Severity)														Surface Characteristics Issues		
			Surface Distress					Cracking Distress					Deformation Distress						
			Ravel/ Weather	Bleed/ Flush	Polish	Segre-gation	Water Bleed/ Pump[a]	Fatigue/ Long WP/ Slippage	Block	Trans Therm	Joint Reflect	Long/ Edge	Wear/ Stable Rutting [b]	Corrug/ Shove [c]	Bumps/ Sags	Patches	Ride Quality	Friction	Noise
	PCI/ PCR	Age, yrs	L/M/H	—	—	L/M/H	—	L/M/H	L/M/H	L/M/H	L/M/H	L/M/H	L/M/H	L/M/H	L/M/H	L/M/H	—	—	—
Crack Fill	75-90	3-6 [d]						×××	⦿○×	○××	○××	●⦿○							
Crack Seal	80-95	2-5 [d]						×××	⦿○×	●⦿○	●⦿○	○××							
Slurry Seal (Type III)	70-85	5-8	⦿●⦿	×	⦿	⦿○×	⦿	⦿○×	●⦿○	⦿○×	⦿○×	⦿○×	○××	×××	×××	⦿○×	×	⦿	⦿
Microsurfacing-Single	70-85	5-8	⦿●⦿	×	⦿	●⦿○	⦿	⦿○×	●⦿○	⦿○×	⦿○×	⦿○×	⦿○×	○××	○××	⦿○×	○	●	⦿
Microsurfacing-Double	70-85	5-8	⦿●⦿	×	⦿	●⦿○	○	⦿○×	●⦿○	●⦿○	●⦿○	●⦿○	●⦿○	○○×	○○×	●⦿○	⦿	●	⦿
Chip Seal-Single																			
Conventional	70-85	5-8	⦿●⦿	○	●	●⦿○	⦿	⦿××	●⦿○	●⦿○	●⦿○	⦿⦿○	⦿○×	○○×	○○×	⦿⦿○	○	●	×
Polymer-modified	70-85	5-8	○⦿⦿	×	●	⦿⦿○	○	⦿○×	●⦿⦿	●⦿⦿	●⦿⦿	⦿○×	⦿○×	○○×	○○×	⦿⦿○	○	●	×
Chip Seal-Double																			
Conventional	70-85	5-8	○⦿⦿	×	⦿	⦿⦿○	×	⦿○×	●⦿⦿	●⦿⦿	●⦿⦿	●⦿⦿	●⦿○	⦿○×	⦿○×	●⦿⦿	⦿	⦿	○
Polymer-modified	70-85	5-8	○○⦿	×	⦿	○⦿○	×	●⦿○	●●⦿	●●⦿	●●⦿	●⦿⦿	●⦿○	⦿○×	⦿○×	●⦿⦿	⦿	⦿	○
Ultra-Thin Bonded Wearing Course	65-85	5-10	⦿●⦿	×	●	⦿⦿○	○	⦿○×	⦿⦿○	⦿⦿○	⦿⦿○	⦿⦿○	⦿○×	⦿○×	⦿○×	⦿⦿○	⦿	●	⦿
Ultra-Thin HMAOL	65-85	5-10	⦿●⦿	×	●	⦿⦿○	○	⦿○×	⦿⦿○	⦿⦿×	⦿⦿×	⦿⦿×	⦿○×	⦿○×	⦿○×	⦿⦿○	⦿	●	●
Thin HMAOL	60-80	6-12	⦿●⦿	○	●	⦿⦿○	○	●⦿○	●●⦿	⦿●⦿	⦿●⦿	⦿⦿●	⦿●⦿	●⦿○	●⦿○	●●⦿	●	●	●
Cold Milling and Thin HMAOL	60-75	7-12	○⦿●	○	○	⦿●⦿	×	⦿⦿○	○⦿⦿	⦿⦿●	⦿⦿●	○⦿●	⦿●⦿	●⦿⦿	●⦿○	●●⦿	●	⦿	○
Hot In-place Recycling																			
Surf Recycle/HMAOL	70-85	5-8	○⦿●	○	○	⦿●⦿	○	⦿⦿○	●⦿○	○⦿●	○⦿●	⦿⦿○	⦿●⦿	⦿⦿○	⦿⦿○	⦿⦿○	⦿	⦿	○
Remixing/HMAOL	60-75	7-12	×○○	○	⦿	×○⦿	×	⦿●⦿	⦿●⦿	⦿●⦿	⦿●⦿	⦿●⦿	⦿●●	⦿●●	○⦿●	○⦿⦿	●	⦿	○
Repaving	60-75	7-12	×○○	○	⦿	×○⦿	×	⦿●⦿	⦿●⦿	⦿●⦿	⦿●⦿	⦿●⦿	⦿●●	⦿●●	○⦿●	○⦿⦿	●	⦿	○
Cold In-place Recycling and HMAOL	60-75	7-12	××○	○	○	×○⦿	×	⦿●⦿	⦿●⦿	⦿●⦿	⦿●⦿	⦿●⦿	⦿●●	⦿●●	○⦿●	○⦿⦿	●	⦿	○
Profile Milling	80-90	3-6	○⦿⦿	⦿	○	×○○	×	×××	×××	×××	×××	×××	●⦿○	○××	⦿⦿○[d]	⦿⦿○[d]	⦿	○	×
Ultra-Thin Whitetopping	60-80	6-12	××○	○	⦿	×○⦿	×	○⦿⦿	○⦿⦿	○⦿⦿	○⦿⦿	○⦿●	○⦿⦿	○⦿⦿	×○○	○⦿⦿	⦿	○	×

Figure 2. Identifying Candidate Treatments for Moderate Severity Reflection Cracking
Click here for an enlarged version of Figure 2.

Preservation Treatment	Treatment Durability								Work Zone Duration Restrictions			Expected Performance on High Volume Facility, yrs	Relative Cost
	Rural Roads				Urban Roads				Overnight or Single-Shift	Weekend	Longer		
	High Traffic ADT > 5,000 vpd	Climatic Zone			High Traffic ADT > 10,000 vpd	Climatic Zone							
		Deep-Freeze	Moderate-Freeze	Non-Freeze		Deep-Freeze	Moderate-Freeze	Non-Freeze					
Crack Fill	●	●	●	●	●	●	●	●	●			2-3	$
Crack Seal	●	●	●	●	●	●	●	●	●			2-6	$
Slurry Seal (Type III)	○	×	⦿	⦿	○	×	⦿	⦿	●			3-5	$$
Microsurfacing-Single	⦿	⦿	●	⦿	⦿	⦿	●	⦿	●			3-5	$$
Microsurfacing-Double	⦿	⦿	●	⦿	⦿	⦿	●	⦿	●			4-6	$$/$$$
Chip Seal-Single Conventional Polymer-modified	⦿	●	⦿	⦿	⦿	⦿	⦿	⦿	●			4-6	$$ $$$
Chip Seal-Double Conventional Polymer-modified	⦿	●	⦿	⦿	⦿	⦿	⦿	⦿	●			6-8	$$/$$$ $$$
Ultra-Thin Bonded Wearing Course	⦿	⦿	●	⦿	⦿	⦿	●	⦿	●			5-8	$$$
Ultra-Thin HMAOL	○	○	⦿	×	⦿	⦿	●	○	●			4-7	$$
Thin HMAOL	●	●	●	⦿	●	●	●	⦿	●			5-10	$$$
Cold Milling and Thin HMAOL	●	●	●	⦿	●	●	●	●	●			6-11	$$$
Hot In-place Recycling Surf Recycle and HMAOL Remixing and HMAOL Repaving	○	○	○	×	○	○	⦿	○	●			5-8 6-12 6-12	$$$ $$$ $$$
Cold In-place Recycling and HMAOL	⦿	⦿	⦿	○	⦿	⦿	⦿	⦿	●			5-11	$$$
Profile Milling	⦿	○	⦿	⦿	⦿	○	●	⦿	●			2-4	$
Ultra-Thin Whitetopping	○	○	○	○	○	○	⦿	○	×	○	⦿	NA	$$$$

Figure 3. Comparing Climate and Relative Cost, Crack Seal is the Selected Treatment

Click here for an enlarged version of Figure 3.

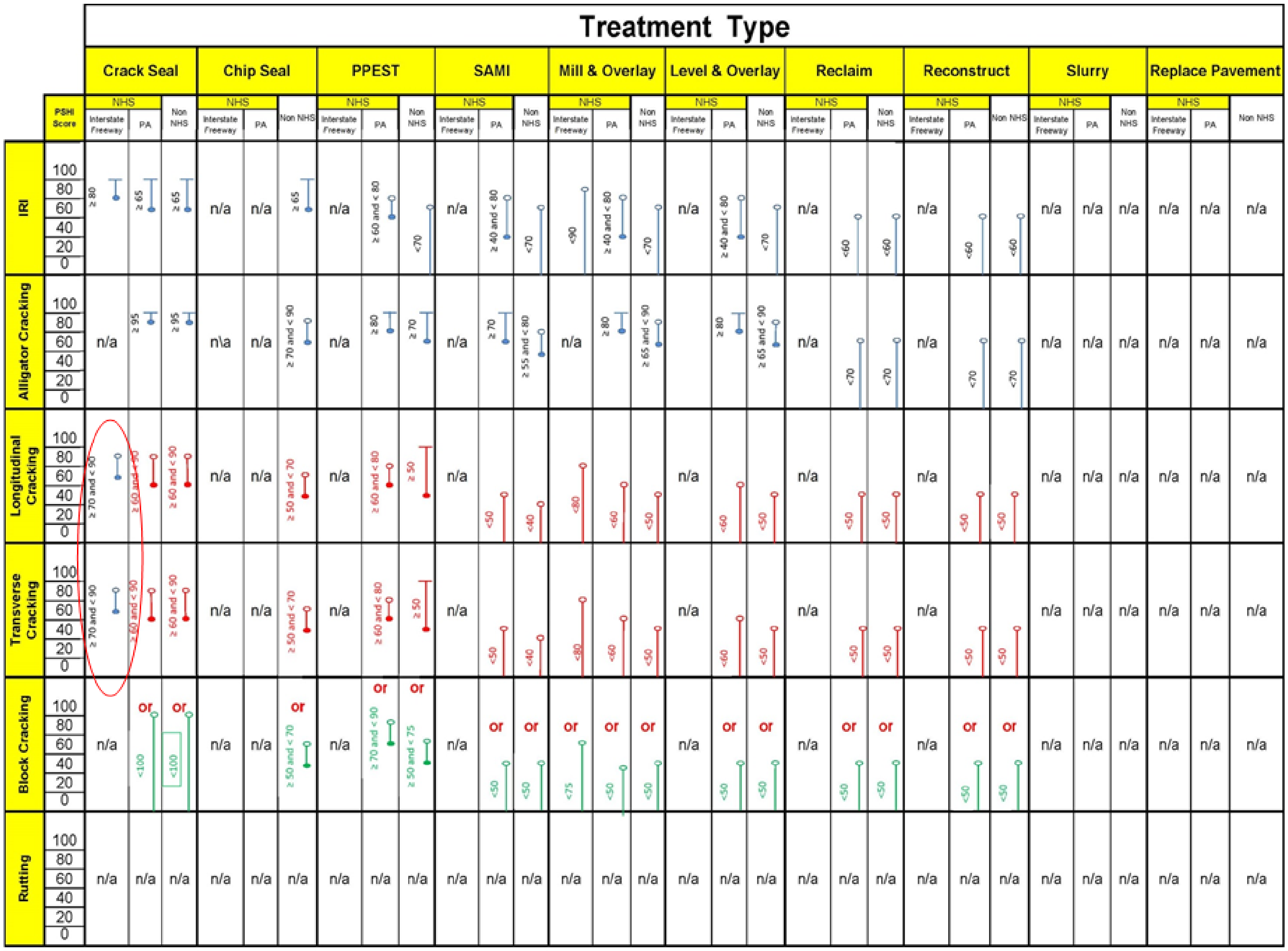

Figure 4. Treatment Selection Based on RIDOT Treatment-Distress Matrix

RI 102 Asphalt Rubber-Modified Chip Seal

Conditions on a rural two-lane collector in Washington County, RI 102, included medium-severity longitudinal and transverse cracking, low-severity flushing, and localized medium-severity rutting on a 10-year-old chip-seal surface. The RIDOT composite PSHI score of 84 indicated the pavement was in good condition but was triggered for treatment by the longitudinal cracking index.

Following the two-step process, several treatments were available to correct the pavement deficiencies, but the chip-seal product is not typically applied anywhere on the National Highway System. However, after using the *Guidelines* to identify the distresses, and to correct flushing and to seal the cracks, a chip seal was determined to be the most economical. Again, as noted previously, RIDOT customized the chip-seal specification to include hot-applied, rubber-modified binder, as shown in Figure 5, with asphalt precoated aggregate.

RI 3 Micro-Milling, Stress-Absorbing Membrane Interlayers, and Paver-Placed Elastomeric Surface Treatment

Medium-severity block cracking was the predominate distress identified on the 21-year-old composite pavement section of RI 3, a five-lane rural collector in Kent County. With a PSHI score of 63.5 and 16,200 average daily traffic (ADT), RIDOT elected to use a combination of preservation treatments. Micro-milling was used to correct the pavement roughness, and a Stress-Absorbing Membrane Interlayers (SAMI) layer of ARCS was applied to seal the underlying pavement and retard reflection cracks. At the surface, RIDOT applied its proven Paver-Placed Elastomeric Surface Treatment (PPEST).

RI 114 Micro-Milling and Paver-Placed Elastomeric Surface Treatment

On RI- 114, an urban four-lane arterial in Providence County, the test section displayed high-severity longitudinal, transverse, and block cracking with a RIDOT PSHI score of 62.9. This was the lowest score of all demonstration sections in RI, and it also had the most significant rutting and the roughest surface. Using the two-step method from the *Guidelines* and consulting the RIDOT PSHI threshold matrix, micro-milling, spot-leveling, and PPEST overlay were selected as the preferred treatments.

Figure 5. Rubber-Modified, Hot-Applied Binder Distributed as Part of the ARCS Treatment (source: RIDOT)

Benefits from Using the *Guidelines*

The *Guidelines* complement current advances being made at many transportation agencies. Based on experiences across the United States, this SHRP2 product has provided state departments of transportation with the necessary assurance on which to progress in using new pavement preservation strategies on higher-volume roads. The *Guidelines* have helped agencies, such as RIDOT, continue to develop and use more innovative practices, as well as reconsider treatments that they previously dismissed as unsuccessful, such as polymer emulsions and microsurfacing. Continued support of the *Guidelines* will enable Lead Adopters to provide examples of best practices, and peer-to-peer exchanges will encourage progressive implementation and innovation. Colin Franco, RIDOT Associate Chief Engineer – Materials, said that continued support of the *Guidelines* and agency sharing will lead to more use of the products and high-volume road preservation practices.

Lessons Learned

RIDOT has incorporated the *Guidelines* multistep evaluation and treatment selection process into its own processes and is applying the concepts and developing trigger thresholds in deploying preservation treatments on high-volume roadways. The agency will continue to apply preservation concepts to minimize life-cycle costs and to develop innovative treatments. Innovation in RIDOT's preservation programs required involvement of cross-functional teams including Design, Maintenance, Materials, and Construction personnel. As part of its implementation strategy, the following treatment specifications have been customized for Rhode Island:

- Using ground tire-rubber modifier (30 mesh) in crack sealant, chip seal applications, and elastomeric overlays
- Using single-size, precoated aggregate chips (0.8 percent asphalt) with hot-applied ARCS
- Reducing risk of stray chips by requiring additional sweeping efforts
- Adding intelligent compaction equipment to thin overlay specifications

Through the *Guidelines* implementation process, RIDOT has also seen selection processes and triggers developed for treatments that closely match its experience. That similarity is reassuring the agency that practices it adopted are helping better manage its network at the lowest life-cycle cost. The *Guidelines* have also encouraged the agency to stretch its program to consider placing treatments onto high-volume routes that were typically considered "not applicable." To further increase the use of pavement preservation, the agency will need continued support of agency efforts and peer-to-peer networking.

References

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The AASHTO SHRP2 product page is available at http://shrp2.transportation.org/Pages/R26_HighTrafficVolRoadways.aspx.