Florida Department of Transportation
Aviation Office

Statewide Airfield Pavement
Management Program

Update to Methodology and Procedures for Data Collection and Condition Analysis for Whitetopping Pavement

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1. Background

Florida has 128 public-use commercial service and general aviation (GA) airports. The Florida Department of Transportation Aviation Office's Statewide Airfield Pavement Management Program (SAPMP) supports the participating airports in maintaining an effective pavement management system in accordance with Public Law 103-305. In total, the SAPMP consists of 95 public-use airport participants.

The FDOT SAPMP adheres to the Federal Aviation Administration's (FAA) guidance for Airport Pavement Management Programs as defined by the following documents:

Table 1. Project Standards and Guidance

Document	Title	Current Version
FAA AC 150/5380-7	Airport Pavement Management Program (PMP)	150/5380-7B, issued 10/10/2014
FAA AC 150/5380-6	Guidelines and Procedures for Maintenance of Airport Pavements	150/5380-6C, issued 10/10/2014
FAA AC 150/5320-17	Airfield Pavement Surface Evaluation and Rating Manuals	150/5320-17A, issued 09/10/2014
FAA AC 150/5320-6	Airport Pavement Design and Evaluation	150/5320-6F, issued 11/10/2016
FAA AC 150/5370-10	Standard Specifications for Construction of Airports	150/5370-10H, issued 12/21/2018
ASTM D5340	Standard Test Method for Airport Pavement Condition Index Surveys	D5340-12, reapproved 2018

The SAPMP includes the performance of a visual pavement functional condition assessment on all airfield pavements maintained by the airports. The condition assessment method used is the Pavement Condition Index (PCI) as defined by the ASTM D5340 "Standard Test Method for Airport Pavement Condition Index Surveys" and stated by Section 2.2.1.4, Pavement Condition Data, of the AC 150/5380-7B "Airport Pavement Management Program (PMP)." The ASTM D5340 PCI Survey Method satisfies the requirements for "an objective and repeatable system for evaluating pavement condition."

Of the 95 participating airports, there are three (3) airports that have a unique composite pavement section known as "Whitetopping" within their airfield pavement system inventory that deviates from the current FAA Advisory Circular 150/5320-6F "Airport Pavement Design and Evaluation." "Whitetopping" is a pavement construction technique otherwise known as "Concrete Overlay." It is recognized that Whitetopping Concrete Overlays do not adhere to the current FAA AC 150/5320-6 guidance for Concrete Overlays based on material specification, documented concrete strength, concrete minimum thickness, joint type, joint sealant, joint layout, and load transfer. It is recognized that the ASTM D5340-12 (current version) may not be suitable to utilize as means to evaluate condition for the Whitetopping Concrete Overlays.

This document serves as an update to the Methodology and Procedures for Data Collection and Condition Analysis for Whitetopping Pavements in Florida Airports.

Whitetopping in Florida Airports

Williston Municipal Airport (X60), Fernandina Beach Municipal Airport (FHB), and New Smyrna Beach Airport (EVB) have airfield pavements that consist of Concrete Overlay pavement facilities that are identified as Whitetopping Concrete Overlays. The Whitetopping Concrete Overlays at these facilities can be classified as a modification to standards of the FAA AC 150/5320-6 "Airport Pavement Design and Evaluation" based on the use of non-standard pavement section thickness, joint type construction, and joint layout construction. Based on available FDOT record documentation, it is not known if the Whitetopping Concrete Overlays at these facilities adhered to the FAA AC 150/5370-10 "Standard Specifications for Construction of Airports." It has been estimated that the Whitetopping Concrete Overlays constructed at the aforementioned Florida airports were of the following three (3) categories: "Conventional Whitetopping", "Thin Whitetopping", and "Ultra-Thin Whitetopping". It should be noted that the American Concrete Pavement Association (ACPA) has existing guidance on Whitetopping as a Concrete Overlay; the following is the definition for each aforementioned variation of "Whitetopping."

Conventional Whitetopping (Unbonded, Classical Whitetopping) typically consists of a rigid concrete layer overlaid on existing asphalt surface. The concrete overlay thickness is usually 6-inches or more. Concrete overlay is typically unbonded to existing asphalt surface.

Thin Whitetopping (Thin Bonded Whitetopping) typically consists of a concrete overlay on existing asphalt surface. The existing asphalt surface is prepared by milling. The concrete overlay thickness is usually 4 to 6 inches. Concrete overly is typically bonded to asphalt surface.

Ultra-Thin Whitetopping typically consists of a concrete overlay on existing asphalt surface. The existing asphalt surface is prepared by milling. The concrete overlay thickness is usually 2 to 4 inches (50mm to 100mm per ACPA) with closely spaced joints. Concrete overlay is typically bonded to asphalt surface.

It should be noted that the ACPA has published several documents over the years that provide a wide range of Whitetopping as a Concrete Overlay for highway pavements. In addition to "Conventional Whitetopping", "Thin Whitetopping", and "Ultra-Thin Whitetopping" Concrete Overlays, the ACPA has additionally defined Thin Composite Whitetopping, however this type of Concrete Overlay is not known to existing Florida airports and therefore will not be discussed.

Williston Municipal Airport (X60)

The Williston Municipal Airport has three (3) sections of airfield pavement identified as Whitetopping Concrete Overlay on Runway 5-23. The three (3) sections are designated as Section IDs 6115, 6125, and 6127. From prior FDOT records, the Whitetopping Concrete Overlay was estimated to be performed in 2006 and can be classified as a "Thin Whitetopping" Concrete Overlay. Based on prior field assessments, the Concrete Overlay had varying joint length and width spacing and the joints were not sealed as part of the construction. Prior condition assessments identified surface distress types that appear to be similar to the ASTM D5430 defined Corner Spalling, Corner Breaks, Faulting, and Joint Spalling. Other noted surface defects consist of missing aggregate, surface chipping, and discoloration.

Figure 1 – Williston Municipal Airport

Based on limited documentation and field estimation, the following table summarizes the inventory data for the Whitetopping pavement sections at Williston Municipal Airport:

Table 2. Williston Municipal Airport Inventory Data

Branch ID	Section ID	Area (SF)	Category of Whitetopping	Estimated Thickness (in)	Estimated Year of Construction	Estimated Joint Layout (L x W))	Joint Sealant	Load Transfer
RW 5-23	6115	500,000	Thin	4 to 6	2006	5 x 5	None	Unknown
RW 5-23	6125	130,000	Thin	4 to 6	2006	4 x 4	None	Unknown
RW 5-23	6127	40,650	Thin	4 to 6	2006	5 x 5	None	Unknown

The concrete specification and strength characteristics are unknown. Additionally, the joint type, layout, and load transfer functionality of the pavement sections are unknown.

Fernandina Beach Municipal Airport (FHB)

The Fernandina Beach Municipal Airport has two (2) types of Concrete Overlay identified as "Thin Whitetopping" and "Conventional Whitetopping." Runway 9-27 and Taxiway C have pavement sections composed of Concrete Overlays with traditional rigid pavement sections as well; both instances of Whitetopping have been estimated to be constructed in 2003 based on limited FDOT record documentation. Runway 9-27 is estimated to consist of "Conventional" and "Thin Whitetopping" Concrete Overlays and Taxiway C is estimated to have "Thin Whitetopping" Concrete Overlays. Based on prior field assessments, the Concrete Overlays had varying joint length and width spacing and were not sealed as part of the construction. Prior condition assessments identified surface distress types that appear to be similar to the ASTM D5430 defined Shrinkage Cracking, Linear Cracking, Corner Spalling, Corner Breaks, Faulting, and Joint Spalling. Other noted surface defects consist of missing aggregate, surface chipping, and discoloration. It was also noted that the grooving features on Runway 9-27 exhibited deterioration and, in some cases, areas in which the grooving was filled in.

Figure 2 – Fernandina Beach Municipal Airport

Based on limited documentation and field estimation, the following table summarizes the inventory data for the Whitetopping pavement sections at Fernandina Beach Municipal Airport:

Table 3. Fernandina Beach Municipal Airport Inventory Data

Branch ID	Section ID	Area (SF)	Category of Whitetopping	Estimated Thickness (in)	Estimated Year of Construction	Estimated Joint Layout (L x W))	Joint Sealant	Load Transfer
RW 9-27	6315	253,550	Thin	4 to 6	2003	5 x 5	None	Unknown
RW 9-27	6317	88,500	Thin	4 to 6	2003	5 x 5	None	Unknown
RW 9-27	6330	41,500	Conventional	6	2003	5 x 5	None	Unknown
TW C	105	64,808	Thin	5	2003	5 x 5	Non	Unknown
TW C	110	60,686	Thin	4	2003	4 x 4	None	Unknown
TW C	115	11,183	Thin	4	2003	4 x 4	None	Unknown
TW C	135	21,887	Thin	4	2010	4 x 4	None	Unknown

The concrete specification and strength characteristics are unknown. Additionally, the joint type, layout, and load transfer functionality of the pavement sections are unknown.

New Smyrna Beach Municipal Airport (EVB)

The New Smyrna Beach Municipal Airport has “Ultra-Thin Whitetopping” Concrete Overlays on various sections of the main apron and the portion of Taxiway C that is defined within the apron. It is estimated that there may have been original Concrete Overlays as early as 1997, however, based on overlays performed by the airport, it is estimated that the surface course material for all current instances of “Ultra-Thin Whitetopping” were constructed in 2002. The “Ultra-Thin Whitetopping” that is estimated to be approximately 2-inches was intended to perform based on a strong bond between the overlay layer and the underlying asphalt surface layer.

Figure 3 – New Smyrna Beach Municipal Airport

Based on limited documentation and field estimation, the following table summarizes the inventory data for the Whitetopping pavement sections at New Smyrna Beach Municipal Airport:

Table 4. New Smyrna Beach Municipal Airport Inventory Data

Branch ID	Section ID	Area (SF)	Category of Whitetopping	Estimated Thickness (in)	Estimated Year of Construction	Estimated Joint Layout (L x W))	Joint Sealant	Load Transfer
TW C	305	48,858	Ultra-Thin	2	2002	4 x 4	None	Unknown
AP	4120	14,180	Ultra-Thin	2	2002	4 x 4	None	Unknown
AP	4121	12,650	Ultra-Thin	2	2002	4 x 4	None	Unknown
AP	4125	24,143	Ultra-Thin	2	2002	4 x 4	None	Unknown
AP	4126	12,547	Ultra-Thin	2	2002	4 x 4	None	Unknown
AP	4150	45,150	Ultra-Thin	2	2002	4 x 4	None	Unknown
AP	4154	7,400	Ultra-Thin	2	2002	4 x 4	None	Unknown
AP	4155	3,500	Ultra-Thin	2	2002	4 x 4	None	Unknown

The concrete specification and strength characteristics are unknown. Additionally, the joint type, layout, and load transfer functionality of the pavement sections are unknown.

Table 5 Summary of Florida Airports with Whitetopping Concrete Overlays provides a summary of the known pavement facilities with this type of non-standard overlay.

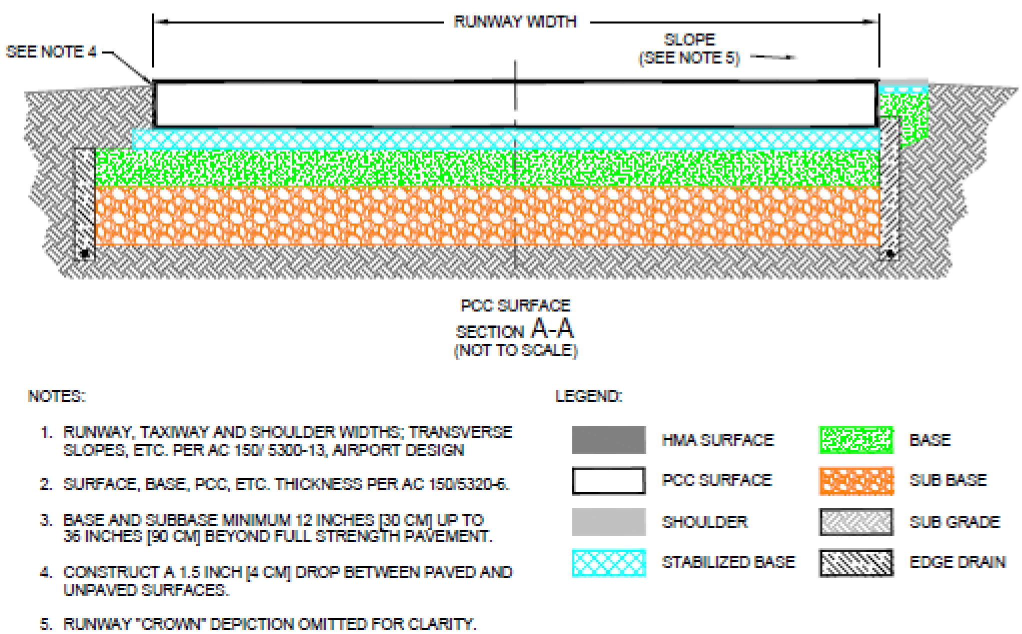
Table 5. Summary of Florida Airports with Whitetopping Concrete Overlays

Airport ID	Airport Name	Branch Facility	Section ID	Category of Whitetopping	Estimated Thickness (in)	Estimated Year of Construction
X60	Williston Municipal Airport	Runway 5-23	6115	Thin	4 to 6	2006
X60	Williston Municipal Airport	Runway 5-23	6125	Thin	4 to 6	2006
X60	Williston Municipal Airport	Runway 5-23	6127	Thin	4 to 6	2006
FHB	Fernandina Beach Municipal Airport	Runway 9-27	6315	Thin	4 to 6	2003
FHB	Fernandina Beach Municipal Airport	Runway 9-27	6317	Thin	4 to 6	2003
FHB	Fernandina Beach Municipal Airport	Runway 9-27	6330	Conventional	6	2003
FHB	Fernandina Beach Municipal Airport	Taxiway C	105	Thin	5	2003
FHB	Fernandina Beach Municipal Airport	Taxiway C	110	Thin	4	2003
FHB	Fernandina Beach Municipal Airport	Taxiway C	115	Thin	4	2003
FHB	Fernandina Beach Municipal Airport	Taxiway C	135	Thin	4	2010
EVB	New Smyrna Beach Municipal Airport	Taxiway C	305	Ultra-Thin	2	2002
EVB	New Smyrna Beach Municipal Airport	Apron	4120	Ultra-Thin	2	2002
EVB	New Smyrna Beach Municipal Airport	Apron	4121	Ultra-Thin	2	2002
EVB	New Smyrna Beach Municipal Airport	Apron	4125	Ultra-Thin	2	2002
EVB	New Smyrna Beach Municipal Airport	Apron	4126	Ultra-Thin	2	2002
EVB	New Smyrna Beach Municipal Airport	Apron	4150	Ultra-Thin	2	2002
EVB	New Smyrna Beach Municipal Airport	Apron	4154	Ultra-Thin	2	2002
EVB	New Smyrna Beach Municipal Airport	Apron	4155	Ultra-Thin	2	2002

2. FAA Advisory Circulars

The FAA AC 150/5320-6F "Airport Pavement Design and Evaluation" recognizes two (2) classifications for pavements systems: flexible pavements and rigid pavements. Flexible pavements are those in which each structural layer is supported by the layer below, and ultimately, supported by the subgrade material. In Florida, a typical flexible pavement section may consist of Item P-401 Asphalt Mix Pavement as a surface course, constructed over Item P-211 Lime Rock Base Course, constructed over Item P-154 Subbase Course. Rigid pavements are those in which the principal load resistance is provided by the rigid Portland cement concrete layer. In Florida, a typical rigid pavement section may consist of Item P-501 Cement Concrete Pavement surface layer, constructed over Item P-306 Lean Concrete Base Course, constructed over Item P-154 Subbase Course. The pavement layer materials identified are based on the FAA AC 150/5370-10H (current edition) "Standard Specifications for Construction of Airports." Typically, the concrete surface must provide a nonskid texture, prevent the infiltration of surface water into the subgrade, and provide structural support for airplane gears. The quality of the concrete, acceptance and control tests, methods of construction and handling, and quality of workmanship are covered in Item P-501 Cement Concrete Pavement. The required concrete pavement thickness is related to the strength of the concrete. For pavement design, the strength of the concrete is characterized by the flexural strength since the primary action and failure mode of a concrete pavement is in flexure (modulus of rupture); FAA recommends a range from 600 to 750 psi, while strengths outside this range will require FAA approval. Based on limited record documentation for each case of "Whitetopping" Concrete Overlay in Florida and for the purpose of this document, it is unknown the exact adherence to the FAA AC 150/5320-6 for design or the AC 150/5370-10 for construction and material characteristics.

Figure 4 – Typical Rigid Pavement Section (FAA AC 150/5320-6F)



(FAA AC 150/5320-6F Figure 3-4. Typical Plan and Sections for Pavements)

It should be noted that this section's general discussion on rigid pavement and Concrete Overlays on Existing Flexible Pavement are intended to provide context to the characteristics of the "Whitetopping" Concrete Overlays in Florida Airports. The main characteristics that should be noted when considering the existing “Whitetopping” Concrete Overlay in Florida Airports consist of the concrete strength, concrete minimum thickness, joint type, joint layout, and load transfer.

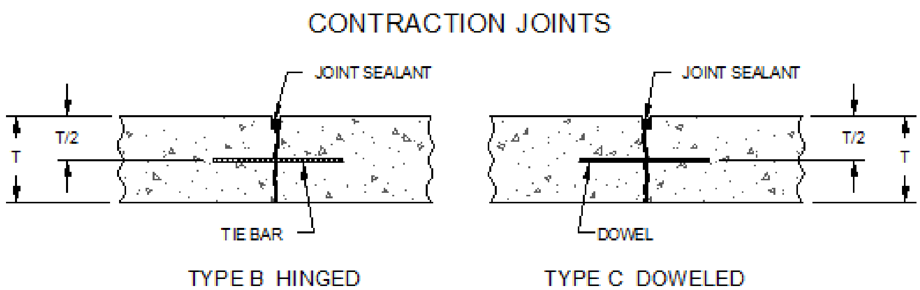
Rigid Pavement – General Discussion

Rigid Portland Cement Concrete (PCC) pavements are typically plain unreinforced or reinforced concrete placed on a granular or stabilized base. Reinforcement of PCC with temperature steel is intended to limit segmentation of cracking within the slab and movement. Reinforcement is recommended when PCC slabs exceed normal joint layout geometry. Examples of PCC requiring reinforcement include PCC slabs subject to utility penetration (stormwater inlet, fuel pit structure, water valve structure, bollard foundation, etc.) and slabs exceeding the recommend length to width ratio for spacing. The majority of airfield pavements are not reinforced.

PCC slabs expand and contract at initial placement due to curing and throughout the life the pavement due to climatic conditions. The movement associated with the expansion and contraction of the PCC will result in cracking; however, pavements are constructed with contraction joints to ensure movement may occur and the “cracking” is controlled. Contraction joints are typically sawn into the pavement after initial curing once the PCC has achieved adequate strength.

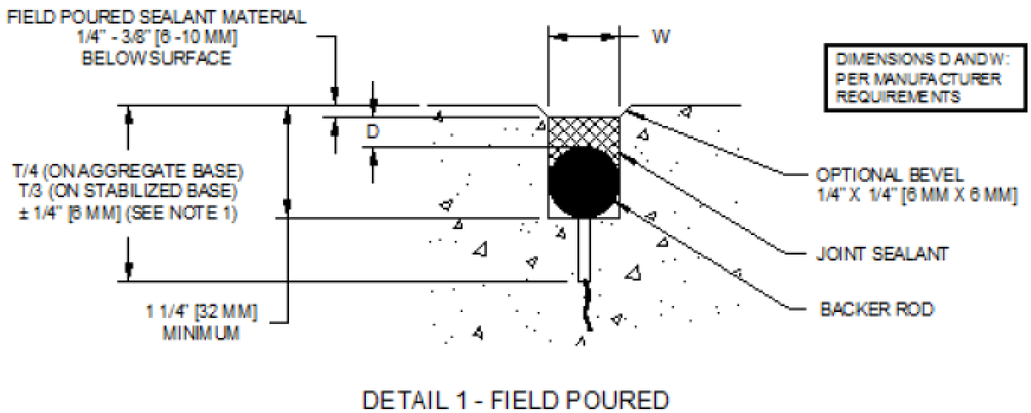
Joints are placed in concrete pavement to minimize random cracking and facilitate uniform construction. Three (3) types of joints that are common in concrete pavement construction are contraction joints, construction joints, and isolation joints. Proper joint spacing will promote effective control of cracking due to tensile stresses created by restrained shrinkage and curling caused by temperature and moisture differentials. The following factors should be considered in adequate joint spacing: thickness of concrete layer, type and size of aggregate, climatic conditions, and use of temperature steel as reinforcement. All joints should be finished in a manner that allows for the joint to be sealed. Joint layouts should result in slabs to be nearly as square as possible when no temperature steel reinforcement is used.

Figure 5 – Example Contraction Joints (FAA AC 150/5320-6F)



(FAA AC 150/5320-6F Figure 3-15b. Rigid Pavement Contraction and Construction Joints)

Figure 6 – Example Joint Sealant (FAA AC 150/5320-6F)



DETAIL 1 - FIELD POURED

(FAA AC 150/5320-6F Figure 3-15c. Rigid Pavement Joint Sealant Details)

PCC pavements support loading differently from flexible pavement sections in that the concrete section is designed to perform like a beam and rely on bending strength of the concrete slabs to support the traffic load. It is imperative that load transfer from slab to slab is achieved through the use of load transfer devices; the FAA AC 150/5320-6 identifies joint type with dowel features. Dowels are smooth steel bars placed across the joint. Dowel bars support the transfer of load between interfacing slabs while allowing the joint to open and close as intended. PCC pavements without proper load transfer devices create vulnerability for unsupported slabs at the edges. The slab edges may be subject to bending under a load, and under a saturated soil condition create a risk for "pumping," which is the migration of soil support out from beneath the PCC pavement. The eventual loss of material may create unintended voids and the pavement will be subject to a non-uniform support condition. This non-uniform support condition may lead to cracking of the slab and further joint deterioration.

Concrete Overlay on Existing Flexible Pavement

The FAA AC 150/5320-6F defines a Concrete Overlay over an existing flexible pavement as having the same design criteria as designing for a new rigid pavement. The existing flexible pavement structure is characterized by the section layer thicknesses and moduli. The minimum thickness for a Concrete Overlay over an existing flexible pavement is 6-inches. Concrete Overlays constructed on flexible pavements should meet the requirements of rigid pavement joint requirements of FAA AC 150/5320-6F, minimum 12.5-feet. The Concrete Overlay material should meet the flexural strength requirements and characteristics defined by AC 150/5320-6 and AC 150/5370-10.

3. Methodology

This section serves to define the technical method of performing an objective and repeatable condition assessment on the "Whitetopping" Concrete Overlays in Florida. Based on the guidance stated in FAA AC 150/5320-17A "Airfield Pavement Surface Evaluation and Rating Manuals", it is recommended that the FDOT SAPMP adopt the **Concrete Airfield Pavement Surface Evaluation and Rating (PASER) Manual** in Appendix B of the Advisory Circular.

The **PA**vement **S**urface **E**valuation and **R**ating (PASER) was produced for the FAA by the Engineering Professional Development, College of Engineering, University of Wisconsin-Madison. The FAA recommends the PASER information and procedures when it is not possible to complete a more detailed PCI Survey as part of a more comprehensive pavement maintenance management program. The PCI Survey as defined by the ASTM D5340-12 (current edition) is intended to evaluate conventional flexible and rigid pavement sections. Select Whitetopping Concrete Overlays will be subject to a visual condition assessment using the PASER methodology for assessing the functional condition of the Concrete Overlay layers; more specifically, the Concrete Overlays with joint layout lengths and widths less than 12.5-feet and/or when a section cannot be evaluated utilizing the parameters defined by the ASTM D5430-12 (current version). The 12.5-feet is based on the guidance from the FAA AC 150/5320-6 minimum joint length.

The purpose of a pavement evaluation is to provide qualitative information to determine causes of deterioration and develop maintenance and rehabilitation timing and needs. From a quantitative analysis standpoint, a pavement evaluation should support the development of planning-level opinions of probable cost based on planning-level quantities.

The Methodology for Whitetopping Data Collection in Florida Airports will consist of the following technical procedures:

1. Historical Data Collection and Records Review
2. Network Definition and System Inventory Updates
3. PASER Section and Sample Definition
4. Field Inventory Data Collection
5. Field Condition Rating Using PASER
    a. Sample PASER Evaluation Form
6. PASER Rating at Section-Level

PASER for Airfield Rigid Portland Cement Concrete Pavements

PASER is an acronym for Pavement Surface Evaluation and Rating system and is used to evaluate the surface condition of rigid concrete and flexible concrete pavement facilities. For the FDOT SAPMP, the PASER system will be limited to Concrete Overlay pavement sections identified as "Whitetopping" that may not be suitable to evaluate utilizing the ASTM D5430-12 (current version) PCI Survey Method. PASER is a visual rating system that utilizes a 0 to 5 rating scale, with a value of 5 representing New pavement (or recent major concrete rehabilitation, like-new condition, typically less than 5 years old, and/or no maintenance required) and a value of 1 representing Extensive full-depth joint repairs or slab replacements, extensive patching and one (1) complete overlay, and/or Complete reconstruction needed.

The PASER condition ratings are assigned by monitoring the type and amount of visual deterioration/distress within a defined feature (section). The PASER system interprets the visual observations into a condition rating. **Table 6. PASER Rating for Airfield Rigid Pavement** provides an organization of the PASER Rating System for airfield pavements constructed with a rigid concrete surface layer.

The key to a useful evaluation is identifying different types of pavement distress and linking them to a cause. Understanding the cause for current pavement conditions is important for identifying practical maintenance, repair, rehabilitation, and/or reconstruction for safe airfield pavement facilities. The PASER Rating System utilizes similar distress types that are defined by the ASTM D5430-12, however PASER excludes the severity level determination and distress measurement procedures. The PASER Rating System identifies four (4) major categories for PCC pavement surface distress and condition: Surface Defects, Joints, Pavement Cracks, and Pavement Distortion.

Each rating in the PASER Value has a corresponding Surface Rating written descriptor (Excellent, Good, Fair, Poor, Failed). The PASER Surface Rating is not based on the ASTM D5430-12. They should not be confused with the formal definitions of the PCI Survey method.

Table 6. PASER Rating for Airfield Rigid Pavement

PASER Value	Surface Rating	Visual Distress	General Conditions	Treatment Measures
5	Excellent	None.	New pavement or recent major concrete rehabilitation. Like-new condition. Less than 5 years old. No maintenance required.	No maintenance required.
4	Good	Hairline or sealed cracks 1⁄8" wide or less. Map cracking. Pop-outs.	Concrete over 5 years old. Signs of wear. Minor spot repair of cracks or joint sealant.	Minor routine maintenance, crack or joint sealing.
3	Fair	Several slabs broken into two pieces by slab cracks. Corner cracking on several slabs, 1⁄4" wide with no spalling. Joint sealant mostly in good condition, less than 10% needing replacement. Several patches in fair to good condition. Map cracking or scaling on 10% or less of the surface area. Slight faulting, less than 1⁄4", in several locations.	First sign of significant slab cracking, corner cracking, scaling, or faulting. Several patches. Joint sealant repair required. Isolated repair of joint or patch.	More crack or joint sealing. Isolated joint repairs or slab patching.
2	Poor	Many slab cracks, some breaking the slab into three or more pieces. Cracks open 1/8" or cracks with spalling. D-cracks at several joints. Sealant failure over 10% of joints. Several patches in fair to poor condition with cracks in patch and uneven surface. Faulting ¼" to ½" in several locations. Severe or extensive scaling.	Needs sealant replacement on more than 10% of cracks or joints. Partial depth or full-depth joint repairs or patch replacement. Repair faulted joints. Replace or overlay slabs with severe scaling. Bonded or unbonded concrete overlay.	Extensive crack or joint sealing. Repair severe joint deterioration. Partial and full-depth slab repairs.
1	Failed	Many wide cracks with failed sealant and grass. Extensive crack and joint spalling. Slabs extensively cracked or shattered. Many corner breaks with spalling. D-cracks with spalling. Patches in poor condition with spalling. Numerous faults over 1⁄2".	Extensive full-depth joint repairs or slab replacements. Extensive patching and complete overlay. Complete reconstruction.	Reconstruction.

PASER Categories for PCC Pavement Surface Distress and Condition

The following section will identify the four (4) major categories of common PCC pavement surface distress and condition and the definition for each distress type in accordance with the PASER Rating System referenced in FAA AC 150/5320-17A Appendix B.

1. Surface Defect Category

The Surface Defect Category for PCC pavements consist of the following distress types:

1. Polishing
2. Map Cracking – Shrinkage Cracking
3. Pop-Outs
4. Scaling
5. Spalling

Polishing – A worn or polished surface may develop from traffic wearing off the surface mortar and skid-resistant texture. An asphalt overlay or grinding the concrete surface can restore skid resistance.

Note: There is no PCC distress in the ASTM D5340D comparable to this distress. However, the ASTM does define Polished Aggregate as an asphalt concrete (AC) distress.

Map Cracking – A pattern of fine cracks usually spaced within several inches is called map cracking. It usually develops into square or other geometrical patterns. Map cracking can be caused by improper cure or over-working the surface during finishing. It may also indicate a problem with the quality of the aggregate known as ASR (alkali-silica reactivity). If severe, cracks may spall or the surface may scale. Repair is usually limited to very severe conditions. An asphalt overlay or partial depth patching may then be necessary.

Note: This is comparable to the ASTM D5340-12 distress Shrinkage Cracking. However, it is further detailed as map cracking or crazing as a result of 'plastic shrinkage'. The ASTM does not define severities for Shrinkage Cracking.

Pop-Outs – Individual pieces of large aggregate may pop out of the surface. This is often caused by chert or other absorbent aggregates that deteriorate under freeze-thaw conditions. Pop-outs alone do not usually affect pavement serviceability. However, damage to aircraft from the debris may occur. For severe areas, a patch, overlay, or slab replacement may be necessary.

Note: This is comparable to the ASTM D5340-12 distress Popouts which also has no degrees of severity defined.

Scaling – Scaling is surface deterioration that causes loss of fine aggregate and mortar. More extensive scaling can result in loss of large aggregate. The cause often is using concrete which has not been air-entrained, making the surface susceptible to freeze-thaw damage.

Scaling can occur as a general condition over a large area or be isolated to locations where poor-quality concrete or improper finishing techniques caused loss of entrained air. In severe cases, deterioration can extend deep into the concrete. Debris from scaling can damage aircraft.

Grinding may remove poor quality surface concrete. Partial depth patching of isolated areas may also prolong the life of the pavement. Severe scaling may require slab replacement.

Note: This is comparable to the ASTM D5430-12 distress Scaling. However, the ASTM defines three severities for Scaling: Low, Medium, and High. The severities are differentiated in most part by the percent loss of paste over the slab area and the amount of FOD potential.

Spalling – Spalling is the loss of a piece of the concrete pavement from the surface or along the edges of cracks and joints. Cracking or freeze-thaw action may break the concrete loose, or spalling may be caused by poor quality materials. Spalling may be limited to small pieces in isolated areas or be quite deep and extensive. Large pieces of loose concrete can cause serious damage to aircraft.

Repair will depend on the cause. Small spalled areas are often patched. Spalling at joints may require full-depth joint repair or full slab replacement.

Note: This is comparable to the ASTM D5340-12 distress Corner Spalling and Joint Spalling. However, PASER rating does not differentiate between joint and corner spalling distresses. The identification of a spall is not characterized by a quantitative measurement.

2. Joints Category

Construction joints or sawn joints are narrow and usually well sealed. As pavements age and materials deteriorate, joints may open wider and deteriorate further. Cracks parallel to the initial joint may develop and accelerate into spalling or raveling. Settlement, instability, or pumping of subgrade soil can cause joints to fault. One common cause of cracks parallel to joints is waiting too long after the pour to saw the joint. Then, during initial cure, the slab will crack near the sawn joint.

Maintaining a tight joint seal can prevent intrusion of water and debris and reduce freeze-thaw damage and pumping. Debris may accumulate in open joints, which prevents normal joint movement. This will greatly accelerate joint deterioration. Severe joint deterioration may require full-depth patching and joint replacement.

Note: This is comparable to the ASTM D5340-12 distress Joint Seal Damage. However, the ASTM defines three severities for Joint Seal Damage (Low, Medium, High) and evaluates damage as it relates to stripping of the joint seal, extrusion of joint seal, weed growth, oxidation, loss of bond, and lack or absence of sealant in the joint.

3. Pavement Cracks Category

The Pavement Cracks Category for PCC pavements consist of the following distress types:

1. Slab Cracks
2. D-Cracks or Durability Cracking
3. Corner Cracks
4. Meander Cracks
5. Manhole and Inlet Cracks or Penetration Cracking

Slab Cracks – Slab cracks divide the slab into two (2) or more pieces. They can be caused by thermal stresses, poor subgrade support, or heavy loadings. They are sometimes related to slabs with joints spaced too widely. Slabs with a length-to-width ratio greater than 1.25 are more likely to develop mid-slab cracks.

As with joints, these cracks may deteriorate further if not sealed well. Slabs can fault at cracks. Cracks can spall and develop additional parallel cracking. Severe deterioration may require patching individual cracks. Multiple transverse cracks in individual slabs indicate further deterioration. Extensive slab cracking indicates pavement failure and the need for complete replacement.

Note: This is comparable to the ASTM D5430-12 distress Longitudinal, Transverse, and Diagonal Cracking also referred to as LTD or Linear Cracking. However, the ASTM defines three severities *for LTD Cracking: Low, Medium, and High. Medium- or high-severity cracks are usually working cracks and are considered major structural distresses.*

D-Cracks or Durability Cracking – Occasionally, severe deterioration may develop from poor quality aggregate. So called D-cracks, or disintegration cracking, develop when the aggregate is able to absorb moisture. This causes the aggregate to break apart under freeze-thaw action, which leads to deterioration. Usually, it starts at the bottom of the slab and moves upward.

Fine cracking and a dark discoloration adjacent to the joint often indicate a D-cracking problem. Once this is visible on the surface, the pavement material is usually severely deteriorated and complete replacement is required.

Joint or crack sealing helps slow D-cracking deterioration. This is a serious defect because it may indicate a material quality problem throughout the pavement. Milling and patching has proven successful as a short-term repair.

Note: This is comparable to the ASTM D5430-12 distress Durability "D"-Cracking. However, the ASTM defines three severities for "D" Cracking: Low, Medium, and High. The severities are differentiated in most part by the portion of slab affected, disintegration, and the amount of FOD potential.

Corner Cracks – Diagonal cracks may develop near the corner of a concrete slab, forming a triangle with the joint. Usually these cracks are within a foot or two of the slab corners and are caused by insufficient soil support or concentrated stress due to temperature-related slab movement. The corner breaks under traffic loading. They may begin as hairline cracks.

Some corner cracks extend the full-depth of the slab while others start at the surface and angle down toward the joint. With further deterioration, more cracking develops, and eventually the entire broken area may come loose. This may be a localized failure, but it often indicates widespread maintenance problems.

Partial or full-depth concrete patching or full-depth joint replacement may be needed when corner cracking is extensive.

Note: This is comparable to the ASTM D5430-12 distress Corner Break. However, the ASTM explicitly states that a corner break extends vertically through the entire slab thickness, while a corner spall intersects the joint at an angle. At low severity, it is typically not evident if the crack extends through the entire slab so the ASTM recommends the following: record a corner break if the crack intersects both joints more than two (2) feet from the corner, record a corner spall if it is less than two (2) feet unless you can verify the crack is vertical.

Meander Cracks – Some pavement cracks appear to wander randomly. They may cross a slab diagonally or meander in a random manner. Meander cracks may be caused by settlement due to unstable subsoil or drainage problems. Frost heave and spring thaw can also cause them. They are often local in nature and may not indicate general pavement problems.

Minor cracks may benefit from sealing to minimize water intrusion. Extensive or severe meander cracks may require replacing the slab, stabilizing the subsurface, or improving drainage.

Note: This is comparable to the ASTM D5430-12 distress Longitudinal, Transverse, and Diagonal Cracking also referred to as LTD or Linear Cracking. However, the ASTM defines three severities for LTD Cracking: Low, Medium, and High. Medium- or high-severity cracks are usually working cracks and are considered major structural distresses.

Manhole and Inlet Cracks / Penetration Cracking – The pavement adjacent to a light can, manhole, or storm sewer inlet often cannot accommodate normal pavement movement due to frost heaving and temperature changes. Cracks and faulting may develop, and the concrete slab may deteriorate further. These are often localized design defects that may not indicate a general pavement problem. Sealing and patching may slow the deterioration. Eventually, full-depth repairs may be required.

Note: There is no PCC distress in the ASTM D5340D comparable to this distress.

4. Pavement Distortion Category

The Pavement Distortion Category for PCC pavements consist of the following distress types:

1. Pavement Settling or Heave
2. Blowups
3. Faulting
4. Utility Repairs, Patches, Potholes

Pavement Settling or Heave – Unstable or poorly drained subgrade soils may cause pavements to settle after construction. Poorly compacted utility trenches may also settle. This may be a gentle swale or a fairly severe dip.

Frost-susceptible soils and high-water tables can cause pavements to heave during the winter months. Extensive pavement cracking and loss of strength during the spring can result in severe deterioration. Improved drainage and stabilization of subgrade soils is usually necessary, along with pavement reconstruction.

Note: This is comparable to the ASTM D5430-12 distress Settlement or Faulting. However, the ASTM defines three severities for Settlement or Faulting: Low, Medium, and High. The severities are differentiated in most part by the difference in elevation across the fault and the associated decrease in ride quality and safety as severity increases.

Blowups – Concrete slabs may push up or be crushed at a joint. This is caused by expansion of the concrete where incompressible materials (sand, debris, etc.) have infiltrated into poorly sealed joints. As a result, there is no space to accommodate expansion. It is more common in older pavements with long joint spacing. Pavements that have aggregate susceptible to ASR may experience more frequent blowups. Pressure relief joints can be installed, and blowup areas must be patched or reconstructed. Cleaning and sealing joints will help prevent blowups.

Note: This is comparable to the ASTM D5430-12 distress Blowup. However, the ASTM defines three severities for Blowup: Low, Medium, and High. The severities are differentiated in most part by the roughness from the distress and if the pavement is operational. Of particular note, no significant research has been conducted to quantify severity levels for blowups as it relates to elevation measurements.

Faulting – Joints and cracks may fault, or develop a step, between adjacent slabs. Faulting is caused by pumping of subgrade soils and creation of voids. Heavy traffic can rapidly accelerate faulting. Joints may fault due to settlement of an adjacent slab.

Faulting creates a rough pavement and may cause slab deterioration. Minor faulting can be corrected by surface grinding. Voids can be subsealed, or slabs can be mud jacked back to level position. Severe cases may need joint or slab replacement.

Note: This is comparable to the ASTM D5430-12 distress Faulting. However, the ASTM defines three severities for Faulting: Low, Medium, and High. The severities are differentiated in most part by the difference in elevation across the fault and the associated decrease in ride quality and safety as severity increases.

Utility Repairs, Patches, Potholes – Slab replacement or repair of utilities will require cuts and slab patching. Patches from previous repairs may perform like original pavement or may show settlement, joint deterioration, or distress.

Localized failures of materials or subgrade soil can cause individual potholes. Surface spalling or other material defects may develop into localized potholes. Full-depth patching or slab replacement is usually required.

Note: This is comparable to the ASTM D5430-12 distress Small Patching and Large Patching. Small patching is less than five (5) square feet and large patching is over five (5) square feet. The ASTM defines three severities for both Small and Large Patching: Low, Medium, and High. The severities are differentiated in most part by patch deterioration and the FOD potential.

Table 7. PASER PCC Pavement Distress Category

Surface Defect			Joint		
Code	PASER Distress	*ASTM 5340 Distress*	**Code**	PASER Distress	*ASTM 5340 Distress*
SD-1	Polishing	*N/A*	**J-1**	Parallel Cracks	*N/A*
SD-2	Map Cracking - Shrinkage Cracking	*Shrinkage Cracking*	**J-2**	Joint Ravelling	*N/A*
	Map Cracking - ASR	*Alkali Silica Reaction*	**J-3**	Joint Seal Damage/Missing	*Joint Seal Damage*
SD-3	Pop-Outs	*Pop-Outs*			
SD-4	Scaling	*Scaling*			
SD-5	Spalling	Joint Spalling or Corner Spalling			
Pavement Cracks			**Pavement Distortion**		
Code	PASER Distress	*ASTM 5340 Distress*	**Code**	PASER Distress	*ASTM 5340 Distress*
PC-1	Slab Cracks	*LTD or Linear Cracking*	**PD-1**	Settling/Heave	*Faulting*
PC-2	D-Cracks	*Durability Cracking*	**PD-2**	Blowups	*Blow Up*
PC-3	Corner Cracks	*Corner Break*	**PD-3**	Faulting	*Faulting*
PC-4	Meander Cracks	*LTD or Linear Cracking*	**PD-4**	Utility Repair/Patch/Pothole	*Small/Large Patch*
PC-5	Manhole/Inlet Cracks	*N/A*			

4. Technical Procedures

The Methodology for Whitetopping Data Collection in Florida Airports will consist of the following technical procedures:

1. Historical Data Collection and Records Review
2. Network Definition and System Inventory Updates
3. PASER Section and Sample Definition
4. Field Inventory Data Collection
5. Field Condition Rating Using PASER
6. PASER Rating at Section-Level

Step 1 – Historical Data Collection and Records Review

On behalf of the FDOT AO-PM, the SAPMP technical team will coordinate a comprehensive request for record documentation from each airport for each known pavement section area limits estimated to have Whitetopping Concrete Overlays. As of 2020 SAPMP update, formal record documentation for the Whitetopping Concrete Overlay construction for Williston Municipal Airport, Fernandina Beach Municipal Airport, and New Smyrna Beach Municipal Airport has been limited to existing FDOT SAPMP records. The following information will be requested:

Table 8. Anticipated Request for Information for Whitetopping Concrete Overlay Facilities

Item	Description	Update Element
1	Airport Layout Plan (CAD, GIS, PDF)	Airfield Pavement System Inventory Airfield Pavement Network Definition
2	Airport Geographic Information System (Geodatabase, Map Package)	Airfield Pavement System Inventory Airfield Pavement Network Definition Spatial compatibility review
3	Engineering Design Documents 1. Geotechnical Report 2. Engineering Design Report 3. Pavement Calculations 4. Opinion of Probable Construction Cost	Pavement Section Composition Joint Layout Geometry Joint Type Load Transfer Airfield Pavement System Inventory Airfield Pavement Network Definition Opinion of Probable Construction Costs
4	Historic Airfield Pavement Construction Project Record Documentation 1. Issued for Construction Plans 2. Project Specifications 3. Project Bid Tabulations 4. As-Built Documents	Airfield Pavement System Inventory Airfield Pavement Network Definition Opinion of Probable Construction Costs
5	Aircraft Fleet Mix / Operational Data 1. Runway Utilization 2. Taxiway Utilization 3. Apron / Ramp Utilization	Airfield Pavement System Inventory Airfield Pavement Network Definition Opinion of Probable Construction Costs Pavement Strength Reporting
6	Post Construction Records 1. Maintenance Records 2. User Feedback 3. Airport Sponsor Feedback	

Step 2 – Network Definition and System Inventory Updates

For the benefit of FDOT AO-PM, the SAPMP technical team will incorporate reasonable airfield pavement network definition and inventory data into the existing SAPMP PAVER database. The data will be limited to Network-, Branch-, and Section-level data. **Table 9 Pavement System Inventory PAVER Data for Whitetopping Concrete Overlays** summarizes the data organization for the Whitetopping Concrete Overlays.

Table 9. Pavement System Inventory PAVER Data for Whitetopping Concrete Overlays

System Inventory Level	Feature Example	Characteristic	Potential Planning Effect
Network	Overall pavement assets maintained by the Airport Example: Williston Municipal Airport (X60)	Airport category Aircraft > 12,500lbs	Grouping of facilities Overall Condition by Network
Branch	Commonly defined asset name as established by Airport and by use Example: "Runway 5-23"	Facility Use a) Apron b) Blast Pad c) Helipad d) Other e) Run-Up f) Runway g) Shoulder h) Storage i) Taxiway j) Taxilane Aircraft Loading a) Greater than 12,500lb b) Greater than 60,000lb c) Greater than 100,000lb d) No Aircraft Loading	
Section / Feature	A defined area of pavement asset that is distinct by the following: Pavement Composition, Construction Work History, Aircraft Traffic	Surface Type PCC – Portland Cement Concrete Work History a) Concrete Overlay "Non-Standard Whitetopping" b) Estimated Thickness Re-Inspection Report a) No PCI Data b) Inspection Notes "PASER Value and PASER Surface Rating"	Application of appropriate Maintenance and Repair treatment. Consideration of appropriate pavement section characteristics for Major Rehabilitation.

Based on PAVER 7.0 and the definition of Whitetopping Concrete Overlays by ACPA, **Table 10 FDOT SAPMP PAVER Database Work Types for Whitetopping Concrete Overlays** will be utilized for inventory records.

Table 10. FDOT SAPMP PAVER Database Work Types for Whitetopping Concrete Overlays

Concrete Overlay	PAVER Work Type	Inventory Description	Resultant Surface	SSort1
Conventional Whitetopping	OL-PU Overlay PCC Unbonded	Whitetopping Non-FAA Standard, greater than 6”	PCC	WT
Thin Whitetopping	OL-PC Overlay PCC	Thin Whitetopping Non-FAA Standard, 4” to 6”	PCC	TWT
Ultra-Thin Whitetopping	OL-PF Overlay PCC Fully Bonded	Ultra-Thin Whitetopping Non-FAA Standard, 2” to 4”	PCC	UTW

Step 3 – PASER Section and Sample Definition

Based on the current understanding of the existing System Inventory at the three (3) airports, specifically for the limits of the known Whitetopping Concrete Overlay, **Table 11 FDOT Whitetopping Concrete Overlay Airfield Pavement System Inventory** will be utilized for the basis of a PASER Rating System Data Collection Plan.

Each Whitetopping Concrete Overlay Section will be evaluated using the PAVER Rating System for the quantity of sample units identified to be inspected in each Section. The SAPMP technical team will utilize the conservative average of the PASER Value rounded down to the nearest whole PASER Value.

Table 11. FDOT Whitetopping Concrete Overlay Airfield Pavement System Inventory

Airport ID	Branch Facility	Section ID	Category of Whitetopping	Estimated Thickness (in)	Estimated Year of Construction	Area (SF)	Joint Length (FT)	Joint Width (FT)	Estimated Total Slabs	FDOT SAPMP Samples to be Inspected	Estimated Slabs Per Sample Unit
X60	Runway 5-23	6115	Thin	4 to 6	2006	500,000	5	5	20,000	20	200
X60	Runway 5-23	6125	Thin	4 to 6	2006	130,000	4	4	8,125	20	313
X60	Runway 5-23	6127	Thin	4 to 6	2006	40,650	5	5	1,626	3	200
FHB	Runway 9-27	6315	Thin	4 to 6	2003	253,550	5	5	10,142	20	200
FHB	Runway 9-27	6317	Thin	4 to 6	2003	88,500	5	5	3,540	3	200
FHB	Runway 9-27	6330	Conventional	6	2003	41,500	5	5	1,660	2	200
FHB	Taxiway C	105	Thin	5	2003	64,808	5	5	2,592	2	200
FHB	Taxiway C	110	Thin	4	2003	60,686	4	4	3,793	2	313
FHB	Taxiway C	115	Thin	4	2003	11,183	4	4	699	1	313
FHB	Taxiway C	135	Thin	4	2010	21,887	4	4	1,368	1	313
EVB	Taxiway C	305	Ultra-Thin	2	2002	48,858	4	4	3,054	2	313
EVB	Apron	4120	Ultra-Thin	2	2002	14,180	4	4	886	1	313
EVB	Apron	4121	Ultra-Thin	2	2002	12,650	4	4	791	1	313
EVB	Apron	4125	Ultra-Thin	2	2002	24,143	4	4	1,509	1	313
EVB	Apron	4126	Ultra-Thin	2	2002	12,547	4	4	784	1	313
EVB	Apron	4150	Ultra-Thin	2	2002	45,150	4	4	2,822	2	313
EVB	Apron	4154	Ultra-Thin	2	2002	7,400	4	4	463	1	313
EVB	Apron	4155	Ultra-Thin	2	2002	3,500	4	4	219	1	313

Figure 7 – Williston Municipal Airport Whitetopping Sections

Table 12. X60 Whitetopping Concrete Overlay Airfield Pavement System Inventory

Airport ID	Branch Facility	Section ID	Category of Whitetopping	Estimated Thickness (in)	Area (SF)	Joint Length (FT)	Joint Width (FT)	Estimated Total Slabs	FDOT SAPMP Samples to be Inspected	Estimated Slabs Per PASER Sample Unit
X60	Runway 5-23	6115	Thin	4 to 6	500,000	5	5	20,000	20	200
X60	Runway 5-23	6125	Thin	4 to 6	130,000	4	4	8,125	20	313
X60	Runway 5-23	6127	Thin	4 to 6	40,650	5	5	1,626	3	200

Figure 8 – Fernandina Beach Municipal Airport Whitetopping Sections

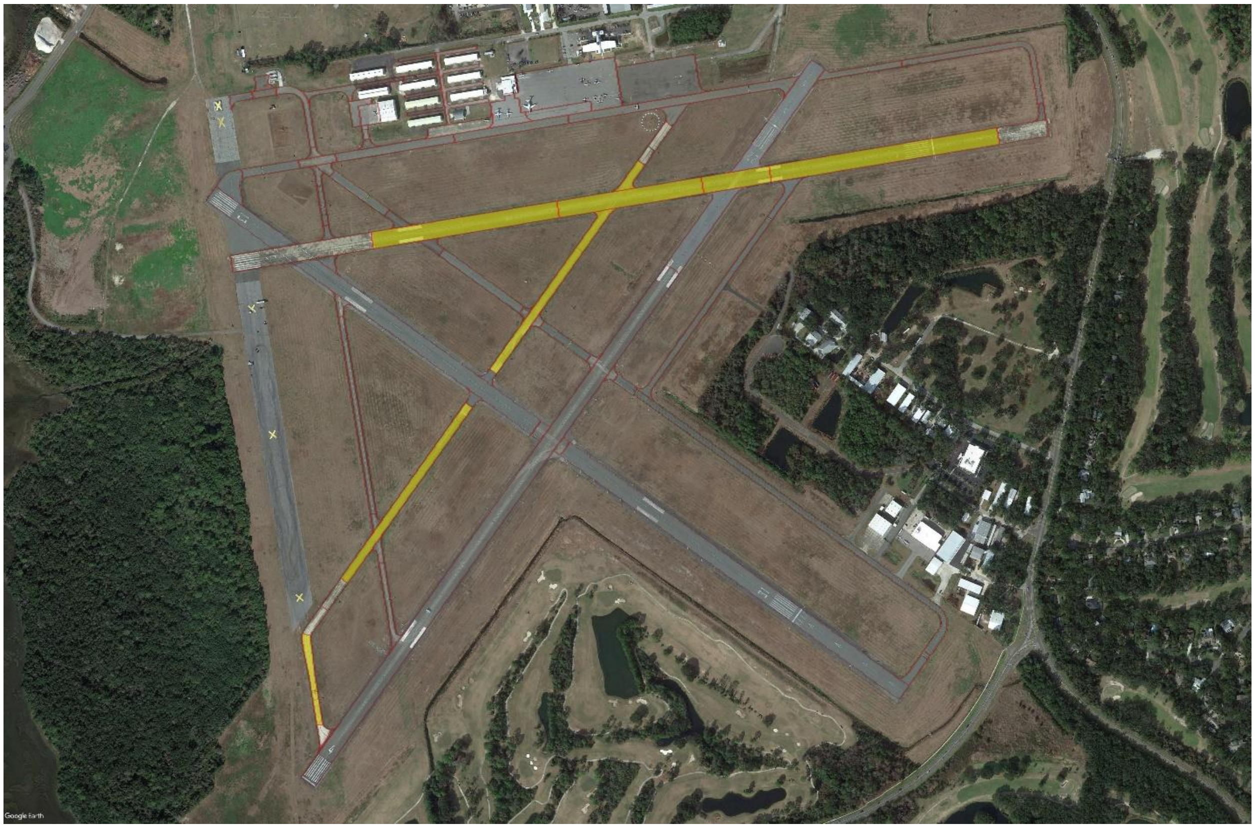


Table 13. FHB Whitetopping Concrete Overlay Airfield Pavement System Inventory

Airport ID	Branch Facility	Section ID	Category of Whitetopping	Estimated Thickness (inches)	Area (SF)	Joint Length (FT)	Joint Width (FT)	Estimated Total Slabs	FDOT SAPMP Samples to be Inspected	Estimated Slabs Per PASER Sample Unit
FHB	Runway 9-27	6315	Thin	4 to 6	253,550	5	5	10,142	20	200
FHB	Runway 9-27	6317	Thin	4 to 6	88,500	5	5	3,540	3	200
FHB	Runway 9-27	6330	Conventional	6	41,500	5	5	1660	2	200
FHB	Taxiway C	105	Thin	5	64,808	5	5	2,592	2	200
FHB	Taxiway C	110	Thin	4	60,686	4	4	3,793	2	313
FHB	Taxiway C	115	Thin	4	11,183	4	4	699	1	313
FHB	Taxiway C	135	Thin	4	21,887	4	4	1,368	1	313

Figure 9 – New Smyrna Beach Municipal Airport Whitetopping Sectons

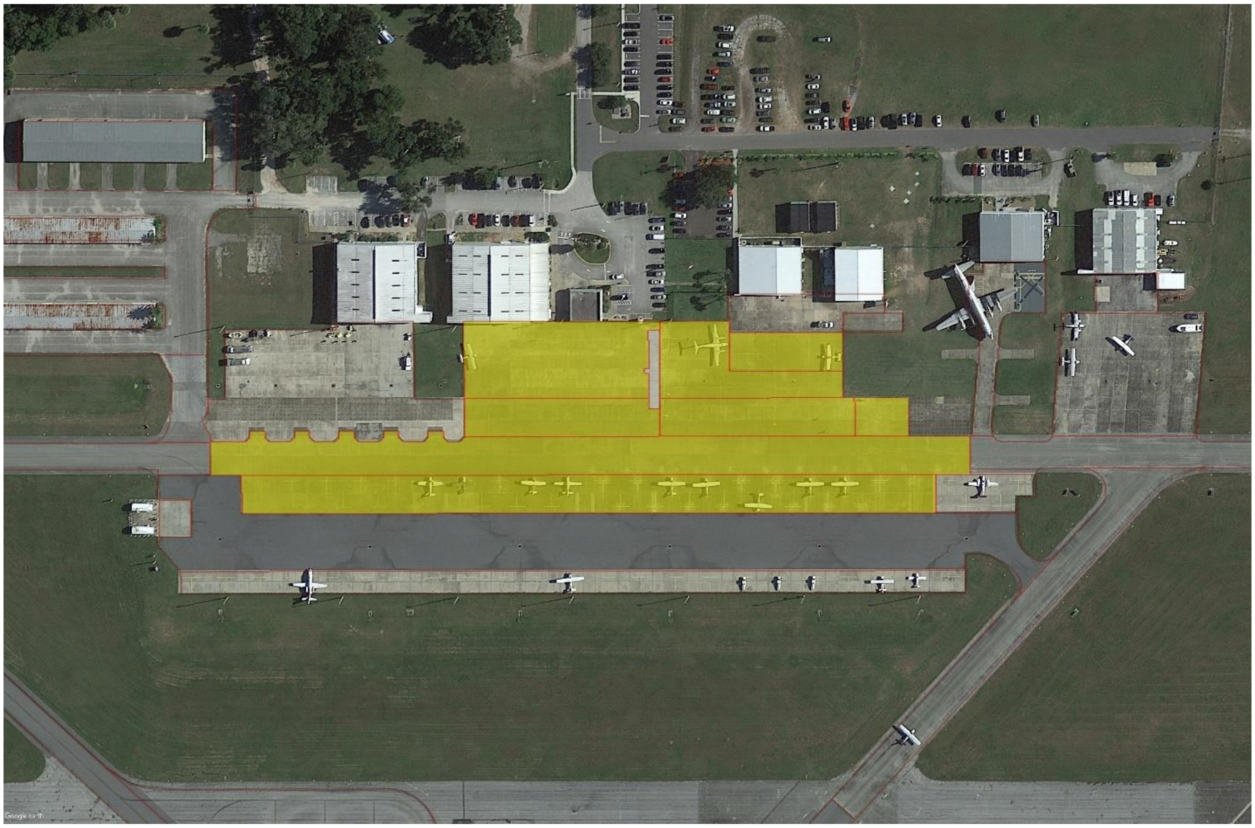


Table 14. EVB Whitetopping Concrete Overlay Airfield Pavement System Inventory

Airport ID	Branch Facility	Section ID	Category of Whitetopping	Estimated Thickness (inches)	Area (SF)	Joint Length (FT)	Joint Width (FT)	Estimated Total Slabs	FDOT SAPMP Samples to be Inspected	Estimated Slabs Per PASER Sample Unit
EVB	Taxiway C	305	Ultra-Thin	2	48,858	4	4	3,054	2	313
EVB	Apron	4120	Ultra-Thin	2	14,180	4	4	886	1	313
EVB	Apron	4121	Ultra-Thin	2	12,650	4	4	791	1	313
EVB	Apron	4125	Ultra-Thin	2	24,143	4	4	1,509	1	313
EVB	Apron	4126	Ultra-Thin	2	12,547	4	4	784	1	313
EVB	Apron	4150	Ultra-Thin	2	45,150	4	4	2,822	2	313
EVB	Apron	4154	Ultra-Thin	2	7,400	4	4	463	1	313
EVB	Apron	4155	Ultra-Thin	2	3,500	4	4	219	1	313

Step 4 – Field Inventory Data Collection

The SAPMP Team Leader will coordinate overall Data Collection efforts in accordance with the Section 5 of the Quality Assurance and Quality Control Procedures Manual. For the three (3) identified airport facilities with Whitetopping Concrete Overlays, the Team Leader will provide a brief discussion with the airport contact on the Whitetopping Concrete Overlay pavement facilities. The discussion will confirm the following:

1. Confirm Airport Staff's acknowledgment of Whitetopping Concrete Overlay
2. Confirm Whitetopping as a deviation from current FAA AC 150/5320-6
3. Confirm data collection and analysis will exclude ASTM D5430-12 (current) for Whitetopping Concrete Overlay pavement sections
    a. Excludes PCI Survey
    b. Excludes current and forecasted PCI Values and Condition Ratings
    c. Excludes M&R Analysis
4. Confirm data collection and analysis for Whitetopping Concrete Overlays will be based on PASER Rating System as defined by FAA AC 150/5320-17A Appendix B
    a. Current PASER Value and Surface Rating at Section-level based on average of limited sampling plan
5. Confirm FDOT SAPMP status of record documentation request for Whitetopping Concrete Overlay construction at airport

The Team Leader will utilize the draft Airfield Pavement Network Definition Exhibit to confirm the approximate limits of the Whitetopping Concrete Overlay facilities with the Airport Staff.

The Team Leader will coordinate the appropriate efforts to collect data in accordance with the following table.

Table 15. Whitetopping Concrete Overlay Airfield System Inventory Data Updates

Inventory Level	Inventory Characteristic	Analysis Element	Validation	Confirmation
Network	Airport Name		FAA 5010 Form	Airport Staff FAA Form
Network	Airport Category		FAA NPIAS SASP	Airport Staff
Branch	Branch Name		Field Observation	Airport Staff
Section / Feature	Pavement Surface Type		AC AAC APC PCC PCC – Whitetopping	Field Observation Record Documentation
Section / Feature	PASER Rating	Distress and Condition	Field Observation	Airport Staff Discussion
Section / Feature	PCC Joint Layout	Slabs per Section Slabs per Sample Unit	Field Measure	Record Documentation As-Builts
Section / Feature	PCC Joint Seal	PASER Rating	Field Observation Indicators of moisture intrusion	Record Documentation As-Builts
Section / Feature	Pavement Grooving	Grooving vs. No Grooving	Field Observation	Record Documentation
Section / Feature	Airfield Utilities Interfacing with PCC	Part of Original Construction		

Step 5 – Field Condition Rating Using PASER

Perform visual condition assessment in accordance with PASER Rating System. Prepare slab distress sketch using FDOT SAPMP Whitetopping Concrete Overlay PASER Rating Forms shown as **Figure 10 Sample PASER Manual Concrete Airfield Pavements Form**. Note that the PASER-PCC form excludes notes on PASER Value 5 Surface Rating Excellent; this deliberate as the rating would represent no distresses observed.

Figure 10 – Sample PASER Manual Concrete Airield Pavements Form (PASER-PCC)

PASER Manual Concrete Airfield Pavements

FAA AC 150/5320-17A Appendix B

PASER-PCC

FACILITY (BRANCH): ____________________ **SAMPLE UNIT(S):** ____________________

FEATURE (SECTION): ____________________ **INSPECTOR(S):** ____________________

Surface Defect (SD)		Joint (J)		Pavement Cracks (PC)		Pavement Distortion (PD)	
SD-1	Polishing	J-1	Parallel Cracks	PC-1	Slab Cracks	PD-1	Settling/Heave
SD-2	Map Cracking - Shrinkage Cracking	J-2	Joint Ravelling	PC-2	D-Cracks	PD-2	Blowups
SD-3	Pop-Outs	J-3	Joint Seal Damage/Missing	PC-3	Corner Cracks	PD-3	Faulting
SD-4	Scaling			PC-4	Meander Cracks	PD-4	Utility Repair/Patch/Pothole
SD-5	Spalling			PC-5	Manhole/Inlet Cracks		

4 - Good	3 - Fair	2 - Poor	1 - Failed
General Conditions	General Conditions	General Conditions	General Conditions
Hairline or sealed cracks 1/8" wide or less. Map cracking. Pop-outs.	Several slabs broken into two pieces by slab cracks. Corner cracking on several slabs, 1/4" wide with no spalling. Joint sealant mostly in good condition, less than 10% needing replacement. Several patches in fair to good condition. Map cracking or scaling on 10% or less of the surface area. Slight faulting, less than 1/4", in several locations.	Many slab cracks, some breaking the slab into three or more pieces. Cracks open 1/8" or cracks with spalling. D-cracks at several joints. Sealant failure over 10% of joints. Several patches in fair to poor condition with cracks in patch and uneven surface. Faulting ¼" to ½" in several locations. Severe or extensive scaling.	Many wide cracks with failed sealant and grass. Extensive crack and joint spalling. Slabs extensively cracked or shattered. Many corner breaks with spalling. D-cracks with spalling. Patches in poor condition with spalling. Numerous faults over 1/2".
Treatment Mesaure	Treatment Mesaure	Treatment Mesaure	Treatment Mesaure
Concrete over 5 years old. Signs of wear. Minor spot repair of cracks or joint sealant.	First sign of significant slab cracking, corner cracking, scaling, or faulting. Several patches. Joint sealant repair required. Isolated repair of joint or patch.	Needs sealant replacement on more than 10% of cracks or joints. Partial depth or full depth joint repairs or patch replacement. Repair faulted joints. Replace or overlay slabs with severe scaling. Bonded or unbonded concrete overlay.	Extensive full depth joint repairs or slab replacements. Extensive patching and complete overlay. Complete reconstruction.

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PASER: **5 4 3 2 1**

Field Condition Rating Step 1

Identify Airfield Pavement Network Definition and System Inventory

A. Identify Facility (Branch)
B. Identify Feature (Section)
    a. Verify Grooving / No Grooving
    b. Verify Joint Layout (Typical Length and Width of Slabs)
    c. Verify Joint Sealant
C. Identify Sample Unit
D. Identify Inspectors

Figure 11 – Form Airfield Pavement Network Definiton and System Inventory

FACILITY (BRANCH):	______________________	**SAMPLE UNIT(S):**	______________________
FEATURE (SECTION):	______________________	**INSPECTOR(S):**	______________________

Field Condition Rating Step 2

A. Review PASER PCC Distress and Condition Major Categories
    a. Surface Defects
    b. Joint
    c. Pavement Cracks
    d. Pavement Distortion
B. Review PASER Rating
    a. General Conditions
    b. Treatment Measure (Anticipated)

Figure 12 – PASER Manual Concrete Airfield Pavements Review

Surface Defect (SD)		Joint (J)		Pavement Cracks (PC)		Pavement Distortion (PD)	
SD-1	Polishing	J-1	Parallel Cracks	PC-1	Slab Cracks	PD-1	Settling/Heave
SD-2	Map Cracking - Shrinkage Cracking	J-2	Joint Ravelling	PC-2	D-Cracks	PD-2	Blowups
SD-3	Pop-Outs	J-3	Joint Seal Damage/Missing	PC-3	Corner Cracks	PD-3	Faulting
SD-4	Scaling			PC-4	Manhole/Inlet Cracks	PD-4	Utility Repair/Patch/Pothole
SD-5	Spalling			PC-5			

4 - Good	3 - Fair	2 - Poor	1 - Failed
General Conditions	General Conditions	General Conditions	General Conditions
Hairline or sealed cracks 1/8" wide or less. Map cracking. Pop-outs.	Several slabs broken into two pieces by slab cracks. Corner cracking on several slabs, 1/4" wide with no spalling. Joint sealant mostly in good condition, less than 10% needing replacement. Several patches in fair to good condition. Map cracking or scaling on 10% or less of the surface area. Slight faulting, less than 1/4", in several locations.	Many slab cracks, some breaking the slab into three or more pieces. Cracks open 1/8" or cracks with spalling. D-cracks at several joints. Sealant failure over 10% of joints. Several patches in fair to poor condition with cracks in patch and uneven surface. Faulting ¼" to ½" in several locations. Severe or extensive scaling.	Many wide cracks with failed sealant and grass. Extensive crack and joint spalling. Slabs extensively cracked or shattered. Many corner breaks with spalling. D-cracks with spalling. Patches in poor condition with spalling. Numerous faults over 1/2".
Treatment Mesaure	Treatment Mesaure	Treatment Mesaure	Treatment Mesaure
Concrete over 5 years old. Signs of wear. Minor spot repair of cracks or joint sealant.	First sign of significant slab cracking, corner cracking, scaling, or faulting. Several patches. Joint sealant repair required. Isolated repair of joint or patch.	Needs sealant replacement on more than 10% of cracks or joints. Partial depth or full depth joint repairs or patch replacement. Repair faulted joints. Replace or overlay slabs with severe scaling. Bonded or unbonded concrete overlay.	Extensive full depth joint repairs or slab replacements. Extensive patching and complete overlay. Complete reconstruction.

Field Condition Rating Step 3

A. Define Sample Unit Layout using Airfield Pavement Network Definition Exhibit
B. Sketch Limits of Sample Unit on PASER-PCC Form
C. Walk Whitetopping Concrete Overlay Pavements and record distress and general location
    a. No ASTM D5340-12 (current) identification, severity rating, or measurement

Figure 13 – Sample Sketch of PASER-PCC Form

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1												PC-1	PC-1												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Note in the example sketch above, the Team Leader observed PC-1 Slab Cracks and PC-4 Meander Cracks. The green shaded cells indicate the sample unit was laid out as 25 slabs wide by 4 slabs long in the direction of travel, for a total of 100 slabs subject to the PASER Rating System.

Field Condition Rating Step 4

A. Collect representative Photograph Documentation using GPS-enabled cameras for image location approximation (±20-ft)
B. Select PASER Value and Surface Rating

Figure 14 – Sample PASER-PCC Form with Data

PASER Manual Concrete Airfield Pavements

FAA AC 150/5320-17A Appendix B

PASER-PCC

FACILITY (BRANCH): Runway 12-30
FEATURE (SECTION): 6105 / 6.5' x 6.5' / Grooved / Sealed Joints
SAMPLE UNIT(S): 101 (25 slabs wide by 4 slabs long)
INSPECTOR(S): Team Leader

Surface Defect (SD)		Joint (J)		Pavement Cracks (PC)		Pavement Distortion (PD)	
SD-1	Polishing	J-1	Parallel Cracks	PC-1	Slab Cracks	PD-1	Settling/Heave
SD-2	Map Cracking - Shrinkage Cracking	J-2	Joint Ravelling	PC-2	D-Cracks	PD-2	Blowups
SD-3	Pop-Outs	J-3	Joint Seal Damage/Missing	PC-3	Corner Cracks	PD-3	Faulting
SD-4	Scaling			PC-4	Meander Cracks	PD-4	Utility Repair/Patch/Pothole
SD-5	Spalling			PC-5	Manhole/Inlet Cracks		

4 - Good	3 - Fair	2 - Poor	1 - Failed
General Conditions	General Conditions	General Conditions	General Conditions
Hairline or sealed cracks 1/8" wide or less. Map cracking. Pop-outs.	Several slabs broken into two pieces by slab cracks. Corner cracking on several slabs, 1/4" wide with no spalling. Joint sealant mostly in good condition, less than 10% needing replacement. Several patches in fair to good condition. Map cracking or scaling on 10% or less of the surface area. Slight faulting, less than 1/4", in several locations.	Many slab cracks, some breaking the slab into three or more pieces. Cracks open 1/8" or cracks with spalling. D-cracks at several joints. Sealant failure over 10% of joints. Several patches in fair to poor condition with cracks in patch and uneven surface. Faulting ¼" to ½" in several locations. Severe or extensive scaling.	Many wide cracks with failed sealant and grass. Extensive crack and joint spalling. Slabs extensively cracked or shattered. Many corner breaks with spalling. D-cracks with spalling. Patches in poor condition with spalling. Numerous faults over 1/2".
Treatment Mesaure	Treatment Mesaure	Treatment Mesaure	Treatment Mesaure
Concrete over 5 years old. Signs of wear. Minor spot repair of cracks or joint sealant.	First sign of significant slab cracking, corner cracking, scaling, or faulting. Several patches. Joint sealant repair required. Isolated repair of joint or patch.	Needs sealant replacement on more than 10% of cracks or joints. Partial depth or full depth joint repairs or patch replacement. Repair faulted joints. Replace or overlay slabs with severe scaling. Bonded or unbonded concrete overlay.	Extensive full depth joint repairs or slab replacements. Extensive patching and complete overlay. Complete reconstruction.

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7																									
6																									
5																									
4								PC-4													PC-4				
3											PC-4	PC-1	PC-1												
2							PC-4					PC-1	PC-1						PC-4						
1												PC-1	PC-1												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

1/4 -in

PASER: | 5 | **4** | 3 | 2 | 1 |

Step 6 – PASER Rating at Section-Level

Upon completion of performing an assessment for each Whitetopping Concrete Overlay pavement section, the Team Leader will summarize evaluated Sample Unit PASER Values and determine an average for the Section. The PASER Rating at a Section-level will be based on the arithmetic average of the Sample Unit-level PASER Values.

5. Conclusion

The three (3) Florida airports identified with Whitetopping Concrete Overlays are to be evaluated using an objective and repeatable method for assessing pavement condition in accordance with Public Law 103-305. It is recognized that Whitetopping Concrete Overlays do not adhere to the current FAA AC 150/5320-6 guidance for Concrete Overlays based on material specification, documented concrete strength, concrete minimum thickness, joint type, joint sealant, joint layout, and load transfer. It is recognized that the ASTM D5340-12 (current version) may not be suitable to utilize as means to evaluate condition for the Whitetopping Concrete Overlays. It is also recognized that creating a modification to the ASTM D5340-12 for the existing Florida Airport Whitetopping Concrete Overlays is not practical.

Based on the active FAA AC 150/5320-17A, FDOT SAPMP will adopt the PASER Manual Concrete Airfield Pavements for specific use on the Florida Airport Whitetopping Concrete Overlays identified in Section 1. The PASER Rating System is an FAA-accepted method for objectively evaluating pavements when a PCI Survey is not practical. The FDOT SAPMP will utilize a 6-Step Procedure to perform records review, field data collection, and analysis to determine Section-level PASER Values and Surface Ratings.

6. References

FAA AC 150/5380-7 Airport Pavement Management Program (PMP), 150/5380-7B issued 10/10/2014

FAA AC 150/5380-6 Guidelines and Procedures for Maintenance of Airport Pavements, 150/5380-6C issued 10/10/2014

FAA AC 150/5320-17 Airfield Pavement Surface Evaluation and Rating Manuals, 150/5320-17A issued 09/10/2014

FAA AC 150/5320-6 Airport Pavement Design and Evaluation, 150/5320-6F issued 11/10/2016

FAA AC 150/5370-10 - Standard Specifications for Construction of Airports, 150/5370-10H issued 12/21/2018

ASTM D5340 Standard Test Method for Airport Pavement Condition Index Surveys, D5340-12 reapproved 2018

ACPA Engineering Bulletin EB 210P Whitetopping – State of the Practice

National Concrete Pavement Technology Center, Guide to Concrete Overlays Sustainable Solutions for Resurfacing and Rehabilitating Existing Pavements 3rd Edition

7. Appendices

Appendix A	Sample PASER Manual Concrete Airfield Pavements Form
Appendix B	FAA AC 150/5320-17A, Appendix B. Concrete Airfield Pavement Surface Evaluation and Rating (PASER) Manual

Appendix A

Sample PASER Manual Concrete Airfield Pavements Form

PASER Manual Concrete Airfield Pavements

FAA AC 150/5320-17A Appendix B

PASER-PCC

FACILITY (BRANCH): ____________________ **SAMPLE UNIT(S):** ____________________

FEATURE (SECTION): ____________________ **INSPECTOR(S):** ____________________

Surface Defect (SD)		Joint (J)		Pavement Cracks (PC)		Pavement Distortion (PD)	
SD-1	Polishing	J-1	Parallel Cracks	PC-1	Slab Cracks	PD-1	Settling/Heave
SD-2	Map Cracking - Shrinkage Cracking	J-2	Joint Ravelling	PC-2	D-Cracks	PD-2	Blowups
SD-3	Pop-Outs	J-3	Joint Seal Damage/Missing	PC-3	Corner Cracks	PD-3	Faulting
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4 - Good	3 - Fair	2 - Poor	1 - Failed
General Conditions	General Conditions	General Conditions	General Conditions
Hairline or sealed cracks 1⁄8" wide or less. Map cracking. Pop-outs.	Several slabs broken into two pieces by slab cracks. Corner cracking on several slabs, 1⁄4" wide with no spalling. Joint sealant mostly in good condition, less than 10% needing replacement. Several patches in fair to good condition. Map cracking or scaling on 10% or less of the surface area. Slight faulting, less than 1⁄4", in several locations.	Many slab cracks, some breaking the slab into three or more pieces. Cracks open 1/8" or cracks with spalling. D-cracks at several joints. Sealant failure over 10% of joints. Several patches in fair to poor condition with cracks in patch and uneven surface. Faulting ¼" to ½" in several locations. Severe or extensive scaling.	Many wide cracks with failed sealant and grass. Extensive crack and joint spalling. Slabs extensively cracked or shattered. Many corner breaks with spalling. D-cracks with spalling. Patches in poor condition with spalling. Numerous faults over 1⁄2".
Treatment Mesaure	Treatment Mesaure	Treatment Mesaure	Treatment Mesaure
Concrete over 5 years old. Signs of wear. Minor spot repair of cracks or joint sealant.	First sign of significant slab cracking, corner cracking, scaling, or faulting. Several patches. Joint sealant repair required. Isolated repair of joint or patch.	Needs sealant replacement on more than 10% of cracks or joints. Partial depth or full depth joint repairs or patch replacement. Repair faulted joints. Replace or overlay slabs with severe scaling. Bonded or unbonded concrete overlay.	Extensive full depth joint repairs or slab replacements. Extensive patching and complete overlay. Complete reconstruction.

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1/4 -in

PASER: | 5 | 4 | 3 | 2 | 1 |

Appendix B

FAA AC 150/5320-17A, Concrete Airfield Pavement Surface Evaluation and Rating (PASER) Manual

Pavement Surface Evaluation and Rating

PASER Manual

Concrete Airfield Pavements

Contents

This manual is intended to assist airfield managers in understanding and rating the surface condition of rigid Portland Cement Concrete (PCC) pavements. It describes types and causes of distress and provides a simple system to visually rate pavement condition.

Produced for the Federal Aviation Administration by Engineering Professional Development, College of Engineering, University of Wisconsin-Madison.

Pavement Surface Evaluation and Rating

PASER Manual

Concrete Airfield Pavements

Donald Walker, P.E., University of Wisconsin–Madison, *author*
Lynn Entine, Entine & Associates, *editor*
Susan Kummer, Artifax, *designer*

PASER — Pavement Surface Evaluation and Rating

Concrete Airfield Pavements

An airport manager's goal is to use available funds to provide a safe and economical pavement surface. This is no simple task. It requires balancing priorities and making difficult decisions in order to manage pavements. This manual offers useful information for planning maintenance and managing Portland Cement Concrete (PCC) pavements. It discusses common problems and typical repairs and includes a visual system for evaluating and rating PCC pavements.

General aviation airfield pavements are often managed informally, based on the staff's judgment and experience. While this process is both important and functional, using a slightly more formalized technique can make it easier to manage pavements effectively.

Experience has shown that there are three steps that are especially useful in managing airfield pavements:

1) Inventory all pavements.
2) Periodically evaluate the condition of all pavements.
3) Use the condition evaluations to set priorities for projects and evaluate alternative treatments.

A comprehensive pavement management system involves collecting data and assessing several pavement characteristics: roughness, surface distress (condition), surface skid characteristics, drainage, and structure (pavement strength and deflection). Planners can combine this condition data with economic analysis, to develop short-range and long-range plans for a variety of budget levels. However, general aviation agencies may lack the resources for such a full-scale system.

Since surface condition is the most vital element in any pavement management system, managers may use the simplified rating system presented in this Concrete Airfield Pavements PASER Manual to evaluate their pavements. A PASER Manual for asphalt airfield pavements is also available (see References, page 20).

Evaluating pavement condition

Rigid pavement performance

PCC pavements are either plain (non-reinforced) or reinforced concrete. Reinforcement is usually provided by steel wire mesh placed approximately at mid-slab depth. The reinforcement is intended to limit crack opening and movement in the concrete slab. Most airfield pavements are not reinforced.

Since concrete slabs need to move (expand and contract) with changes in temperature and during initial cure (drying and shrinkage), pavements are constructed with contraction joints. These are usually sawn into the pavement shortly after initial curing. This joint gives the slab a place to crack and makes a straight, well-formed groove to seal. Runways, taxiways and aprons (ramps) are sawn to create square slabs ranging from 15’ to a maximum of 25’.

Isolation joints are occasionally provided. These are wider, full depth, and filled with a material to allow expansion. If used, they are placed adjacent to structures that cannot move with the pavement such as buildings, manholes, and other utility structures. These isolation joints are also used at pavement intersections and allow changes in joint patterns.

Rigid, PCC pavements carry traffic loadings differently than flexible pavements (asphalt). Concrete pavements are designed to act like a beam and use the bending strength of the slabs to carry the load. Therefore, load transfer across cracks and joints is important, especially on pavements with heavy traffic loading. Hairline and narrow cracks still have interlocked concrete aggregate and can effectively transfer loads. Because wide cracks and widely-spaced joints open up, they cannot transfer loads and must take higher edge loads. These higher edge loads can cause further cracking and deterioration along the joint, or crack edges.

Many concrete pavements use joints that have load transfer dowels. These are smooth steel bars placed across the joint. They transfer traffic loads between adjacent concrete slabs while allowing the joint to open and close. These bars can rust and sometimes cause problems. The corrosion causes forces on the concrete which leads to spalling, cracking, and general joint deterioration. Epoxy coated dowels may be used to reduce corrosion.

Unsupported slab edges will deflect or bend under a load. If the supporting soil is saturated it can squirt up through joints or cracks when the slab bends. This is called ***pumping***. Eventually the loss of supporting soil through pumping creates an empty space or void under the slab. The slabs may then crack further under loads and joints will deteriorate more.

Undoweled joints under heavy traffic may ***fault***. This is when one slab edge is lower than the next slab. Faulting is more likely on pavements with most of the traffic in one direction. The downstream traffic slab will be lower than the upstream slab, creating a step. Faulting creates a rough pavement.

You can often detect pumping by the soil stains around pavement joints or cracks. The resulting voids can be grouted full or sub-sealed. Slabs can be leveled by slab jacking or mud jacking. Obviously, sealing cracks and joints and improving subsoil drainage will help reduce pumping, faulting, and joint failures.

PCC pavement conditions and defects

It is helpful to separate various conditions common to PCC pavements. These are described individually in some detail. We include causes for deterioration and common strategies for repair. Some defects are localized while others indicate that problems may develop throughout the pavement. It is important to distinguish between local and widespread defects. Assessing the conditions of actual pavements also involves looking for combinations of these individual defects.

There are four major categories of common PCC pavement surface distress and condition:

Surface defects
Polishing, map cracking, pop-outs, scaling, spalling.

Joints
Longitudinal and transverse joints.

Pavement cracks
Slab cracks, D-cracking, corner cracks, meander cracks, manhole and inlet cracking.

Pavement distortion
Pavement settlement or heave; blow ups; faulting; utility repairs, patches and potholes.

In reviewing the different defects it is important to consider both their severity and extent. Generally, conditions begin slowly and progressively become more serious. Slight defects may grow into moderate and then severe conditions. In addition, defects might initially be indicated only in a few isolated cases. Examples in the rating section will help identify how bad and how extensive a condition is.

SURFACE DEFECTS

Polishing

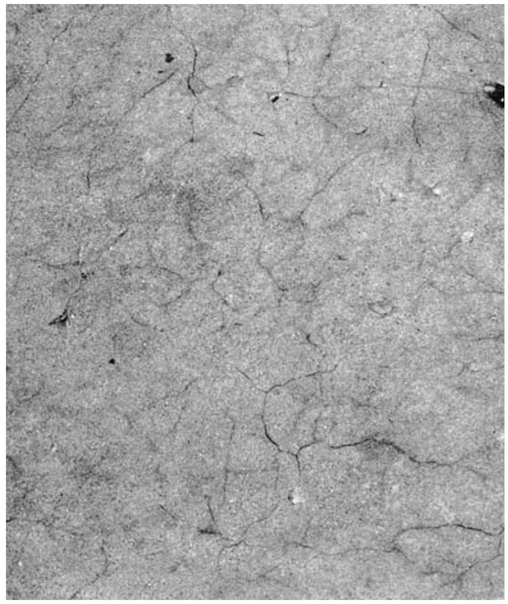
A worn or polished surface may develop from traffic wearing off the surface mortar and skid-resistant texture. An asphalt overlay or grinding the concrete surface can restore skid resistance.

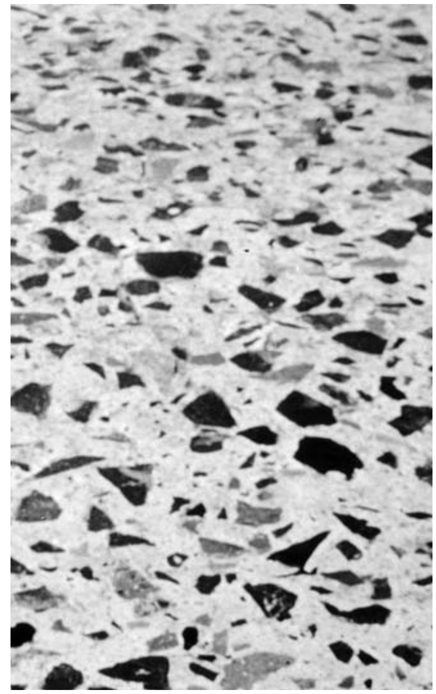
Map cracking

A pattern of fine cracks usually spaced within several inches is called map cracking. It usually develops into square or other geometrical patterns. Map cracking can be caused by improper cure or over-working the surface during finishing. It may also indicate a problem with the quality of the aggregate known as ASR (alkali-silica reactivity). If severe, cracks may spall or the surface may scale. Repair is usually limited to very severe conditions. An asphalt overlay or partial depth patching may then be necessary.

Pop-outs

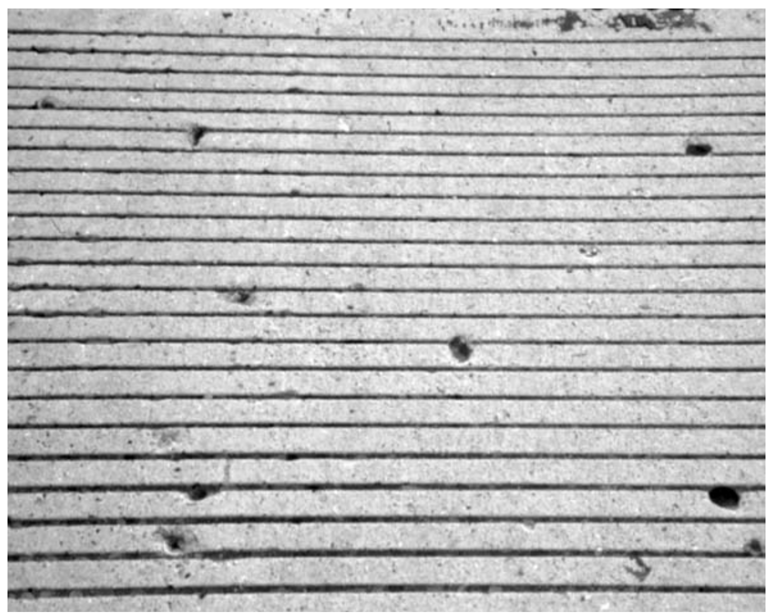
Individual pieces of large aggregate may pop out of the surface. This is often caused by chert or other absorbent aggregates that deteriorate under freeze-thaw conditions. Pop-outs alone do not usually affect pavement serviceability. However, damage to aircraft from the debris may occur. For severe areas, a patch, overlay or slab replacement may be necessary.





► **Close-up of a polished pavement surface.**

▲ **Map cracking has hairline surface cracks, probably shallow in depth. May not cause any long-term performance problems.**



► **Several pop-outs in a new slab.**

► **Extensive pop-outs of large aggregate from surface.**

▲ **Slight scaling. Minor loss of surface mortar.**

► **Moderate surface scaling. Loss of mortar and fines starting to expose larger aggregate.**

◄ **Severe scaling. Some larger aggregate is loose.**

◄ **Small surface spall that has been patched.**

◄ **Spall at crack. Creates dangerous debris.**

◄ **Spalling along a joint.**

Scaling

Scaling is surface deterioration that causes loss of fine aggregate and mortar. More extensive scaling can result in loss of large aggregate. The cause often is using concrete which has not been air-entrained, making the surface susceptible to freeze-thaw damage.

Scaling can occur as a general condition over a large area or be isolated to locations where poor quality concrete or improper finishing techniques caused loss of entrained air. In severe cases, deterioration can extend deep into the concrete. Debris from scaling can damage aircraft.

Grinding may remove poor quality surface concrete. Partial depth patching of isolated areas may also prolong the life of the pavement. Severe scaling may require slab replacement.

Spalling

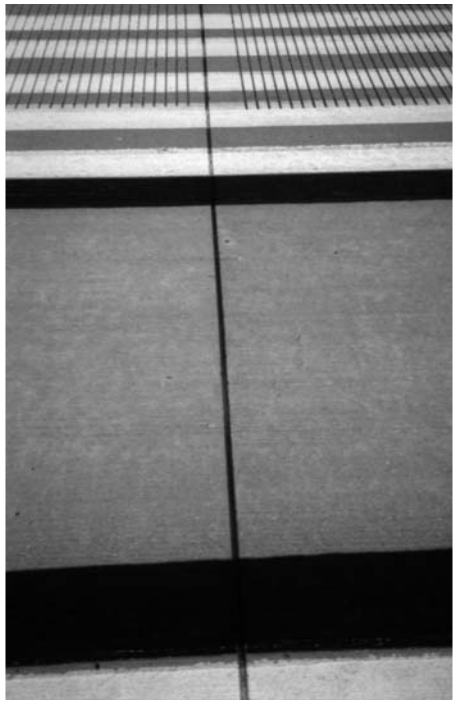
Spalling is the loss of a piece of the concrete pavement from the surface or along the edges of cracks and joints. Cracking or freeze-thaw action may break the concrete loose, or spalling may be caused by poor quality materials. Spalling may be limited to small pieces in isolated areas or be quite deep and extensive. Large pieces of loose concrete can cause serious damage to aircraft.

Repair will depend on the cause. Small spalled areas are often patched. Spalling at joints may require full depth joint repair or full slab replacement.

JOINTS

Construction joints or sawn joints are narrow and usually well sealed. As pavements age and materials deteriorate, joints may open wider and deteriorate further. Cracks parallel to the initial joint may develop and accelerate into spalling or raveling. Settlement, instability, or pumping of subgrade soil can cause joints to fault. One common cause of cracks parallel to joints is waiting too long after the pour to saw the joint. Then, during initial cure the slab will crack near the sawn joint.

Maintaining a tight joint seal can prevent intrusion of water and debris and reduce freeze-thaw damage and pumping. Debris may accumulate in open joints which prevents normal joint movement. This will greatly accelerate joint deterioration. Severe joint deterioration may require full depth patching and joint replacement.



▲ New pavement with good joints.

▲ Joint sealant deterioration on apron. Slab is in good condition.

► Taxiway with spalled joint.

▲ Joint sealant in poor condition. Loss of bond to edge allows water into pavement.

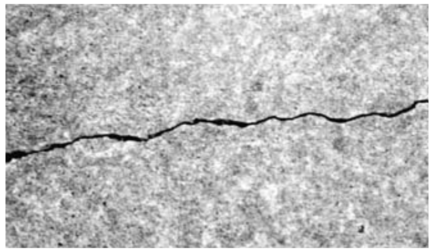
▲ Severe spalling along joint and crack. Creates debris.

PAVEMENT CRACKS

Slab cracks

Slab cracks divide the slab into 2 or more pieces. They can be caused by thermal stresses, poor subgrade support, or heavy loadings. They are sometimes related to slabs with joints spaced too widely. Slabs with a length-to-width ratio greater than 1.25 are more likely to develop mid-slab cracks.

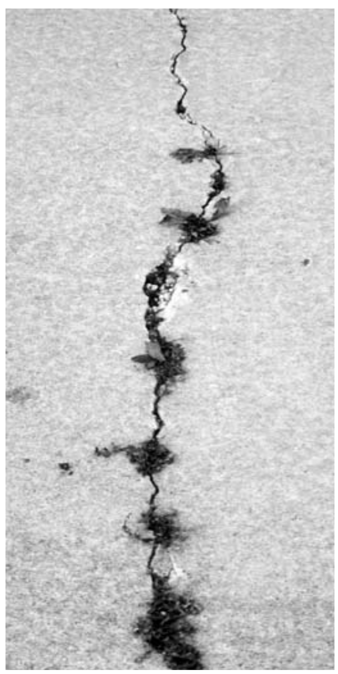
As with joints, these cracks may deteriorate further if not sealed well. Slabs can fault at cracks. Cracks can spall and develop additional parallel cracking. Severe deterioration may require patching individual cracks. Multiple transverse cracks in individual slabs indicate further deterioration. Extensive slab cracking indicates pavement failure and the need for complete replacement.



▲
Hairline slab crack. Tight with no spalling.

◄
Crack next to joint often caused by late sawing. Crack shows early signs of spalling.

Slab crack with grass, no sealant, and spalls developing.
▼



◄◄
Slab crack with spalling and debris.

Multiple slab cracks and broken pavement. Replacement needed.
▼

◄
Closely spaced, hair-line, transverse cracks indicate slab is broken and needs replacing.

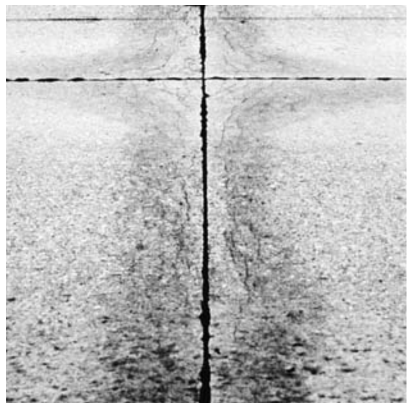
D-cracks

Occasionally, severe deterioration may develop from poor quality aggregate. So called D-cracks or disintegration cracking, develop when the aggregate is able to absorb moisture. This causes the aggregate to break apart under freeze-thaw action which leads to deterioration. Usually, it starts at the bottom of the slab and moves upward.

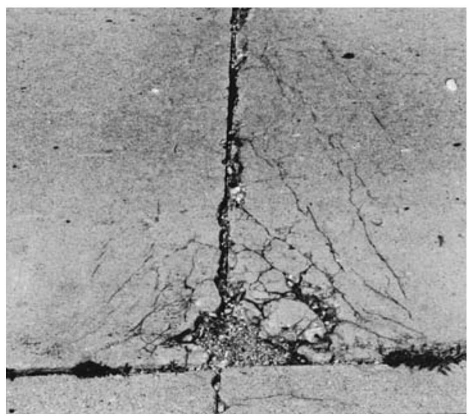
Fine cracking and a dark discoloration adjacent to the joint often indicate a D-cracking problem. Once this is visible on the surface the pavement material is usually severely deteriorated and complete replacement is required.

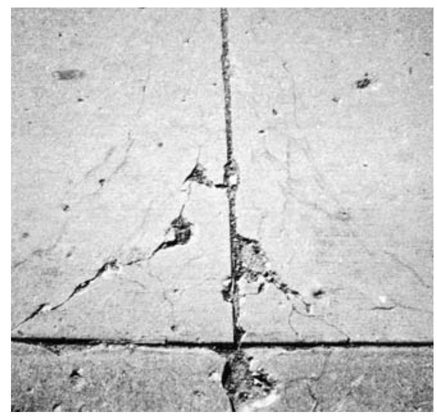
Joint or crack sealing helps slow D-cracking deterioration. This is a serious defect because it may indicate a material quality problem throughout the pavement. Milling and patching has proven successful as a short term repair.

Surface discoloration near joints and cracks indicates D-cracking and severe slab deterioration. ▼ ►



► **Multiple crack patterns adjacent to joints. Common D-cracking pattern.**





Corner cracks

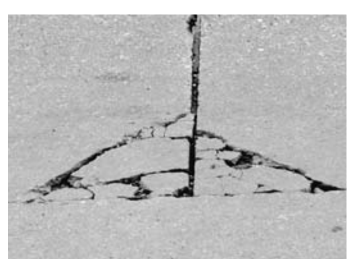
Diagonal cracks may develop near the corner of a concrete slab, forming a triangle with the joint. Usually these cracks are within a foot or two of the slab corner and are caused by insufficient soil support or concentrated stress due to temperature-related slab movement. The corner breaks under traffic loading. They may begin as hairline cracks.

Some corner cracks extend the full depth of the slab while others start at the surface and angle down toward the joint. With further deterioration, more cracking develops, and eventually the entire broken area may come loose. This may be a localized failure, but it often indicates widespread maintenance problems.

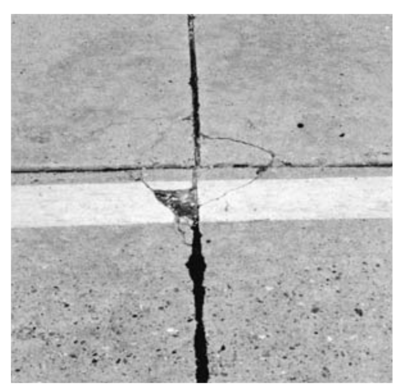
Partial or full depth concrete patching or full depth joint replacement may be needed when corner cracking is extensive.

► **Corner cracking with slight spalling.**

► **Corner cracking, severe spalling, and dangerous debris.**



► **Corner cracking in all four slabs.**



◄ **Meander crack caused by settlement. Lack of maintenance allows water to intrude and debris to collect in crack.**

◄ **Faulting and spalling of a meander crack.**

Meander cracks

Some pavement cracks appear to wander randomly. They may cross a slab diagonally or meander in a random manner. Meander cracks may be caused by settlement due to unstable subsoil or drainage problems. Frost heave and spring thaw can also cause them. They are often local in nature and may not indicate general pavement problems.

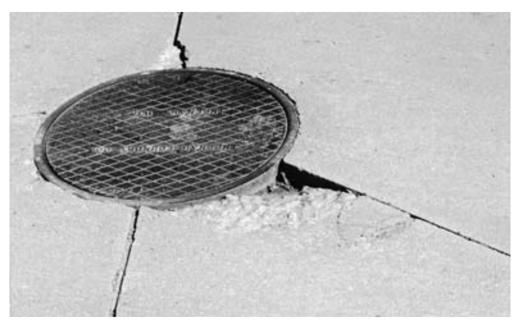
Minor cracks may benefit from sealing to minimize water intrusion. Extensive or severe meander cracks may require replacing the slab, stabilizing the subsurface, or improving drainage.

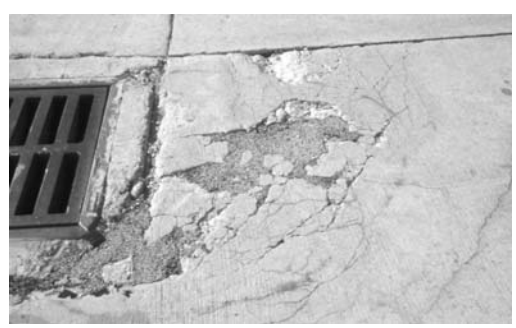
Manhole and inlet cracks

The pavement adjacent to a light can, manhole, or storm sewer inlet often cannot accommodate normal pavement movement due to frost heaving and temperature changes. Cracks and faulting may develop and the concrete slab may deteriorate further. These are often localized design defects that may not indicate a general pavement problem. Sealing and patching may slow the deterioration. Eventually full depth repairs may be required.

▲ **Slabs replaced next to inlet. Good joint design.**

Two spalls at manhole in a new pavement. Partial depth patching would be beneficial. ▼





► **Inlet with severe cracking and spalling. Full depth slab repair required.**

PAVEMENT DISTORTION

Pavement settling or heave

Unstable or poorly drained subgrade soils may cause pavements to settle after construction. Poorly compacted utility trenches may also settle. This may be a gentle swale or a fairly severe dip.

Frost-susceptible soils and high water tables can cause pavements to heave during the winter months. Extensive pavement cracking and loss of strength during the spring can result in severe deterioration. Improved drainage and stabilization of subgrade soils is usually necessary, along with pavement reconstruction.

Blowups

Concrete slabs may push up or be crushed at a joint. This is caused by expansion of the concrete where incompressible materials (sand, debris, etc.) have infiltrated into poorly sealed joints. As a result, there is no space to accommodate expansion. It is more common in older pavements with long joint spacing. Pavements that have aggregate susceptible to ASR may experience more frequent blowups. Pressure relief joints can be installed and blowup areas must be patched or reconstructed. Cleaning and sealing joints will help prevent blowups.

▲ **Settlement caused meander crack with faulting.**

Extensive cracking and patching caused by settlement. Pavement was built on unstable sub-grade soils. ▼

▲ **Internal pressure has partially raised slab at the joint. Complete replacement is required.**

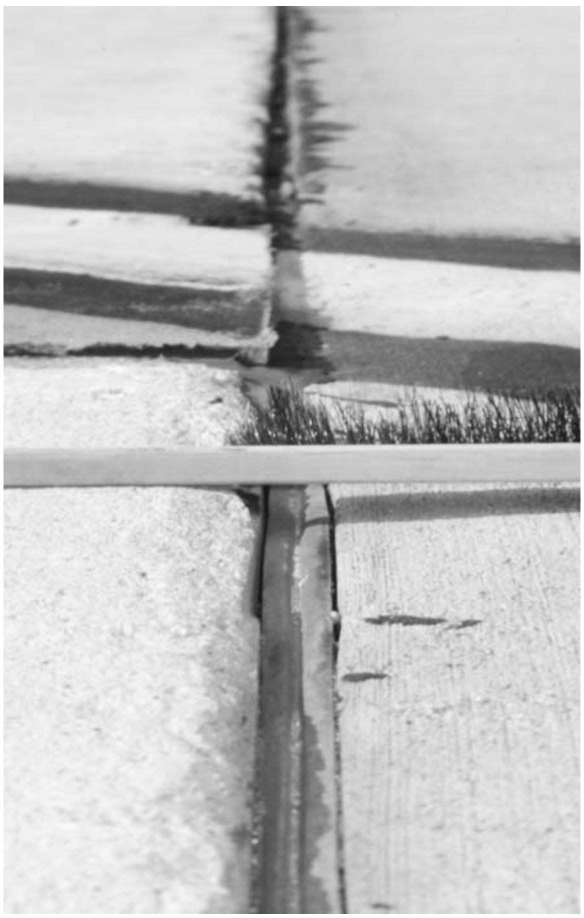
▼ **Pavement blowup in progress—concrete is crushed and slab buckled.**

Faulting

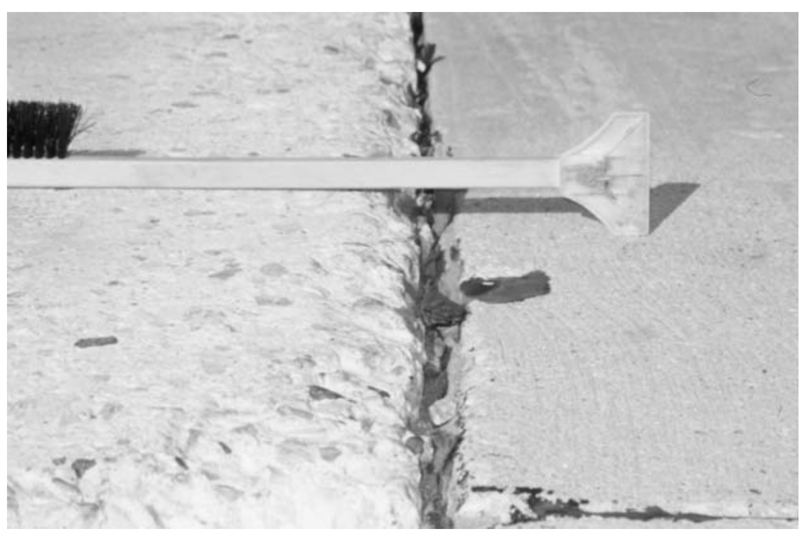
Joints and cracks may fault or develop a step between adjacent slabs. Faulting is caused by pumping of subgrade soils and creation of voids. Heavy traffic can rapidly accelerate faulting. Joints may fault due to settlement of an adjacent slab.

Faulting creates a rough pavement and may cause slab deterioration. Minor faulting can be corrected by surface grinding. Voids can be subsealed, or slabs can be mud jacked back to level position. Severe cases may need joint or slab replacement.

▲
Faulting of joints. Aggravated by heavy traffic in one direction. Could improve surface by grinding.



Severe joint fault.
◄

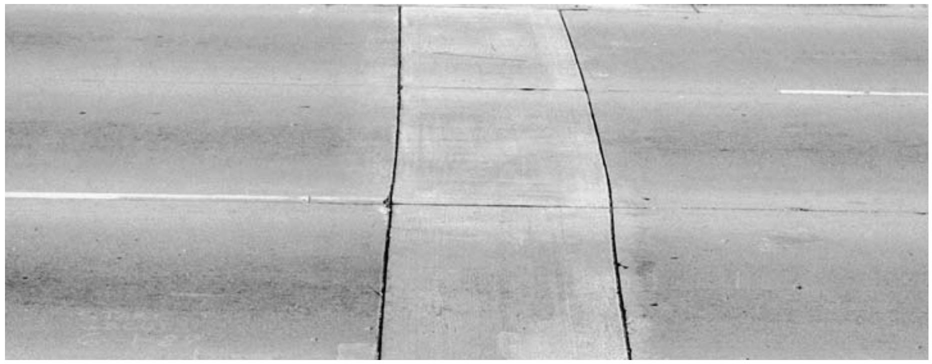


►
Severe joint fault and spalling.

Utility repairs, patches and potholes

Slab replacement or repair of utilities will require cuts and slab patching. Patches from previous repairs may perform like original pavement or may show settlement, joint deterioration or distress.

Localized failures of materials or subgrade soil can cause individual potholes. Surface spalling or other material defects may develop into localized potholes. Full depth patching or slab replacement is usually required.



▲
Full depth joint repair. Very good condition.

►
Joint repair with asphalt. Very good condition.

►
Partial depth concrete patch to repair corner cracks. Good condition.

Potholes caused by severe joint deterioration. Need repair.
▼

►
Asphalt patches. Poor *(top)* **and fair** *(bottom)* **condition.**

Rating pavement surface condition

Using your understanding of pavement conditions and distress, you can evaluate and rate airfield PCC pavements. The rating scale ranges from **5–excellent** condition to **1–very poor or failed.** Some pavements will deteriorate through the phases listed in the rating scale. The time it takes to go from an excellent (5) to failed condition (1) depends largely on the quality of the original construction, age, and the amount of heavy traffic loading.

Once significant deterioration begins, it is common to see pavements deteriorate rapidly. This is usually due to the combined effects of loading and additional moisture. As a pavement ages and additional cracks develop, more moisture can enter and accelerate the rate of deterioration.

Look at the photographs which follow and become familiar with the descriptions of the individual rating categories. To evaluate an individual pavement, first determine its general condition. Is it relatively new, toward the top end of the scale? In very poor condition and at the bottom of the scale? Or somewhere in between? Next, think generally about the appropriate maintenance method.

Finally, review the individual pavement condition and distress and select the appropriate pavement surface rating. Individual pavements may not have all of the types of distress listed for any particular rating. They may have only one or two types. Use the categories in the rating table below.

Each rating also includes a recommendation for needed maintenance or repair. This makes the rating system easier to use and enhances its value as a tool in ongoing airfield pavement maintenance.

Rating 5 – Excellent
No maintenance required.

Rating 4 – Good
Minor routine maintenance, crack or joint sealing.

Rating 3 – Fair
More crack or joint sealing. Isolated joint repairs or slab patching.

Rating 2 – Poor
Extensive crack or joint sealing. Repair severe joint deterioration. Partial and full-depth slab repairs.

Rating 1 – Failed
Reconstruction.

Rating system

Surface rating	*Visible distress**	*General condition/ treatment measures*
5 Excellent	None.	New pavement or recent major concrete rehabilitation. Like-new condition. Less than 5 years old. No maintenance required.
4 Good	Hairline or sealed cracks ⅛” wide or less. Map cracking. Pop-outs.	Concrete over 5 years old. Signs of wear. Minor spot repair of cracks or joint sealant.
3 Fair	Several slabs broken into two pieces by slab cracks. Corner cracking on several slabs, ¼” wide with no spalling. Joint sealant mostly in good condition, less than 10% needing replacement. Several patches in fair to good condition. Map cracking or scaling on 10% or less of the surface area. Slight faulting, less than ¼”, in several locations.	First sign of significant slab cracking, corner cracking, scaling, or faulting. Several patches. Joint sealant repair required. Isolated repair of joint or patch.
2 Poor	Many slab cracks, some breaking the slab into three or more pieces. Cracks open ⅛” or cracks with spalling. D-cracks at several joints. Sealant failure over 10% of joints. Several patches in fair to poor condition with cracks in patch and uneven surface. Faulting ¼” to ½” in several locations. Severe or extensive scaling.	Needs sealant replacement on more than 10% of cracks or joints. Partial depth or full depth joint repairs or patch replacement. Repair faulted joints. Replace or overlay slabs with severe scaling. Bonded or unbonded concrete overlay.
1 Failed	Many wide cracks with failed sealant and grass. Extensive crack and joint spalling. Slabs extensively cracked or shattered. Many corner breaks with spalling. D-cracks with spalling. Patches in poor condition with spalling. Numerous faults over ½”.	Extensive full depth joint repairs or slab replacements. Extensive patching and complete overlay. Complete reconstruction.

** A given pavement segment may not have all of the types of distress listed for a particular rating. It may have only one or two types.*

RATING 5

EXCELLENT — No maintenance required

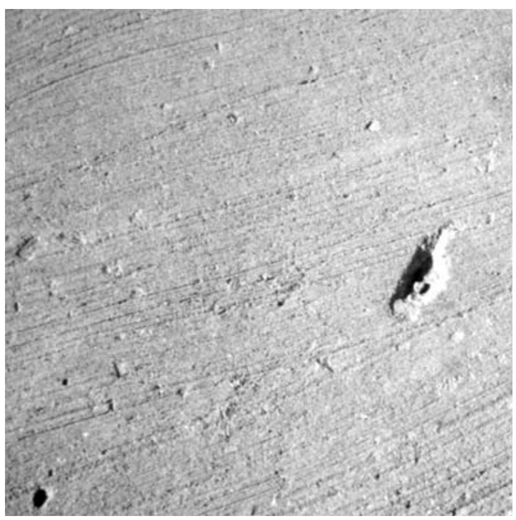
Rating 5 is for new pavement or for recent major concrete rehabilitation. Like-new condition. Less than 5 years old. No maintenance required.

► **New or like-new pavement condition.**

RATING 4

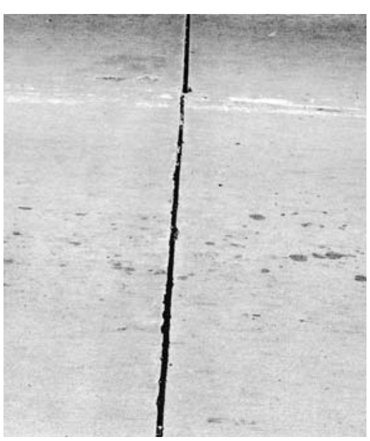
GOOD — Little or no maintenance required

Minor spot repair of cracks or joint sealing required. PCC pavement over 5 years old. Signs of wear: hairline or sealed cracks ⅛″ wide or less, map cracking, pop-outs.



► **Surface wear and pop-outs.**

▲ **Map cracking, but pavement is sound.**



▲ **Partial loss of joint sealant.**

◄ **Isolated meander crack, tight and well sealed.**

▲
Isolated spall at manhole.

◄
Moderate scaling.

RATING 3

FAIR — First sign of significant slab cracking, corner cracking, scaling, or faulting. Several patches. Joint sealant repair required. Isolated repair of joint or patch.

Several slabs broken into two pieces by slab cracks. Corner cracking on several slabs, ¼" wide with no spalling. Joint sealant mostly in good condition, less than 10% needing replacement. Several patches in fair to good condition. Map cracking or scaling on 10% or less of the surface area. Slight faulting, less than ¼", in several locations.

◄
Crack breaks off large corner of slab.

◄
Crack parallel to joint. Open ¼". No spalling.

▲
Crack breaks slab into two pieces. Well sealed.

▲
Severe scaling. Joint and sealant in fair condition.

RATING 2

POOR —Cracks open 1/8”, D-cracks at joints. Replace sealant, repair joints.

Many slab cracks, some breaking the slab into three or more pieces. Cracks open 1/8″ or cracks with spalling. D-cracks at several joints. Sealant failure over 10% of joints. Several patches in fair to poor condition with cracks in patch and uneven surface. Faulting 1/4″ to 1/2″ in several locations. Severe or extensive scaling.

▲
Open joints and cracks. Need sealant on more than 10% of joints.

►
Open joint with spalling.

Open cracks with edge spalling. Corner crack ▼ and broken corner piece.

►
Corner cracks with spalling. Full depth patch required.

▲
Faulting of joints aggravated by heavy traffic in one direction.

▲
Full depth joint repair required.

▲
Concrete patch in poor condition.

RATING 1

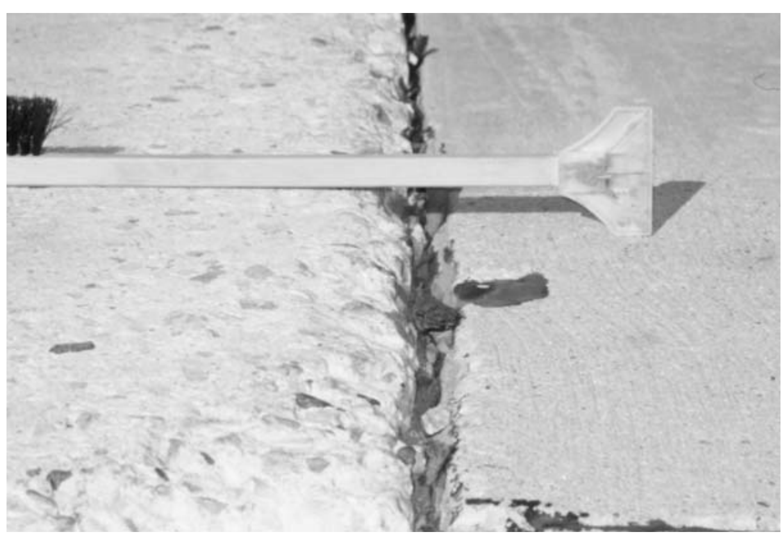
FAILED — Extensive repairs, overlay, or complete reconstruction necessary.

Many wide cracks with failed sealant and grass. Extensive crack and joint spalling. Slabs extensively cracked or shattered. Many corner breaks with spalling. D-cracks with spalling. Patches in poor condition with spalling. Numerous faults over 1/2″. Extensive full depth joint repairs or slab replacements, extensive patching and complete overlay, or complete reconstruction needed.

▲
Failed joint with severe spalling and pothole.

▲
Multiple slab cracks, spalling and shattered slabs.

Inlet with severe cracking and spalling. Full depth slab repair required.
▼



►
Severe joint fault and spalling.

RATING 1

FAILED (continued)

► **Closely spaced cracks and poor joint. Reconstruct.**

► **Severe deterioration. Requires reconstruction.**

► **Severe scaling over extensive areas. Reconstruction required.**

Practical advice on rating airfield pavements

Inventory and field inspection

Most airport owners routinely observe pavement conditions as a part of their normal work. However, an actual inspection means looking at the entire system as a whole and preparing a written summary of conditions. This inspection has many benefits over casual observations. It can be helpful to compare pavement features, and ratings decisions are likely to be more consistent because the system is considered as a whole within a relatively short time.

An inspection also encourages a review of specific conditions important in pavement maintenance, such as drainage, adequate strength, and safety.

A simple written inventory is useful in making decisions where other people are involved. You do not have to trust your memory, and you can usually answer questions in more detail. Having a written record and objective information also improves your credibility with the funding agencies.

Finally, a written inventory is very useful in documenting changing pavement conditions. Without records over several years, it is more difficult to know if conditions are improving, holding their own, or declining.

A sample inventory form is shown on the inside back cover. It is very helpful to collect background information on each feature. Pavement thickness, age, and major maintenance are examples of helpful information.

Annual budgets and long range planning are best done when based on actual needs as documented with a written inventory.

Pavement features

Inventory and pavement condition data are normally organized by dividing the pavements into segments or features. A plan or aerial photo of the entire airfield is most helpful in identifying these individual features. Runways, taxiways and aprons should be considered as separate categories. Within each category, the pavement should be separated into features with similar construction. For example, pavements with different thickness, age, or type of construction should be rated separately.

A runway may be all one feature if conditions are similar. However, if parts of the runway have significantly different construction details or condition, then separate features will make the rating more logical and useful.

Each taxiway, can be considered a separate feature. You may combine several sections of taxiway if conditions are similar.

Apron areas can be separated into features according to the areas they serve. For example, aprons serving a terminal, hangers, tie-down area, or fueling area would be separate features. Areas in different conditions may also be separated into features.

It is helpful to note the size of slabs or panels as well as the number of slabs in a feature. The overall area can be calculated and used to prepare maintenance or construction estimates.

Averaging and comparing sections

No pavement feature is entirely consistent. Also surfaces in one section may not have all of the types of distress listed for any particular rating. They may have only one or two types.

The objective is to rate the condition that represents the majority of the pavement feature. Small or isolated conditions should not influence the rating. It is useful to note these special conditions on the inventory form so this information can be used in planning specific improvement projects. For example, some spot repairs may be required.

Occasionally surface conditions vary significantly within a feature. For example, short sections of good condition may be followed by sections of poor surface conditions. In these cases, it is best to rate the feature according to the worst conditions and note the variation on the form.

The overall purpose of condition rating is to be able to compare each feature relative to all the other features in your airport pavement system. On completion you should be able to look at any two pavement features and find that the better surface has a higher rating.

Assessing drainage conditions

Moisture and poor pavement drainage are significant factors in pavement deterioration. Some assessment of drainage conditions during pavement rating is highly recommended. While you should review drainage in detail at the project level, at this stage simply include an overview drainage evaluation at the same time as you evaluate surface condition.

Consider both pavement surface drainage and lateral drainage (ditches or storm sewers). Pavement should be able to quickly shed water off the surface. Ditches should be large and deep enough to drain the pavement and remove the surface water efficiently into adjacent waterways.

Look at the crown and check for low surface areas that permit ponding. Runways and taxiways should have approximately a 1.5°% cross slope or crown across the pavement. Apron areas require positive drainage and often include storm drainage systems. Maintenance of the entire drainage system is critical. Ditches, subsurface drains and outlets should be inspected and cleaned regularly.

A pavement's ability to carry heavy traffic loads depends on both the pavement materials (concrete slab and granular base) and the strength of the underlying soils. Most soils lose strength when they are very wet. Therefore, it is important to provide drainage to the top layer of the subgrade supporting the pavement structure.

Planning annual maintenance and repair budgets

We have found that relating a normal maintenance or rehabilitation procedure to the surface rating scheme helps managers use the rating system. However, an individual surface rating should not automatically dictate the final maintenance or rehabilitation technique.

Consider future traffic projections, original construction, and pavement strength since these may dictate a more comprehensive rehabilitation than the rating suggests.

Summary

Using funds most efficiently requires good planning and accurate identification of appropriate rehabilitation projects. Assessing pavement conditions is an essential first step in this process. This pavement surface condition rating procedure has proven effective in improving decision making and using funds more efficiently. It can be used directly by airport staff and consultants or combined with additional testing and data collection in a more comprehensive pavement management system.

References

Asphalt Airfield Pavements PASER Manual, 2003, Engineering Professional Development, College of Engineering, University of Wisconsin-Madison.

Guidelines and Procedures for Maintenance of Airport Pavements, 7/14/03, Federal Aviation Administration, Advisory Circular AC:150/5380-6A.

AIRFIELD PAVEMENT INVENTORY

Airfield ______________________ **Condition survey date** ______________

Done by ______________________

Facility (runway, taxiway, apron) ______________________

Feature description ______________________

Feature location ______________________

Feature area ______________________

Construction date ______________________

Pavement type: ☐ **Asphalt** ☐ **Concrete** **Layer thicknesses:** ________ ________ ________

Maintenance history ______________________

____

____

PASER Rating **(5 = Excellent, 4 = Good, 3 = Fair, 2 = Poor, 1 = Failed)** ☐

Comments on pavement and drainage conditions ______________________

____

____

____

Recommended maintenance ______________________

____

____

____

____

Recommended rehabilitation ______________________

____

____

____

PASER

Concrete Airfields