PB2000-102424

Maintenance Selection Manual for

Maintenance of Pavements with Chemically Stabilized Layers

Airport Pavements
1998

REPRODUCED BY:
U.S. Department of Commerce
National Technical Information Service
Springfield, Virginia 22161

The following manual was assembled by TTI as part of the "Maintenance of Pavements with Chemically Stabilized Layers" project. The purpose of this manual is to provide guidance on what maintenance strategy or technique to use for stabilized pavements in different conditions.

To use this manual, select the predominant distress case from the choices of 1 - Transverse Cracking, 2 - Longitudinal Cracking, 3 - Rutting, 4 - Alligator Cracking, 5 - Swell/Roughness, or 6 - Failures, then select the appropriate categories of extent, severity, traffic, etc. until the strategy or treatment is identified. The TxDOT PMIS manual was used for the description and severity of each distress (1). The PMIS description and pictures of each distress are included below. In each district, the following description of each element was used. For the purpose of this discussion, we will proceed across a block of the selection process and describe each element. When moving to a new line or block, only the new items will be discussed.

Except for the initial performance period, most pavements do not exhibit only a single type of distress. For example, rutting is often accompanied, or followed, by alligator cracking while transverse cracking is accompanied by longitudinal cracking. However, to have a simple, usable

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matrix the strategy selection process had to be based on a single dominant distress. If the pavement has substantial amounts of multiple distresses, the procedure should be analyzed for each one and the most corrective treatment chosen.

Predominant Distress - For this pavement, determine which distress is the primary reason for maintenance of this pavement. The procedure can be rerun with a different distress to assess the impact on the treatment assignment. Normally, the more comprehensive treatment would be selected. For example, if crack sealing was the result of one run, and seal coat was the result of using a different distress, seal coat would be selected.

Case 1, the predominant distress is Transverse Cracking

Transverse Cracking - "Transverse cracking consists of cracks or breaks which travel at right angles to the pavement centerline (Figure 1). Joint cracks and reflective cracks may also be rated as transverse cracking.
Transverse cracks are usually caused by differential movement beneath the pavement surface. They may also be caused by surface shrinkage due to extreme temperature variations." (TxDOT 1998)

What is the approximate spacing between transverse cracks?

Crack Spacing -	> 40'	For a given pavement with only transverse cracking, assume that the crack spacing is >40'. One way to visualize this is 40' spacing is about one crack every centerline paint stripe.
Crack Spacing -	15'-40'	In this case, assume the crack spacing is generally about 30'.
Crack Spacing -	< 15'	Assume that cracks are now spaced every 10' - 15'.

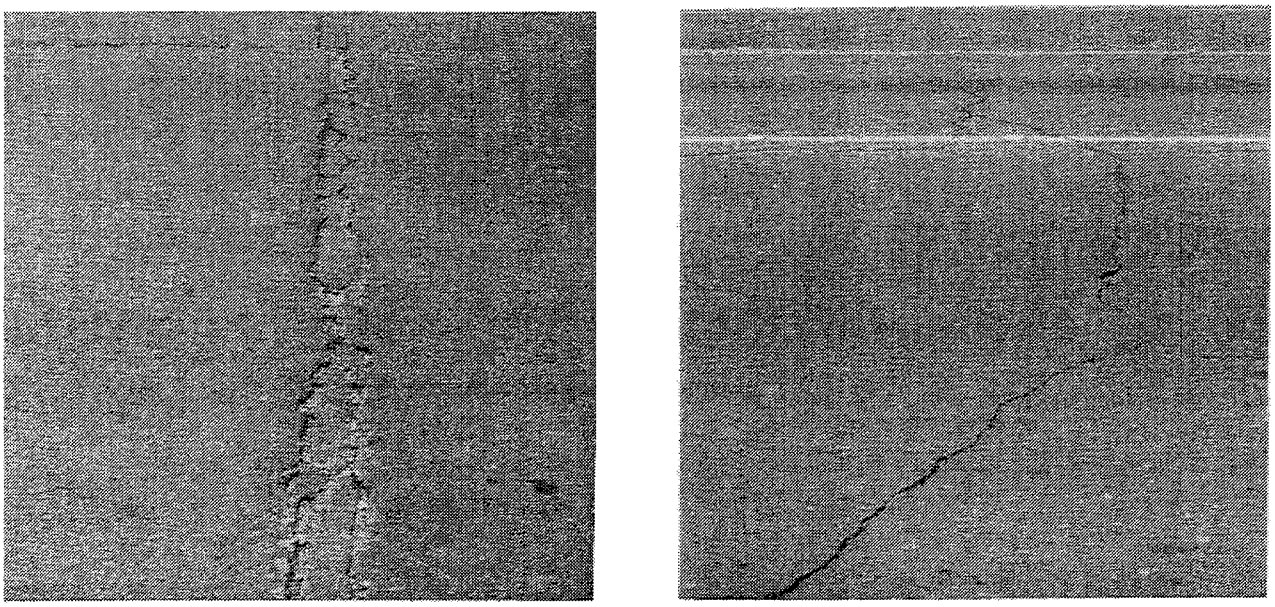

Figure 1. Example of Transverse Cracking (TxDOT 1998)

What is the typical severity of the cracks? Remember, small areas can be patched.

Severity -	Mostly tight	These cracks are tight or hairline, about 1/16" to 1/8" wide. They are difficult to see unless after a rain or when stopped along the road and looking towards the sun.
Severity -	Open, < ½"	These cracks are easy to see, even while driving. They are wider than the tight cracks described above, but are not spalled. These are easy to crack seal.
Severity -	> ½" or Deteriorated	These cracks are wide enough to be felt while driving and are easily visible. Small areas may be deteriorated, especially in the wheel paths.
Severity -	Cupped or Tented	These cracks are a difficult type of crack to repair. They are very rough and are usually caused by infiltration (tent) or pumping (cup) of the material. These cracks are somewhat rare in Texas, but if encountered can be difficult to address.

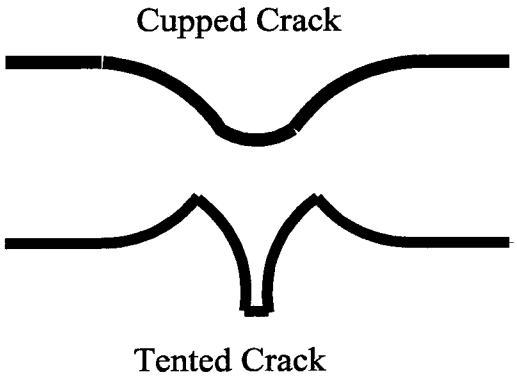

Figure 2. Example of Cupped and Tented Cracks

What is the traffic level or importance of the facility?

Traffic Level - or Importance	Low	Think of a typical low-volume pavement that doesn't carry much traffic. An apron or taxiway at a low-volume facility is an example that can be used.
Traffic Level - or Importance	Medium	A pavement that is fairly important to air operations, but not critical. A runway at a low-volume facility and aprons or taxiways at a medium or high-volume facility are examples that can be used.
Traffic Level - or Importance	High	A pavement that is critical to air operations and carries most of the traffic. Runways and other necessary pavements at high-volume facilities are an example that can be used.

Based on the categories discussed above and the purpose of the maintenance, what treatment strategy would be used?

Strategy	Action if Only Localized	What do you do if the transverse cracking is only in one small area of about 200' long?
Strategy	Short-term Repair 1 - 2 Years	What do you do if you are just trying to hold the pavement for a year or two until a major or more appropriate treatment can be scheduled?
Strategy	Long-term Treatment 3+ Years	What is the appropriate Long-term treatment for this road?

Case 2, the predominant distress is Longitudinal Cracking

Longitudinal Cracking - "Longitudinal cracking consists of cracks or breaks which run approximately parallel to the pavement centerline. Edge cracks, joints or slab cracks, and reflective cracking on composite pavement (i.e. overlaid concrete pavement) may all be rated as longitudinal cracking. Differential movement beneath the surface is the primary cause of longitudinal cracking." (TxDOT 1998)

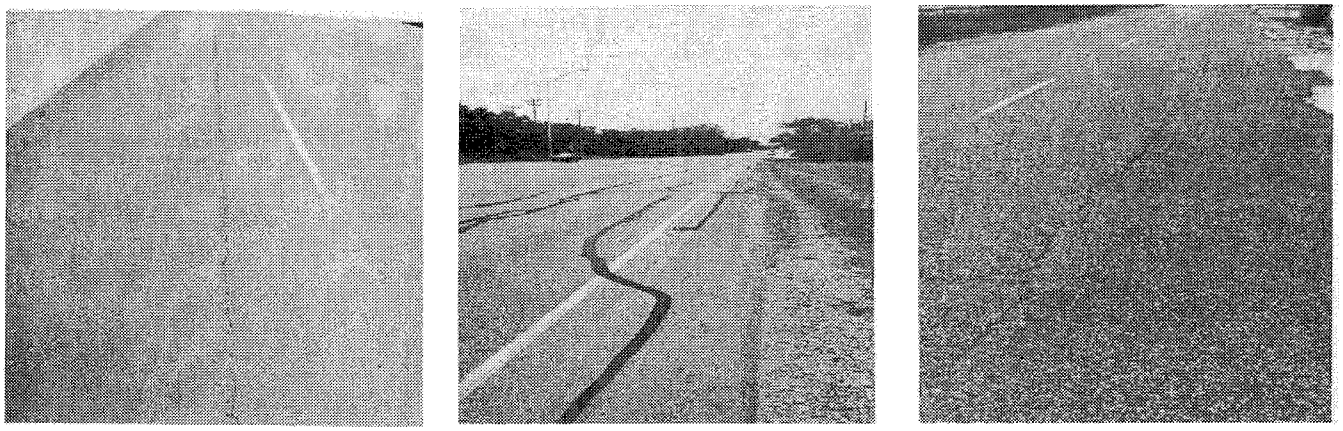

Figure 3. Examples of Longitudinal Cracking (TxDOT 1998)

What is the approximate number of longitudinal cracks?

Crack Spacing -	> Lane Width	Assume that there is only one crack for both lanes.
Crack Spacing -	1 Per Lane	In this case, there is one crack in each lane.
Crack Spacing -	> 1 per Lane	For this case, there is more than one crack per lane. Usually this case has some faulting or dishing out of the outer crack in the outside lane.

What is the typical severity of the cracks? Remember, small areas can be patched.

Severity -	Mostly tight	These cracks are tight or hairline, about 1/16" to 1/8" wide. They are difficult to see unless after a rain or when stopped along the road and looking towards the sun.
Severity -	Open, < ½"	These cracks are easy to see, even while driving. They are wider than the tight cracks described above, but are not spalled. These are easy to crack seal.
Severity -	> ½" or Deteriorated	These cracks are wide enough to be felt while driving and are easily visible. Small areas may be deteriorated and their may be faulting or spalling of the cracks.

Traffic Level or Importance, and Strategy selection are the same as for Transverse Cracking.

Case 3, the predominant distress is Rutting.

Rutting - "A rut is a longitudinal surface depression in a wheelpath (Figure 4). Rutting in the rated lane may be observed in one or both wheelpaths. Rutting is caused by consolidation or lateral movement of the pavement materials due to traffic loads. Significant amounts of rutting indicate that one or more of the pavement layers is inadequate. Rutting is indicative of a structural problem and may lead to the onset of serious structural failures." (TxDOT 1998)

What is the extent of the rutting?

# Lanes -	1 Wheelpath	Assume that the rutting is only in one wheelpath.
# Lanes -	Both Wheelpaths	What do you do if both wheelpaths are rutted?

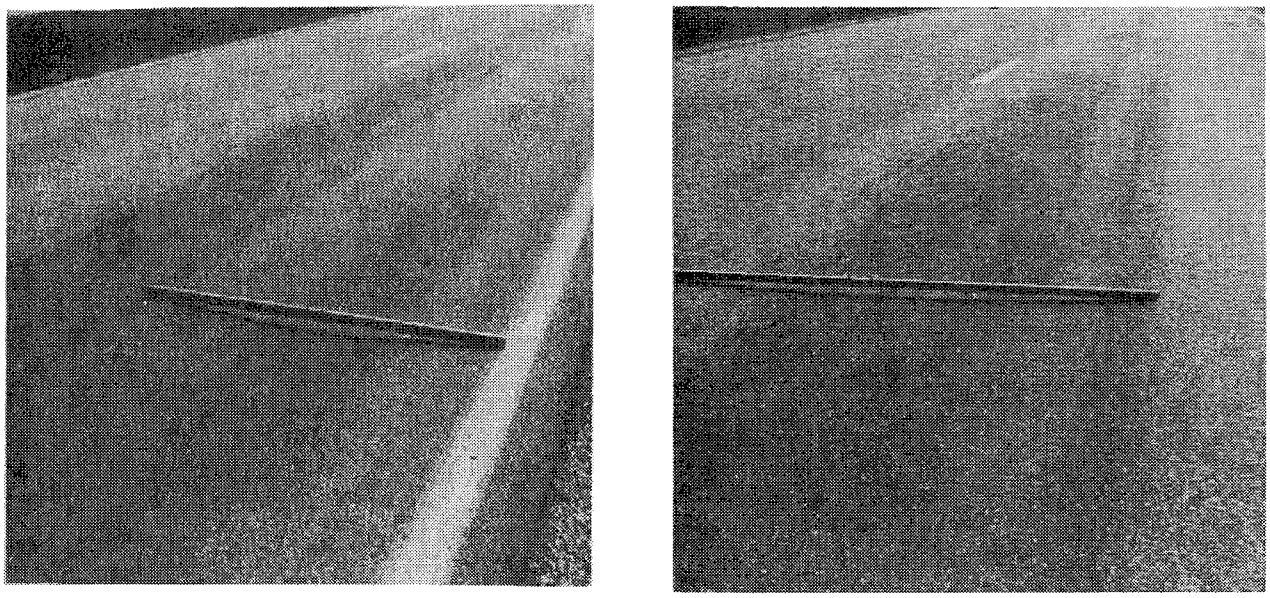

Figure 4. Examples of Rutting (TxDOT 1998)

What is the typical depth of the rutting?

Severity -	½" to 1"	The rutting is defined as shallow, and may be difficult to see.
Severity -	> 1"	The rutting is deep, will hold considerable water, and is easy to see, even while driving. If the rut is greater than 2", use the criteria for failures.

Traffic Level or Importance, and Strategy selection are the same as for Transverse Cracking.

Case 4, the predominant distress is Alligator Cracking

Alligator Cracking - "Alligator cracking consists of interconnecting cracks which form small, irregularly-shaped blocks which resemble the patterns found on an alligator's skin (Figure 5). Blocks formed by alligator cracks are less than 1 foot by 1 foot (0.3 meter by 0.3 meter). Larger blocks should be rated as block cracking.

Alligator cracks are formed whenever the pavement surface is repeatedly flexed under traffic loads. As a result, alligator cracking may indicate improper design or weak structural layers. Alligator cracking may also be caused by heavily-loaded vehicles." (TxDOT 1998)

What is the extent of the alligator cracking?

# Lanes -	1 Wheelpath	Assume that the alligator cracking is only in one wheelpath.
# Lanes -	Both Wheelpaths	What do you do if both wheelpaths have alligator cracking?

What is the severity of the alligator cracking?

Severity -	Minor	Not too extensive, cracking not too severe.
Severity -	Major	Alligator cracking is extensive, nearly continuous throughout the section and the cracking is severe, but not yet a failure.

Traffic Level or Importance, and Strategy selection are the same as for Transverse Cracking.

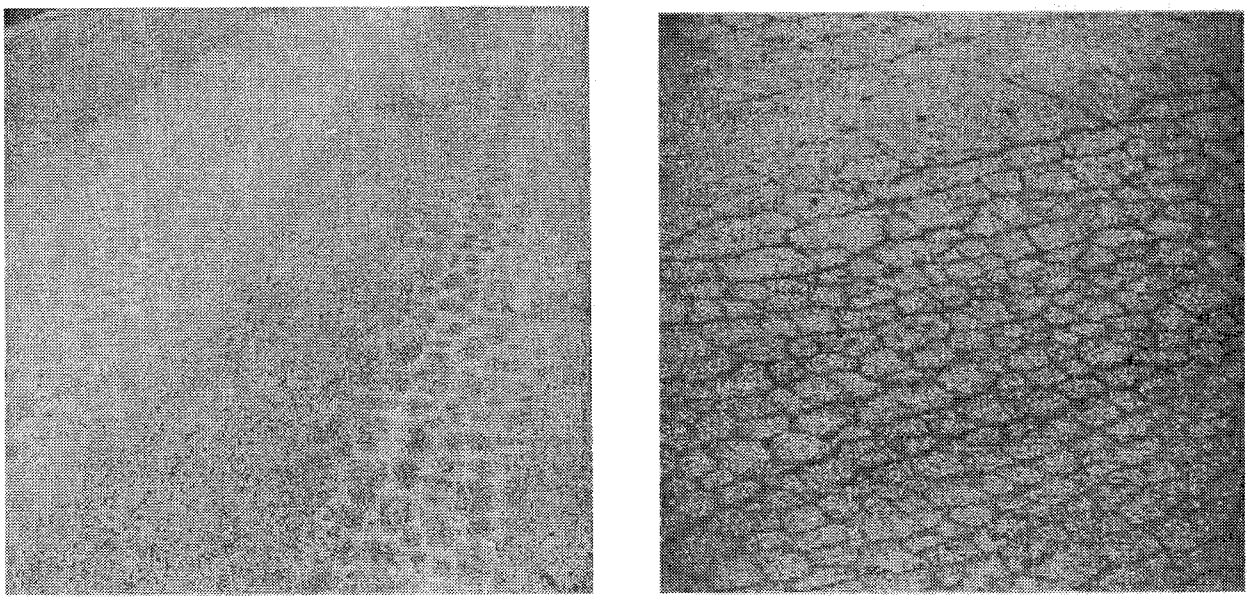

Figure 5. Examples of Alligator Cracking (TxDOT 1998)

Case 5, the predominant distress is Swelling or general Roughness.

Swell/Roughness - Swelling is the uplift of an area of pavement caused by soils that absorb large quantities of water or by a chemical reaction that causes expansion. Roughness is a general discomfort to the driver caused by irregularities in the pavement surface.

What is the severity of the roughness?

Severity -	Some Roughness	The pavement is moderately rough with some discomfort to the driver. Probably receiving some complaints.
Severity -	Rough	The pavement causes discomfort and is somewhat difficult to drive on.

Traffic Level or Importance, and Strategy selection are the same as for Transverse Cracking.

Case 6, the predominant distress is Failures.

Failures - "A failure is a localized section of pavement where the surface has been severely eroded, badly cracked, or depressed (Figure 6). Failures are important to rate because they identify specific structural deficiencies which may pose safety hazards.
Severe alligator cracking should be rated as a failure if the base is exposed, except that severe alligator cracking on a thin surface treatment pavement is not a failure if the base layer is exposed but in good condition." TxDOT 1998.

What is the extent of the failures?

Few or Many -	Few	Few failures, less than ten per mile.
Few or Many -	Many	Many failures, more than ten per mile.

Traffic Level or Importance, and Strategy selection are the same as for Transverse Cracking.

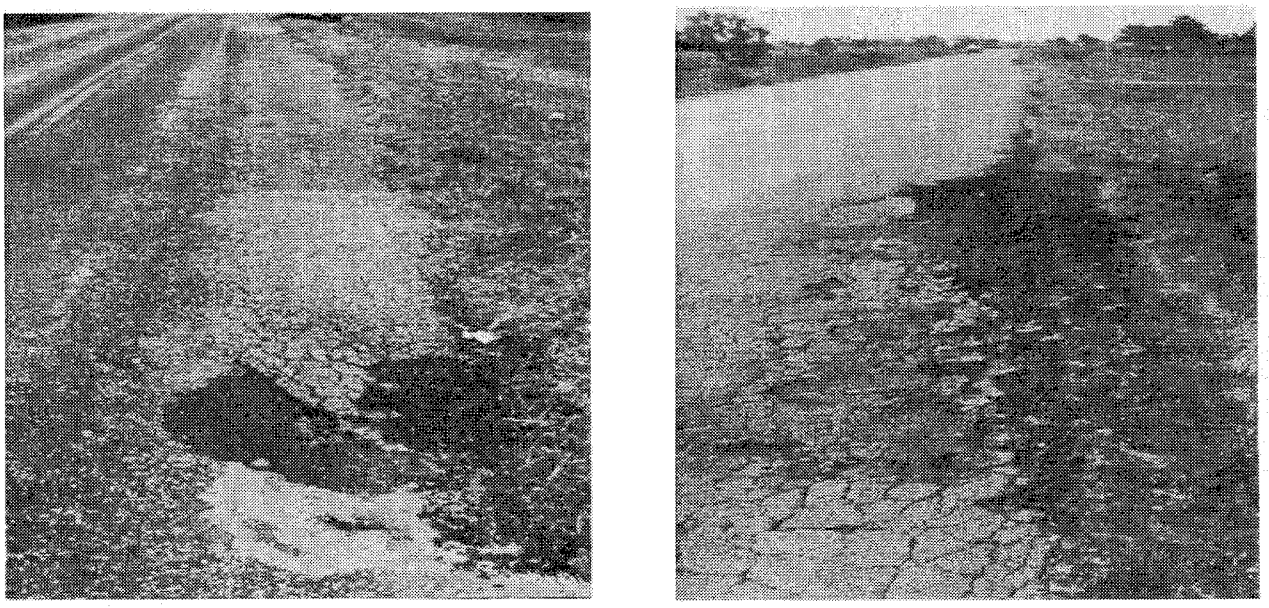

Figure 6. Examples of Failures (TxDOT 1998)

Airports

Predominant Distress	Crack Spacing	Severity	Traffic Level or Importance	Action if Only Localized	Short-term Repair 1-2 Years	Long-term Treatment 3+ Years
Transverse Cracking	>40'	Mostly tight	Low	Monitor	Monitor	Crack seal
			Medium	Monitor	Monitor	Crack seal
			High	Monitor	Monitor	Crack seal or Slurry seal
		Open, < 1/2"	Low	Monitor	Crack seal	Crack seal
			Medium	Crack seal	Crack seal	Crack seal
			High	Crack seal	Crack seal	Crack seal or seal coat or slurry seal
		> 1/2" or deteriorated	Low	Crack seal	Crack seal	Crack seal
			Medium	Crack seal or crack fill	Crack seal or crack fill	Crack fill
			High	Crack seal or crack fill	Crack seal or crack fill	Crack fill or seal coat
		Cupped or Tented	Low	Crack seal	Crack fill	Crack fill
			Medium	Blade tops of cracks or crack fill	Blade tops of cracks or crack fill	Blade tops of cracks or crack fill and seal coat
			High	Blade tops of cracks or crack fill	Blade tops of cracks or crack fill	Blade tops of cracks or crack fill and seal coat
	15' - 40'	Mostly tight	Low	Monitor	Fog seal	Fog seal
			Medium	Crack seal	Fog seal	Fog seal or slurry seal
			High	Crack seal	Fog seal or slurry seal	Fog seal or slurry seal
		Open, < 1/2"	Low	Crack seal	Crack seal	Seal coat or slurry seal
			Medium	Crack seal	Crack seal	Seal coat or slurry seal
			High	Crack seal	Crack seal	Seal coat or slurry seal
		> 1/2" or deteriorated	Low	Crack seal	Crack seal or crack fill and seal coat	Crack seal or crack fill and seal coat
			Medium	Crack seal or crack fill	Crack seal or crack fill and seal coat	Crack seal or crack fill and seal coat
			High	Crack seal or crack fill	Crack seal or crack fill and seal coat or cape seal	Crack seal or crack fill and seal coat or cape seal
		Cupped or Tented	Low	Crack seal	Crack fill	Mill and seal coat
			Medium	Blade tops of cracks or crack fill	Blade tops of cracks or crack fill	Mill and overlay
			High	Blade tops of cracks or crack fill	Blade tops of cracks or crack fill	Mill and overlay or reconstruct
	<15'	Mostly tight	Low	Monitor	Seal coat	Seal coat
			Medium	Crack seal	Seal coat or slurry seal	Seal coat or slurry seal
			High	Crack seal	Seal coat or slurry seal	Seal coat or slurry seal or cape seal
		Open, < 1/2"	Low	Crack seal	Seal coat or slurry seal	Seal coat
			Medium	Crack seal	Seal coat or slurry seal	Seal coat or slurry seal
			High	Crack seal	Seal coat or slurry seal	Seal coat or slurry seal or cape seal
		> 1/2" or deteriorated	Low	Crack seal	Crack seal or crack fill and seal coat	Mill and seal coat
			Medium	Crack seal or crack fill	Crack seal or crack fill and seal coat	Mill and overlay
			High	Crack seal or crack fill	Crack seal or crack fill and seal coat or cape seal	Mill and overlay or reconstruct
		Cupped or Tented	Low	Crack seal	Mill and seal coat	Mill and seal coat
			Medium	Blade tops of cracks or crack fill	Mill and overlay	Mill and overlay
			High	Blade tops of cracks or crack fill	Mill and overlay or reconstruct	Mill and overlay or reconstruct

Airports (Cont)

Predominant Distress	Crack Spacing (Across)	Severity	Traffic Level or Importance	Action if Only Localized	Short-term Repair 1-2 Years	Long-term Treatment 3+ Years
Longitudinal Cracking	>Lane Width	Mostly tight	Low	Crack seal	Crack seal	Crack seal
			Medium	Crack seal	Crack seal	Crack seal
			High	Crack seal	Crack seal	Crack seal
		Open, < 1/2"	Low	Crack seal	Crack seal	Crack seal
			Medium	Crack seal	Crack seal	Crack seal
			High	Crack seal	Crack seal	Crack seal
		> 1/2" or deteriorated	Low	Crack seal	Crack fill	Crack fill
			Medium	Crack fill	Crack fill	Crack fill
			High	Crack fill	Crack fill	Crack fill
	1 per lane	Mostly tight	Low	Crack seal	Crack seal	Seal coat or slurry seal
			Medium	Crack seal	Crack seal	Seal coat or slurry seal
			High	Crack seal	Crack seal	Seal coat or slurry seal
		Open, < 1/2"	Low	Crack seal	Crack seal	Seal coat or slurry seal
			Medium	Crack seal	Crack seal	Seal coat or slurry seal
			High	Crack seal	Crack seal	Seal coat or slurry seal
		> 1/2" or deteriorated	Low	Crack seal	Crack fill	Seal coat or cape seal
			Medium	Crack fill	Crack fill	Seal coat or cape seal
			High	Crack fill	Crack fill	Seal coat or cape seal
	>1 per lane	Mostly tight	Low	Crack seal	Seal coat	Seal coat or slurry seal
			Medium	Crack seal	Seal coat	Seal coat or slurry seal
			High	Crack seal	Seal coat	Seal coat or slurry seal
		Open, < 1/2"	Low	Crack seal	Seal coat	Seal coat or slurry seal
			Medium	Crack seal	Seal coat	Seal coat or slurry seal
			High	Crack seal	Seal coat	Seal coat or slurry seal
		> 1/2" or deteriorated	Low	Crack seal	Seal coat or reconstruct	Seal coat or reconstruct
			Medium	Crack seal	Seal coat or reconstruct	Seal coat or reconstruct
			High	Crack seal	Bomag and overlay	Seal coat or reconstruct

Airports (Cont)

Predominant Distress	# Lanes	Severity	Traffic Level or Importance	Fast or Slow	Action if Only Localized	Short-term Repair 1-2 Years	Long-term Treatment 3+ Years
Rutting	1 Wheelpath		Low	F	Monitor	Monitor	Monitor
				S	Monitor	Monitor	Monitor
			Medium	F	Monitor	Monitor	Monitor
		0.5" to 1" (Shallow)		S	Monitor	Monitor	Monitor
			High	F	Skin patch	Skin patch	Skin patch or microsurfacing
				S	Skin patch	Skin patch	Skin patch or microsurfacing
			Low	F	Skin patch	Skin patch	Skin patch
				S	Skin patch	Skin patch	Skin patch
			Medium	F	Skin patch	Skin patch	Skin patch or microsurfacing
		> 1" (Deep)		S	Skin patch	Skin patch	Skin patch or microsurfacing
			High	F	Dig out and patch	Dig out and patch	Microsurfacing or dig out and patch
				S	Skin patch	Skin patch	Microsurfacing or dig out and patch
	Both Wheelpaths		Low	F	Monitor	Monitor	Monitor
				S	Monitor	Monitor	Monitor
			Medium	F	Monitor	Monitor	Skin patch
		0.5" to 1" (Shallow)		S	Monitor	Monitor	Skin patch
			High	F	Skin patch	Skin patch	Skin patch or microsurfacing
				S	Skin patch	Skin patch	Skin patch or microsurfacing
			Low	F	Skin patch	Skin patch	Skin patch
				S	Skin patch	Skin patch	Skin patch
			Medium	F	Skin patch	Skin patch	Skin patch or microsurfacing
		> 1" (Deep)		S	Skin patch	Skin patch	Skin patch or microsurfacing
			High	F	Dig out and patch	Dig out and patch	Microsurfacing or dig out and patch
				S	Skin patch	Skin patch	Microsurfacing or dig out and patch

Airports (Cont)

Predominant Distress	# Lanes	Severity	Traffic Level or Importance	Action if Only Localized	Short-term Repair 1-2 Years	Long-term Treatment 3+ Years
Alligator Cracking	1 Wheelpath	Minor	Low	Crack seal if sealing nearby	Crack seal if sealing nearby	Dig out and patch
			Medium	Crack seal if sealing nearby	Crack seal if sealing nearby	Dig out and patch
			High	Crack seal if sealing nearby	Dig out and patch	Dig out and patch
		Major	Low	Crack seal if sealing nearby	Crack seal if sealing nearby	Dig out and patch
			Medium	Dig out and patch	Dig out and patch	Dig out and patch
			High	Dig out and patch	Dig out and patch	Dig out and patch
	Both Wheelpaths	Minor	Low	Crack seal if sealing nearby	Crack seal if sealing nearby	Dig out and patch
			Medium	Dig out and patch	Dig out and patch	Dig out and patch
			High	Dig out and patch	Dig out and patch	Dig out and patch
		Major	Low	Dig out and patch	Dig out and patch	Dig out and patch
			Medium	Dig out and patch	Dig out and patch	Dig out, patch, and overlay
			High	Dig out and patch	Dig out and patch	Dig out, patch, and overlay

Predominant Distress	Severity	Traffic Level or Importance	Action if Only Localized	Short-term Repair 1-2 Years	Long-term Treatment 3+ Years
Swell/ Roughness	Some Roughness	Low	Monitor	Monitor	Monitor
		Medium	Monitor	Blade tops and patch	Blade tops and patch
		High	Blade tops and patch	Blade tops and patch	Blade tops and patch
	Rough	Low	Monitor	Monitor	Monitor
		Medium	Blade tops and patch	Blade tops and patch	Blade tops and patch
		High	Blade tops and patch	Blade tops and patch	Blade tops and patch

Predominant Distress	Few or Many	Traffic Level or Importance	Action if Only Localized	Short-term Repair 1-2 Years	Long-term Treatment 3+ Years
Failures	Few	Low	Dig out and patch	Dig out and patch	Dig out and patch
		Medium	Dig out and patch	Dig out and patch	Dig out and patch
		High	Dig out and patch	Dig out and patch	Dig out, patch, and overlay
	Many	Low	Dig out and patch	Dig out and patch	Dig out and patch
		Medium	Dig out and patch	Dig out, patch, and overlay	Dig out, patch, and overlay
		High	Dig out and patch	Dig out, patch, and overlay	Dig out, patch, and overlay

Tom Freeman