TECHNIQUES FOR MITIGATION OF REFLECTIVE CRACKS
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ABSTRACT

Reflective cracks are a major concern to airport management personnel, because they can significantly reduce the service life of hot mix asphalt (HMA) overlays of airside airport pavements. Reflective cracks also pose safety problems for airfield pavements because of their potential to cause Foreign Object Debris (FOD), and loss of ride quality or smoothness. These reflective cracks have to be maintained to prevent the generation of loose aggregate and increased roughness that can be detrimental to aircraft operations.

The purpose of Airport Asphalt Pavement Technology Program (AAPTP) Project 05-04 was to provide guidance for designing rehabilitation strategies of airside pavements to mitigate the occurrence of reflective cracks in HMA overlays of rigid and flexible pavements. The technical approach and data sources used to determine the effectiveness of different treatment methods was extracted from three areas: information and data included in the literature (including the comparative field studies), data and information obtained from airfields and roadway projects that have placed one to multiple treatment methods, and information from detailed site visits. The probability of success and risk factors were used to rate the reflective cracking mitigation methods. The overall rating of a mitigation method was simply determined by multiplying its probability of success and risk values.

Decision trees were prepared for selecting appropriate reflective cracking mitigation techniques and methods that depend on the type and condition of the existing pavement. The decision trees were prepared based on the results from previous research studies, forensic investigation of rehabilitation strategies for the methods identified, a detailed survey of various projects, and experience documented in the literature. This paper overviews the decision tress and recommendations from AAPTP Project 05-04 for mitigation of reflective cracks in HMA overlays.

INTRODUCTION

Reflective cracks are a major concern to airport management personnel because they can significantly reduce the service life of hot mix asphalt (HMA) overlays of airside airport pavements. When HMA overlays are placed over jointed and/or severely cracked rigid and flexible pavements, the cracks and joints in the existing pavement can reflect to the surface in a short period of time. These cracks allow water to penetrate the underlying layers causing further damage to the pavement structure by destroying the bond between the existing pavement and overlay, causing moisture damage in the HMA layers, as well as weakening unbound layers, and result in a loss of ride quality or smoothness.

Although the problems of reflective cracks has been known for decades, established procedures to select, design, and construct effective mitigation strategies have not been adopted. Federal Aviation Administration (FAA) AC-150/5320-6E [1] provides general design recommendations for HMA overlays of existing Portland Cement Concrete (PCC) pavements, but detailed guidance is not provided on what constitutes an appropriate treatment method for a given situation. In addition, the Advisory Circular (AC) does not address HMA overlays of distressed flexible or composite pavements from the standpoint of reflective cracks.

Numerous studies throughout the previous three decades have attempted to develop methods and materials to prevent these cracks from occurring within the design period. Most of the materials and methods in use today, however, only delay or limit the severity of the reflective cracks. One possible reason for the shortened service life of HMA overlays is that the rehabilitation strategy selected for a specific project is insufficient for the condition of the existing pavement.

Despite significant advances in the understanding of reflective cracking phenomenon, there is still minimal practical technical guidance needed for an airport pavement designer or contractor on assessing when a given pavement can be effectively treated with reflective crack control measures, what constitutes an effective method for a given situation, how to apply the treatment, and how to evaluate the effectiveness of the treatment prior to and after installation/construction of the treatment. In this paper, a summary of the decision trees for selecting an adequate mitigation strategy for a specific condition is presented. These decision trees were prepared by Von Quintus, et al. for airport engineers and managers to use in mitigating reflective cracking [2, 3].

MECHANISMS OF REFLECTIVE CRACKING

The basic mechanisms leading to the occurrence of reflective cracks are horizontal and differential vertical movements between the original pavement and HMA overlay. The classical theory on the cause of reflective cracks is shown in Figure 1. Reflective cracks can be caused by horizontal movements from the expansion and contraction of the PCC slabs that are concentrated at joints and cracks, and from increased vertical deflections at the joints and cracks. Although reflective cracks are more associated with rigid or composite pavements, they do occur in HMA overlays of flexible pavements. Reflective cracks have been attributed to three mechanisms, which are listed below.

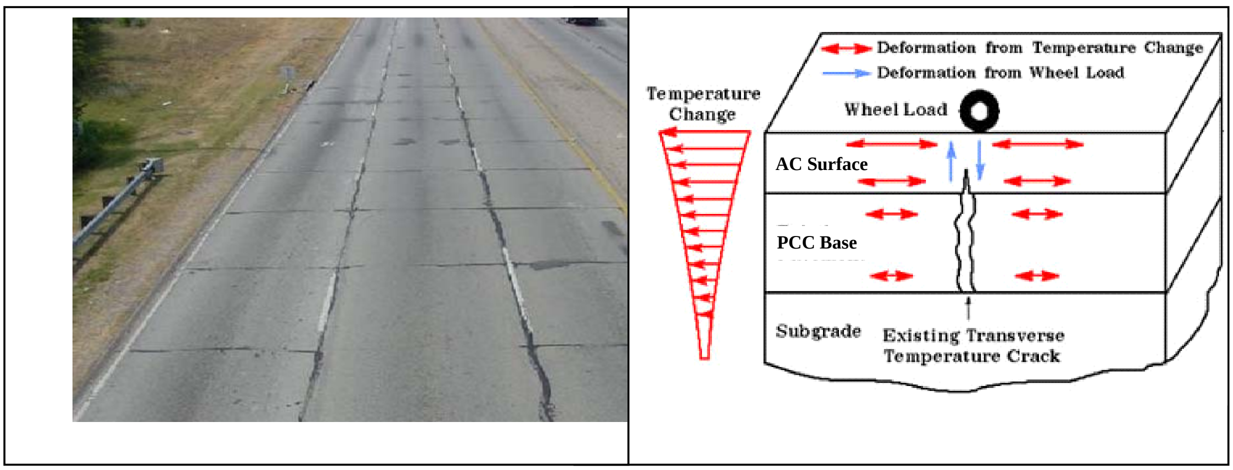


Figure 1. Reflective Cracking in HMA Overlays of PCC Pavements.

1. The most common accepted cause of reflective cracking is from horizontal movements concentrated at joints and cracks in the existing pavement, and is referred to as thermally induced cracking. These horizontal movements are caused by temperature changes in the PCC slab and from temperature changes in HMA layers that exhibit transverse cracks.

The tensile stresses and strains resulting from joint movements become critical in the areas of construction joints and cracks, because of the bond between the overlay and existing pavement. Reflection cracks caused by this mechanism initiate at the bottom of the HMA overlay.

2. The second mechanism causing reflective cracking is differential vertical deflections across joints and cracks in the existing pavement and is referred to as traffic induced cracking. Differential vertical deflections concentrated at the joints and cracks are caused by wheel loads that depress abutting slabs or crack faces resulting in shear-stress concentrations in the HMA overlay at the joints and cracks. The differential vertical deflections can be caused by the gradual reduction of load transfer at the joints and cracks in the PCC pavement or the development of voids beneath the PCC at joints and cracks.

3. A third mechanism that causes reflective cracks is the curling of PCC slabs during colder temperatures when the HMA overlay is stiff and brittle. Reflective cracks caused by this mechanism initiate at the surface where the majority of mixture aging takes place and propagate downward. The upward curl between adjacent slabs result in tensile stresses at the surface of the overlay, and when the tensile stress exceeds the tensile strength, a crack develops above the joint. HMA mixtures with higher air voids will age faster, resulting in higher modulus values but lower tensile strains at failure; in other words, brittle mixtures susceptible to cracking.

In summary, the commonly attributed factors that cause movements at joints and cracks in the base pavement (termed trigger factors) are low temperatures (temperature drop), wheel loads, freeze-thaw cycles, aging of the HMA near the surface (level of air voids), and shrinkage of PCC, HMA, and cement treated base layers.

MITIGATION STRATEGIES—CONCEPTS AND METHODS

Numerous materials and methods have been tried to solve the reflective cracking problem with varying degrees of success. These methods include: increased overlay thickness, modification of asphalt and mixture properties, crack arresting (reinforcing) interlayer, stress absorbing membrane interlayer (SAMI), strain tolerant interlayer, treatment at cracks/joints in existing pavements, and fracturing existing PCC pavements (crack/seat, break/seat, and rubblization). Button and Lytton [4] classified the methods to address reflective cracking into three major categories: reinforcement of the overlay, stress or stain relieving interlayer, and re-strengthening of cracked pavement before overlaying. For purposes of this paper and project, however, those three were expanded into five categories. Table 1 lists those five categories.

PERFORMANCE REVIEWS & EVALUATIONS

The present state-of-the-art for mitigating reflective cracks in HMA overlays is to a large degree still based on experience gained from trial and error methods of in service pavements; both for highways and airfields. The data sources used to determine the effectiveness of different treatment methods was extracted from three areas: (1) information and data included in the literature, including comparative field studies, (2) data and information obtained from airfields and roadway projects that have placed one to multiple treatment methods, and (3) information from the detailed site visits where different mitigation strategies had been used. Site visits were made within the study to a number of airfield pavements to investigate the performance of different mitigation strategies and methods. The site visits included discussions with airport managers, design engineers, and field inspectors, as well as observing the surface condition of the HMA overlay.

Table 1. Categories to Mitigate Reflective Cracking of HMA Overlays.

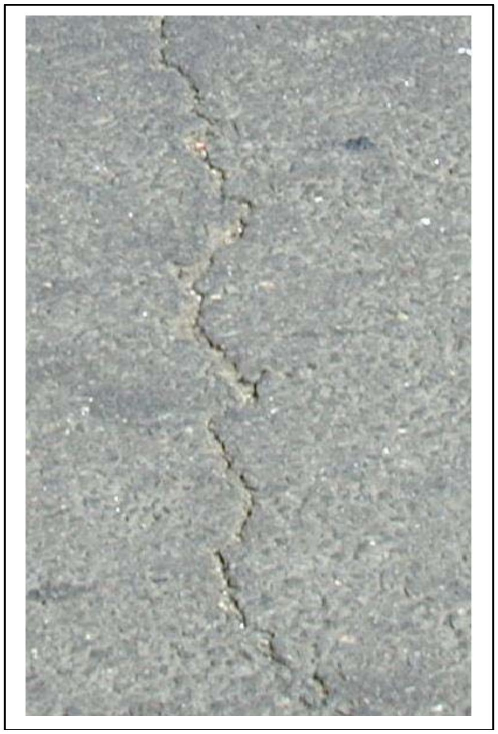
Existing PCC or Rigid Pavements	**Existing HMA or Flexible Pavements**
1. Modify/strengthen existing PCC surface. • *Crack or break & seat PCC slabs.* • *Rubblize PCC slabs.* 2. Overlay layer/mixture modification. • *Thick HMA layers.* • *Modified asphalt & specialty mixtures.* 3. Cushion or crack relief layer. • *Crushed stone aggregate & sand.* • *HMA crack relief layer.* • *Bond breaker layer.* 4. Reinforcement of HMA overlays. • *Steel reinforcement.* • *Geosynthetics.* 5. Crack control method.	1. Modify/strengthen existing HMA surface. • *Mill & Replace Wearing Surface.* • *Hot In Place Recycling & Heater Scarification* • *Full-Depth Reclamation.* 2. Overlay layer/mixture modification. • *Thick HMA layers.* • *Modified asphalt & specialty mixtures.* 3. Stress or strain relieving interlayer. • *Chip seals.* • *STRATA—A proprietary material.* • *Interlayer stress absorbing composite—A proprietary material.* • *HMA interlayer with material modification.* • *Fabrics—Geosynthetics.* 4. Reinforcement of HMA overlays. • *Steel reinforcement.* • *Geosynthetics.* 5. Crack control method.

Results from previous studies documented in the literature, evaluations documented in field reports, and the site visits were used to compare the performance characteristics of different mitigation strategies. Figure 2 shows the reflective cracking of moderate to high severity levels that were used in recording data on crack progression during the site visits and to summarize the data from other airfield studies on reflective cracking, while Table 2 lists the projects that were contacted and/or visited, and the mitigation strategies that were used.

The final report for AAPTP 05-04 documents the results and performance reviews from all information used in the study (Von Quintus, et al. [2]). Based on the comprehensive review of the different reflective cracking mitigation strategies applied by various airport and highway projects under different conditions, the following bullets itemize and summarize findings from the literature review site visits.

- No pavement rehabilitation technique has been shown to prevent reflective cracking, with the exception of rubblizing PCC pavements and full-depth reclamation for flexible pavements. However, several techniques have demonstrated the ability to reduce reflective cracking when designed and constructed properly. The performance and effectiveness of all reflective cracking mitigation strategies is heavily dependent on construction quality (good compaction—low air voids), good workmanship, and use of HMA mixtures for the overlay that are not susceptible to moisture damage.

- A major element for selecting, designing, and constructing a rehabilitation strategy is adequately determining the structural condition of the existing pavement and other site condition features to determine the reflective cracking mechanisms that must be addressed.



Low to Moderate Severity Reflective Crack—Crack easily seen and extends across entire pavement width; secondary cracks beginning to occur.

Moderate to High Severity Reflective Crack—Crack has started to deteriorate, secondary cracks have occurred.

Figure 2. Reflective Crack Severity Levels Used in Recording Crack Progression During the Site Visits.

- Climate, structural condition of the existing pavement and overlay thickness are the three parameters that have the greatest effect relative to mitigating reflective cracks. The climatic conditions, especially the temperature conditions (such as freeze-thaw cycles and extremely cold weather conditions) have significant effect on the performance of different interlayer products (such as geotextile and asphalt rubber SAMI products) for controlling reflective cracking (Amini [5]). The freeze-thaw cycles in severe cold climates can cause contraction and expansion of water within the pavement, which accelerates the damage from water filtration. All reflective cracking retarding products or processes perform better in warm and mild climates than in the hard-freeze or freeze-thaw cycling climates.
- One reason for the poor performance of some of the thinner reflective cracking mitigation methods is that the HMA overlay was found to be too thin for the aircraft traffic, climate, and on-site conditions.

Table 2. List of Reflective Cracking Projects Used for the Site Visits [2].

No.	Airport Name	Rehab. Type	Year of Overlay	Climate	Aircraft Loading	Reflection Cracking Mitigation Strategy
1	Willard; Champaign, IL	HMA/PCC	1999	Freeze-Thaw	GA/Com.	Includes two strategies: stress relieving interlayer (ISAC), reinforcing fabric (PavePrep); and 2 traffic levels.
2	Rantoul, IL	HMA/PCC (WWII)	1999	Freeze-Thaw	GA	Three treatments: ISAC, rubblization, & saw and seal.
3	Smyrna, TN	HMA/PCC	1993-94	Warm	GA	Two treatments: double bituminous surface treatment [DBST] as a SAMI, reinforcing fabric.
4	Purdue, IN	HMA/HMA	1997	Freeze-Thaw	GA	Two treatments: pulverization or CIPR, Paveprep fabric reinforcing.
5	Cannon AFB, NM	HMA/PCC	1998	Warm	Military	The only airport using saw and seal technique in this region.
6	George Bush Intercontinental Houston, TX	HMA/HMA	1999	Warm	Com.	Only stress relieving project (SAMI) with HMA over existing HMA pavement.
7	Peoria, IL	HMA/HMA	2001	Freeze-Thaw	GA/Com.	Using Glasgrid fabric reinforcing technique with two traffic levels.
8	Mandan, ND	HMA/HMA	1998	Hard-Freeze	GA	Several treatment techniques were used: PavePrep fabric reinforcing, Glasgrid reinforcing, and Mill & Fill with HMA crack control.
9	Fargo, ND	HMA/HMA	1996	Hard-Freeze	GA	Two reinforcing products: Geogrid and Petromat. This project is similar as project 8.
10	Dayton International, OH	HMA/PCC	2007	Freeze-Thaw	GA/Com.	Two projects: one using fabric reinforcing (“Center One” apron); the other upcoming project using membrane and fabric on taxiway.
11	Willow Run Airfield; Detroit, MI	HMA/PCC	1955, 1960	Hard-Freeze	GA	Using HMA overlay and welded wire fabric reinforcing; the only reinforcing project in Hard-Freeze climate. Project was not visited because of missing historical and other data.

No.	Airport Name	Rehab. Type	Year of Overlay	Climate	Aircraft Loading	Reflection Cracking Mitigation Strategy
12	Huntsville International, AL	HMA/PCC	2003	Warm	Com.	Composite over PCC covered by thin HMA overlay (1 inch), the only stress relieving project in warm climate visited.
13	Selfridge Air National Guard Base, MI	HMA/PCC	2002	Hard-Freeze	Military	Rubblization, the only crack control project in Hard-Freeze climate with sufficient data and information.
14	Reno International, NV	HMA/PCC	Before 1978	Warm	Com.	Reinforcing steel fiber used inside of the PCC. This project was not selected because it was not clear if reinforcing was in HMA overlay or just using reinforced PCC pavement.
15	Wright-Patterson AFB; Dayton, OH	HMA/PCC	---	Freeze-Thaw	Military	Rubblization; the only crack control project in F-T climate. This project was not visited considering its similar treatment & climate condition as project 2.
16	Wilmington International Airport, NC	HMA/---	Summer 1977	Warm	Com.	Several techniques were used; stress relieving (SAMI) and Nonwoven polypropylene fabric reinforcing. The project was not visited as the existing pavement type was unknown.

- Poor load transfer and voids beneath a crack or joint in the old PCC pavement will allow traffic loads to accelerate the rate of reflective cracking. Joints and cracks with load transfer efficiencies greater than 80 percent have the higher success rates in retarding reflective cracking.
- Fabrics perform best when used over old HMA pavements with closely spaced random or alligator cracks (not caused by base or subgrade failures) with crack widths less than 1/8 in (3 mm). Fabrics do not perform well when placed on old PCC pavement joints/cracks or over wide (greater than 3/8 in [9.5 mm]) transverse or shrinkage cracks in old HMA pavements. Fabrics and SAMIs that act as moisture barriers prevent rising water and vapor from the base or subgrade that can cause additional distress in the pavement layers. These materials also prevent water infiltration into the underlying pavement, as fatigue and thermal cracks begin to initiate within the overlay wearing surface.
- SAMI layers, which work on the principal of isolating the horizontal movement of the base pavement from the overlay, have been successfully employed to reduce the rate of reflective cracking when the crack spacing and crack widths are smaller. It has been found that eventually the crack will work through, even with the more compliant SAMI materials.

- Steel reinforcement and geogrids have been effective in reducing reflective cracks from existing HMA layers. These materials are less effective when the overlay is placed over jointed concrete pavements, but definitely keeps the cracks narrower as they occur. A grid or strip reinforcing product must have a higher modulus than the HMA mixture surrounding it, if it is to reinforce the overlay. These products are effective in reinforcing the overlay against horizontal thermally induced movements but not against the traffic-induced bending and shearing movements.
- Thick crack relief layers consisting of large-stone, open-graded, asphalt-stabilized layers (defined as cushion courses within this report), which also work on the base isolation principle, have not performed as expected in some cases. The stones simply do not act as "ball bearings," as was originally anticipated. Instead, their interparticle friction eventually transmitted horizontal movements of the base pavement into the overlay.
- Saw and seal of the HMA overlay to match the joints in the old PCC pavements has met with great success in many places. Several highway agencies have used it as a preferred rehabilitation method. However, in some instances "tenting" of the sealant has been a problem or concern. This concern has resulted in a cautious use of this technique on high-speed facilities such as interstate highways or airport runways and parallel taxiways.
- Of the fracturing techniques used to destroy the slab action of base PCC pavement, the state-of-the-practice is slowly moving towards rubblization because it has been shown to be most effective. ARA (Von Quintus, et al. [6]) completed a rubblization study under the Wisconsin Highway Research Program (WHRP) and found that the rubblization process was successful in eliminating the occurrence of reflective cracks after the Department increased the minimum HMA overlay thickness for constructability reasons. Also, Change Number 4 to FAA AC 150/5320-6 has switched the preferred fracturing technique for old PCC pavements that are in very poor condition from crack-and-seat to rubblization (FAA [1]).

RATING OF MITIGATION STRATEGIES: PROBABILITY OF SUCCESS & RISKS

The probability of success and risk factors were used to rate the reflective cracking mitigation methods. The overall rating of a mitigation method was simply determined by multiplying its probability of success and risk values. Both of these terms and the factors used in the analysis are defined below:

- The probability of success for the treatment methods were defined based on the performance data documented in the literature and from the site visits. This factor is normally determined from the survivability or probability of failure relationship for a specific treatment method. Table 3 is a summary of the success rate scale (probability of success) that was used in quantifying the different treatment methods. Projects with accelerated reflective cracks were defined as moderate to high severity cracks that occur within 25 percent of the rehabilitation design life (refer to Figure 2).

- Confidence or risk factors are used as a tool to indicate the uncertainty associated with the results obtained for treatment methods that have not been used extensively and do not have an extensive database substantiating their use. The confidence factor accounts for the uncertainty associated with results obtained for methods that are not yet in routine use by industry and for which long-term performance data do not yet exist. Confidence factors are normally defined on a scale of 0 to 1. A confidence factor equal to 0 implies that there is no confidence that the treatment method will perform as expected or designed. Conversely, a confidence factor of 1 means that there is full confidence that the method will perform as expected in mitigating reflective cracks. In other words, the method is routinely used and appropriate performance data are available. The risk of using different mitigation strategies is an important parameter in assessing and comparing strategies that have been in use for different periods of time. Table 4 summarizes the risk categories and values used in comparing the different treatment methods.

Table 3. Success Categories Used to Rate Reflective Cracking Mitigation Methods [2].

Percent of Projects Reported Exhibiting Premature or Accelerated Reflective Cracking	**Probability of Success Category and Value**	
<2 (few projects exhibiting premature reflective cracking)	Very High	1.0
2 to 10	High	0.9
10 to 25	Moderate	0.75
25 to 50	Low	0.6
>50 (extensive number of projects exhibiting premature reflective cracking)	Very Low	0.5

Table 4. Risk Categories Used to Rate Reflective Cracking Mitigation Methods [2].

Number of Projects for Site Parameters	**Number of Years in Use**				
	<5	**5 to 10**	**10 to 15**	**15 to 20**	**>20**
<10	Very High	Very High	High	Moderate	Low
10 to 20	Very High	High	Moderate	Low	Low
20 to 50	High	Moderate	Low	Low	Very Low
>50	High	Moderate	Low	Very Low	Very Low
Risk Category—The following defines typical values associated with each category of risk: Very Low = 1.0; Low = 0.9; Moderate = 0.75; High = 0.6; Very High = 0.5					

Table 5 summarizes the overall rating for each reflective cracking mitigation strategy. It should be noted that the higher rating does not necessarily mean that the strategy listed is the most cost effective repair method for the conditions noted. A discussion of the individual categories and combination of methods to increase the probability of success and lower the risk of exhibiting reflective cracks for different site and design conditions is included in the final report for AAPTP Project 05-04 (Von Quintus, et al., 2009 [2]).

Table 5. Overall Rating of Reflective Cracking Mitigation Methods [2].

Method		**Existing Pavement**	**Climate**	**Rating of: Success**	**Risk**	**Value**	**Notes or Assumptions**
Modify Surface of Existing Pavement	Rubblization	PCC	All	Very High	Low	0.90	Strength of foundation is important.
	Crack & Seat		All	Moderate	Low	0.68	
	Full-depth reclamation & CIPR	HMA	All	Very High	Very Low	1.0	
	HIPR or Heater Scarification		All	Moderate	Low	0.68	Cracks confined to surface layer or wearing surface.
	Mill & Inlay		All	High	Very Low	0.90	
Strengthen or Modify HMA Overlay Mixture	Thick HMA Overlay	HMA	All	Moderate	Moderate	0.56	Existing pavement structurally adequate.
		PCC	Area I	Very Low	Low	0.45	Slabs intact & structurally adequate.
			Areas II & III	Very Low	High	0.30	
	Modified HMA & Specialty Mixture	HMA	All	Low	Low	0.54	Existing pavement structurally adequate.
		PCC	Area I	Low	Moderate	0.45	
			Areas II & III	Very Low	Moderate	0.38	
Stress & Strain Relieving Interlayer	Strata	PCC	All	Moderate	High	0.45	Slabs intact & structurally adequate.
	SAMI		All	Low	High	0.36	
	ISAC		All	High	Very High	0.45	
	Fabrics		All	Very Low	High	0.30	

	Strata	HMA	All	Very High	Moderate	0.75	Existing pavement structurally adequate.
	SAMI		All	High	Low	0.81	
	ISAC		All	Very High	Very High	0.50	
	Fabrics		All	Moderate	Low	0.68	
	Bond Breaker	PCC & HMA	All	Low	High	0.36	
Cushion Course	Crack Relief Layer	PCC & HMA	All	Moderate	Low	0.68	Existing condition has adequate clearance requirements for the thicker layers.
	Aggregate Base	PCC	All	Moderate	Moderate	0.56	
Reinforce Overlay	Welded Wire Fabric	PCC & HMA	Area I	Moderate	Moderate	0.56	
			Areas II & III	Low	High	0.36	
	Geogrid	PCC & HMA	Area I	High	Moderate	0.68	
			Areas II & III	Low	High	0.36	
	Composite Materials	PCC & HMA	Area I	Moderate	Moderate	0.56	
			Areas II & III	Low	High	0.36	
Crack Control	Saw & Seal	PCC	All	Very High	Very Low	1.0	Existing pavement structurally adequate.

NOTE: The success and risk categories listed above are based on the individual methods. A combination of strategies could be used to increase the success and risk rating of each method.

DECISION TRESS FOR IDENTIFYING APPROPRIATE MITIGATION TECHNIQUES

The key to designing an adequate rehabilitation strategy over a design period is to select the right treatment method for the right condition application. Decision trees were prepared for selecting appropriate reflective cracking mitigation techniques and methods that depend on the type and condition of the existing pavement. Figures 3 through 5 are decision trees for selecting a mitigation method to minimize the impact of reflection cracking on the rehabilitation design for different types and conditions of existing pavements. The decision trees were prepared based on the results from previous research studies, forensic investigation of rehabilitation strategies for the different mitigation strategies included within the study, a detailed survey of various projects, and experience documented in the literature. A minimum rating of 0.65 was used in identifying the applicable mitigation strategies.

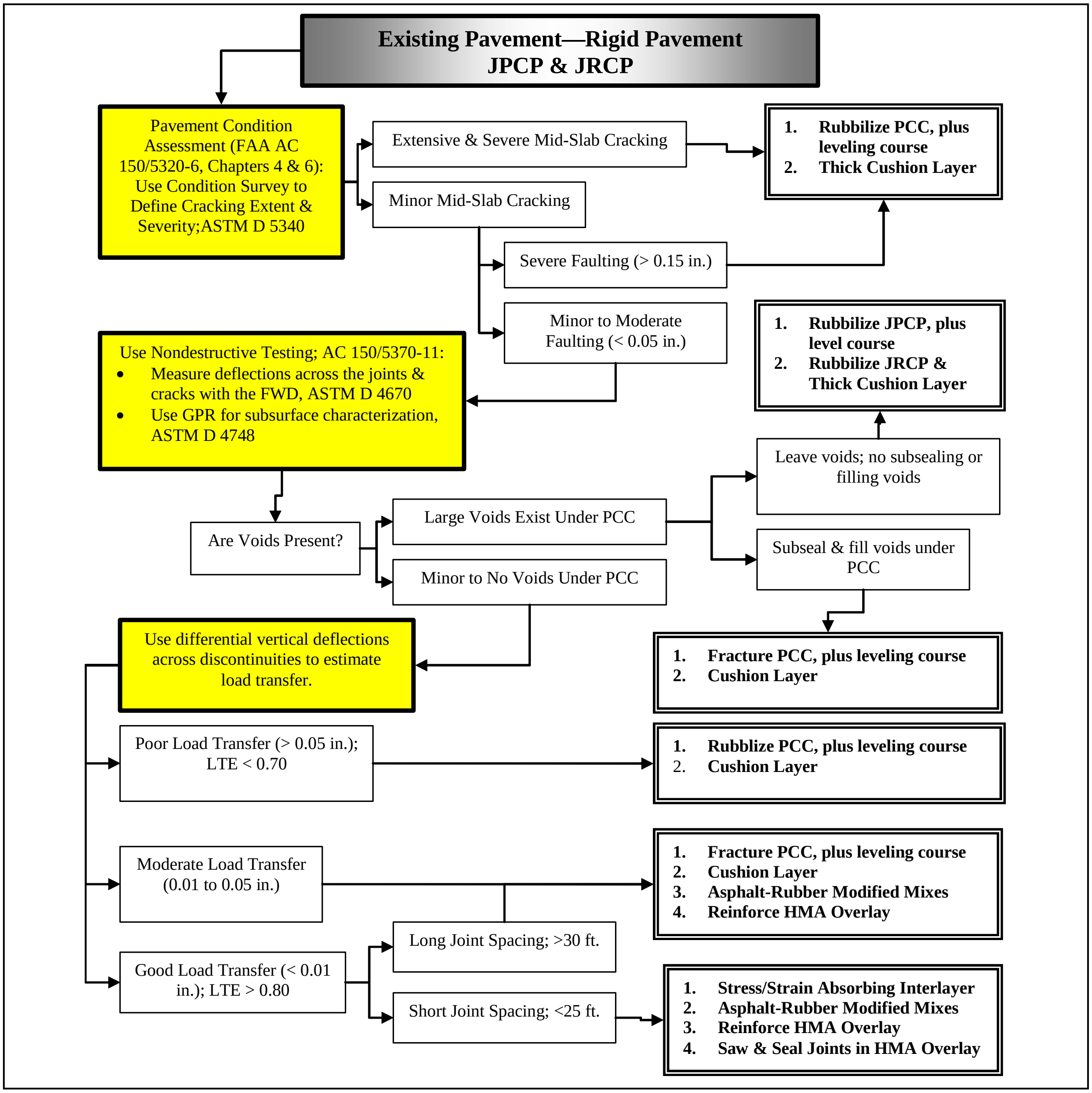


Figure 3. Decision Tree Providing Guidance to Mitigate Reflective Cracks in HMA Overlays of Existing Rigid Pavements [2,3].

It should be noted that the reflective cracking mitigation methods can be used individually or in combination with each other. After one or multiple rehabilitation design strategies have been selected, an economic analysis should be completed to determine the life cycle cost (LCC) of each strategy to select the least costly one. Report FAA-RD-81-78 describes the economic analysis for airport pavement rehabilitation alternatives (Epps and Wootan [7]). The difficulty in comparing the LCC of different reflective cracking mitigation methods is estimating the expected service life of the rehabilitation strategy and when reflective cracks and other distresses start to appear. The remaining section provides some discussion and information on the benefits and limitations of different methods for use in LCC analysis.

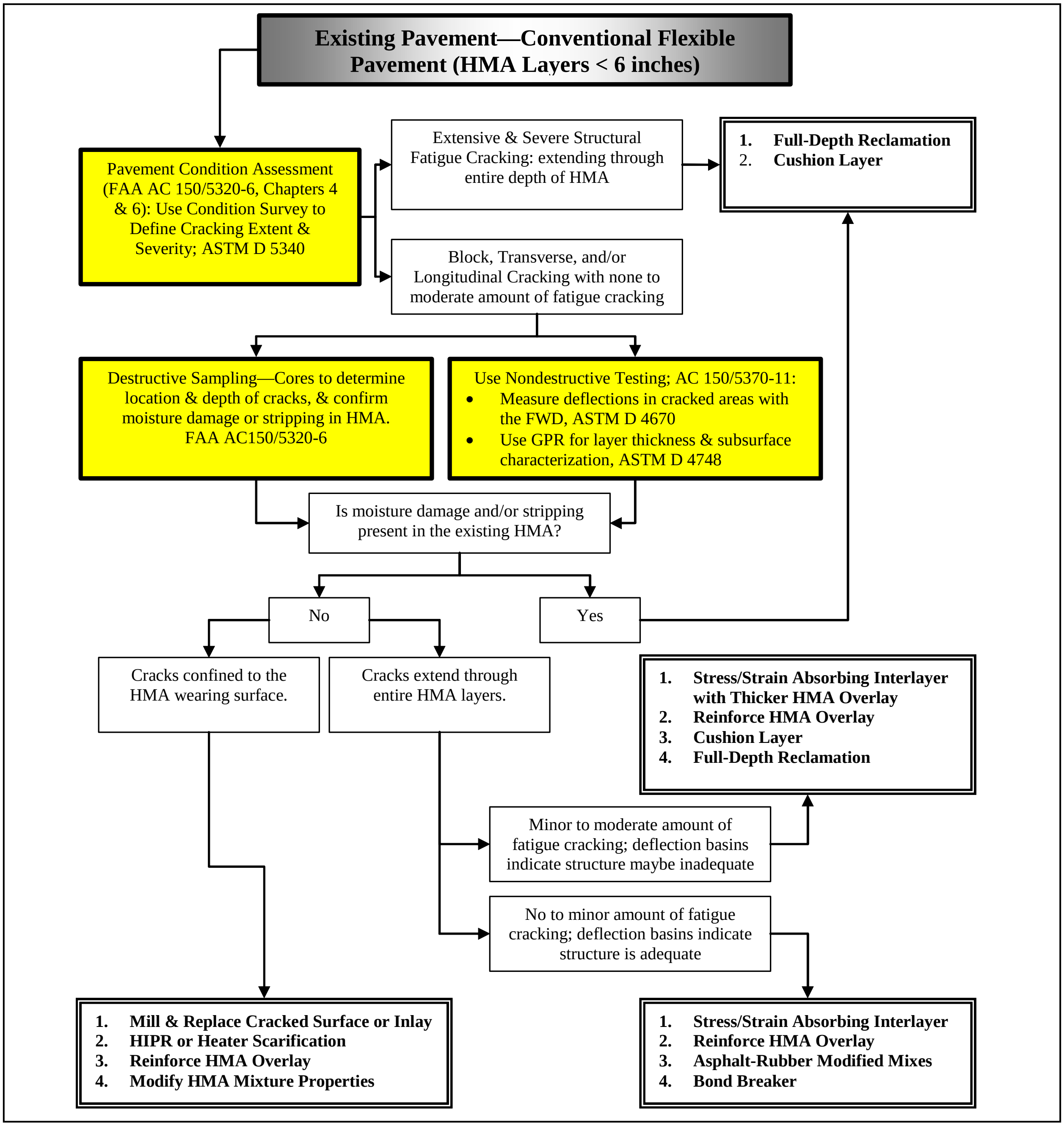


Figure 4. Decision Tree Providing Guidance to Mitigate Reflective Cracks in HMA Overlays of Existing Conventional Flexible Pavements [2,3].

CONCLUSIONS

In summary, there is no material or treatment method that will prevent reflective cracks from occurring under all conditions, with the exception of FDR for flexible pavements and rubblization for rigid pavements. FDR for flexible pavements and rubblization for rigid pavements, however, will not always be a cost-effective rehabilitation strategy. In order to select and design an adequate and cost effective rehabilitation strategy, a detailed pavement evaluation program is needed to determine the site features and condition of the existing pavement to identify the reflective cracking mechanism that must be designed for. The HMA overlay thickness and reflective cracking strategy should be determined based on the number of expected aircraft operations, climate, and other site features.

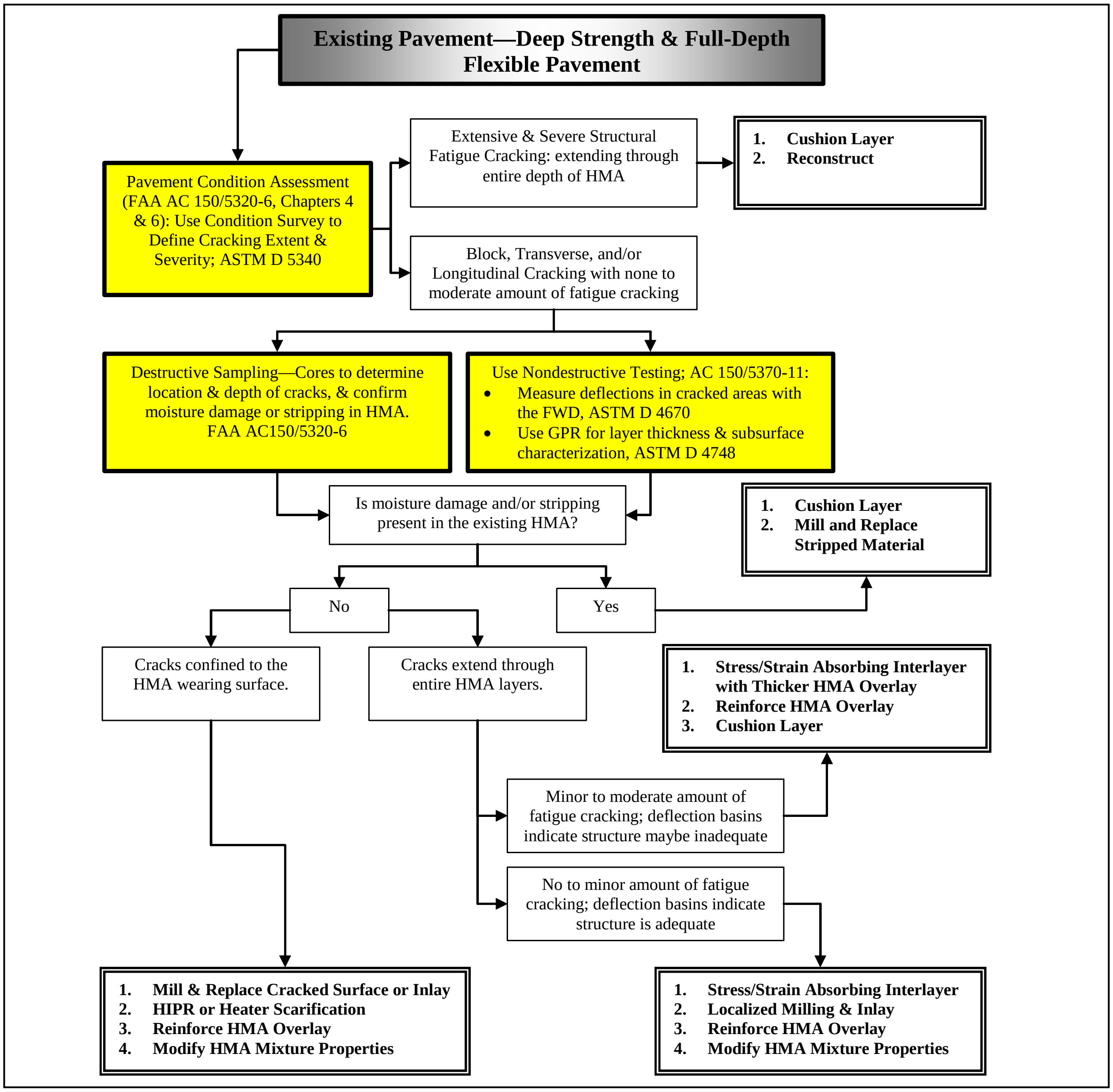


Figure 5. Decision Tree Providing Guidance to Mitigate Reflective Cracks in HMA Overlays of Existing Deep Strength and Full-Depth Flexible Pavements [2,3].

At best, the use of various materials and methods available today only slightly delay or limit the severity of the reflective cracks. One possible reason for this reduced service life of HMA overlays is that the rehabilitation strategy selected for a specific project is insufficient for the condition of the existing pavement. AAPTP Project 05-04 provides guidance to the FAA and others responsible for managing and designing rehabilitation strategies of airside pavements. The key to designing an adequate rehabilitation strategy over a design period is to select the right treatment method for the right condition application. This guidance includes selection and use of materials and treatment methods to mitigate the occurrence of reflective cracks in HMA overlays of rigid and flexible pavements. The technical guidance is provided in a separate document—*Technical Guide for Techniques for Mitigation of Reflective Cracks*, dated February 2009 (Von Quintus, et al. [3]). The decision trees (Figures 3 to 5) were included in the Technical Guide for selecting appropriate reflective cracking mitigation techniques and methods that depend on the type and condition of the existing pavement.

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