

Statewide Executive Summary

2024 Indiana Airport Pavement Management System Update



PREPARED BY

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Introduction

Pavements represent one of the largest capital investments in the Indiana aviation system. Recognizing a need to protect this critical investment, the Indiana Department of Transportation, Office of Aviation (INDOT) established a statewide airport pavement management system (APMS) in the 1980s to monitor the condition of the Indiana airport infrastructure and to proactively plan for its preservation. Currently sixty-seven airports are included in the Indiana APMS. The ultimate goal of the APMS is to provide the airports, INDOT, and the Federal Aviation Administration (FAA) with the pavement information and analysis to identify pavement-related needs, optimize the selection of projects and treatments over a multi-year period, and evaluate the long-term impacts of their project priorities.

In 2019, Applied Pavement Technology, Inc. (APTech)—with assistance from CHA Consulting, Inc. (CHA) and CAD Vantage, Inc.—was selected to update the APMS for INDOT. The project consists of inspecting approximately one third of the system airports each year over a three-year cycle. Additionally, all pavement construction and rehabilitation work completed on any of the sixty-seven airports currently in the system has been collected and updated in the current system. A second three-year update was initiated in late 2022. This report summarizes the findings and recommendations of these updates.

Benefits of the APMS

Indiana's APMS yields many benefits. It provides INDOT, the individual airports, and the FAA with the information needed to monitor the condition of the pavements to ensure they are able to safely accommodate aircraft operations. The APMS is also a tool that provides INDOT with the information necessary to make cost-effective decisions about the maintenance and rehabilitation (M&R) needs of the pavement infrastructure while understanding the long-term impacts of the decisions made. In addition, the APMS fulfills many of the National Plan of Integrated Airport Systems (NPIAS) airport requirements of Public Law 103-305 and Grant Assurance 11 for maintaining a pavement maintenance management system. The effective utilization of APMS data and results demonstrates Indiana's effort to maintain its airport infrastructure in line with the priorities of the FAA for continued maintenance of existing pavement. This is particularly important for individual airports to remain eligible for federal funding or to show pavements maintained in a good condition when wishing to add additional pavement.

The APMS also identifies when different pavement repair strategies are most appropriate. The timing of projects is important because preventive maintenance actions, such as crack sealing and surface treatments, can cost-effectively extend the life of a pavement when completed at the appropriate time in a pavement's life cycle. Once preventive maintenance is no longer the appropriate repair, a pavement becomes a candidate for major rehabilitation, such as an overlay or surface reconstruction. At some point if rehabilitation of a pavement is delayed further, the pavement structure may become so degraded that the only viable alternative is complete reconstruction. The financial impact of delaying repairs until this point is reached can be severe, as the cost of reconstruction can be many times that of a rehabilitation. In addition, there is a point when the pavement becomes unsafe for aircraft operations.

Project Airports

The Indiana APMS system consists of sixty-seven airports with approximately one third of the airports inspected each year over a three-year cycle. Annually, records for pavement construction and rehabilitation are collected and updated within the APMS for all airports included in the current system. These airports represent 111.2 million square feet of pavement. This can be further broken down into approximately 48.0 million square feet of runway pavement, 34.6 million square feet of taxiway pavement, 22.7 million square feet of apron pavement, and 5.9 million square feet of T-hangar pavement. The following figure identifies the airports included in the Indiana APMS.






Pavement Condition Assessment

Pavement Condition Index

The pavements were evaluated using the Pavement Condition Index (PCI) procedure, documented in FAA Advisory Circular (AC) 150/5380-6C, *Guidelines and Procedures for Maintenance of Airport Pavements*, and ASTM D5340, *Standard Test Method for Airport Pavement Condition Index Surveys*. During a PCI survey, the types, severities, and amounts of distress present on a pavement surface are quantified. This information is then used to develop a composite index that represents the overall condition of the pavement in numerical terms, ranging from 0 (failed) to 100 (excellent). The PCI is a measure of overall condition and is indicative of the level of work that will be required to maintain or repair a pavement. Further, the distress information provides insight into what is causing the pavement to deteriorate, which is the first step in selecting the appropriate repair action.

After being programmed into an APMS, PCI data are used to determine current pavement condition, predict future pavement condition, and identify the most cost-effective repair type and timing of that repair. The figure below depicts Indiana’s PCI legend along with corresponding pictures of several pavements and typical repair strategies.

PCI	PCI	Representative Pavement Surface	Typical Repair Alternative
86 - 100	74		Pavements with PCIs above 60 to 70 often benefit from cost-effective preventive maintenance, such as crack sealing and surface treatments.
71 - 85			
56 - 70	62		Pavements with a PCI in the range of 40 to 70 will typically require more expensive rehabilitation, such as an overlay.
41 - 55			
26 - 40			
11 - 25	23		Pavement allowed to deteriorate below a PCI of 40 could require costly reconstruction to restore it to operational condition.
0 - 10			

Typical Distress Types at Indiana Airports

Following is a description of the most frequently observed pavement distresses, excluding patching, at the evaluated Indiana airports.

Longitudinal and Transverse (L&T) Cracking



L&T cracking can be caused by any of the following: 1) separation of pavement at paving lane joints, 2) shrinkage of AC pavement due to temperature differentials in older or brittle pavements, or 3) reflection cracking from underlying existing cracking in overlaid pavements.

Raveling



Raveling occurs as the coarse aggregate begins to dislodge and produce loose pieces of material, or foreign object debris (FOD).

Weathering



Weathering is the wearing away of the asphalt binder and/or fine aggregate that occurs in an asphalt pavement as it ages and hardens.

Alligator Cracking



Alligator cracking is a load-related distress caused by excessive tensile strains at the bottom of the AC layer or stabilized AC base layer from repeated aircraft loadings. It typically shows up on the surface as a series of parallel cracks, which eventually interconnect to form a pattern resembling alligator skin.

Depression



A depression is a pavement surface area that has an elevation slightly lower than that of the surrounding pavement. It can be caused by settlement of the underlying base layers or soils and is often found in areas where insufficient drainage capacity exists and soils are weakened due to water penetration or where underlying layers were not compacted enough during construction.

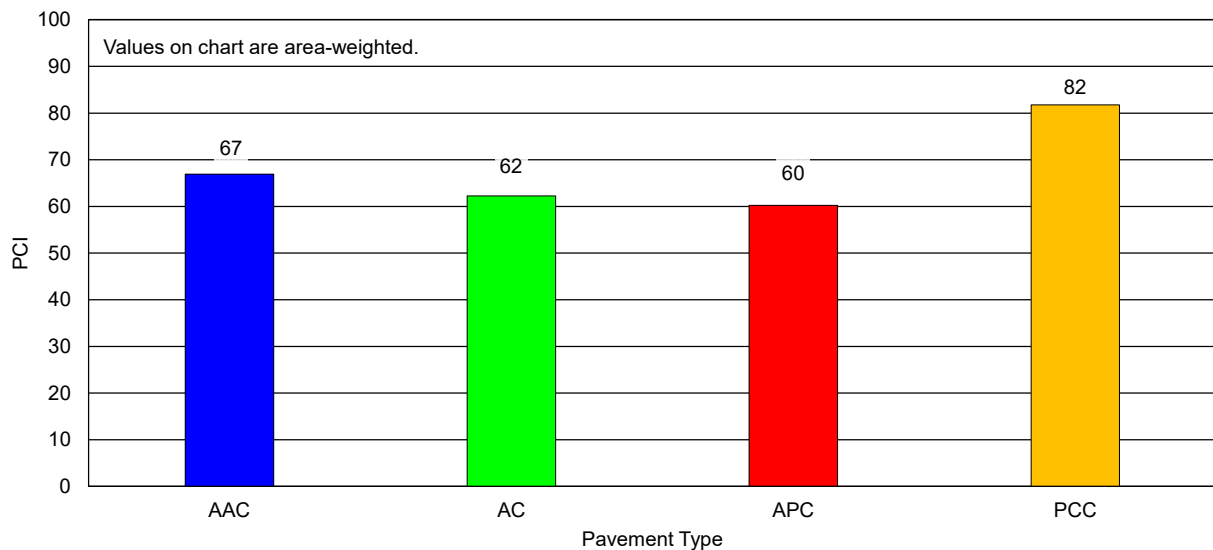
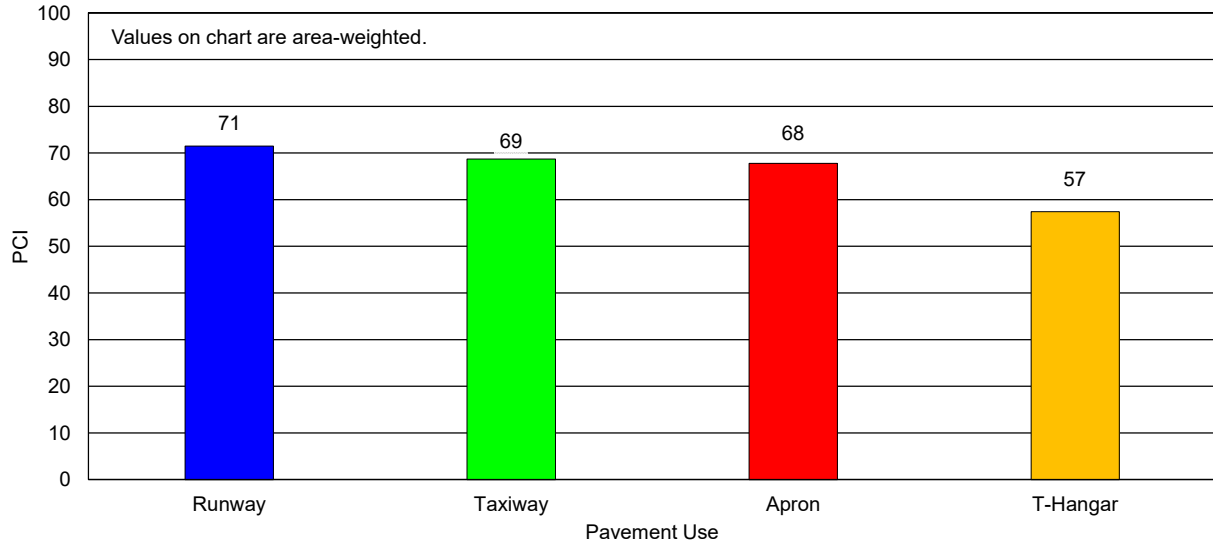
Spalling



Spalling, in PCC pavement, is the breakdown of the slab edges in close proximity to the slab joint. Spalling is identified as occurring in the corner or along the joint of a PCC slab. Spalling is typically caused by the introduction of incompressible material in the joint, weaker pavement at the joint caused by overworking of the pavement during construction, traffic loading, or a combination of these.

Overall Pavement Condition

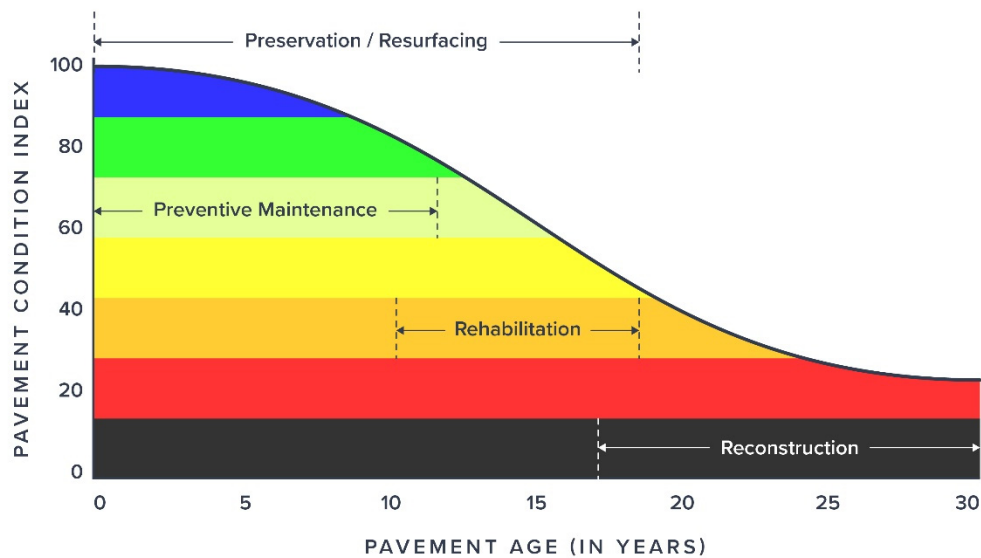
The overall 2023 area-weighted PCI (average PCI adjusted to account for the relative size of each pavement) of the sixty-seven airports included in the Indiana APMS is a PCI of 69. This is comprised of airport condition data collected in 2021, 2022, and 2023 and incorporates any work completed since the airports were last inspected. The figures below show the 2023 area-weighted condition of the pavement broken out by pavement use and surface type.



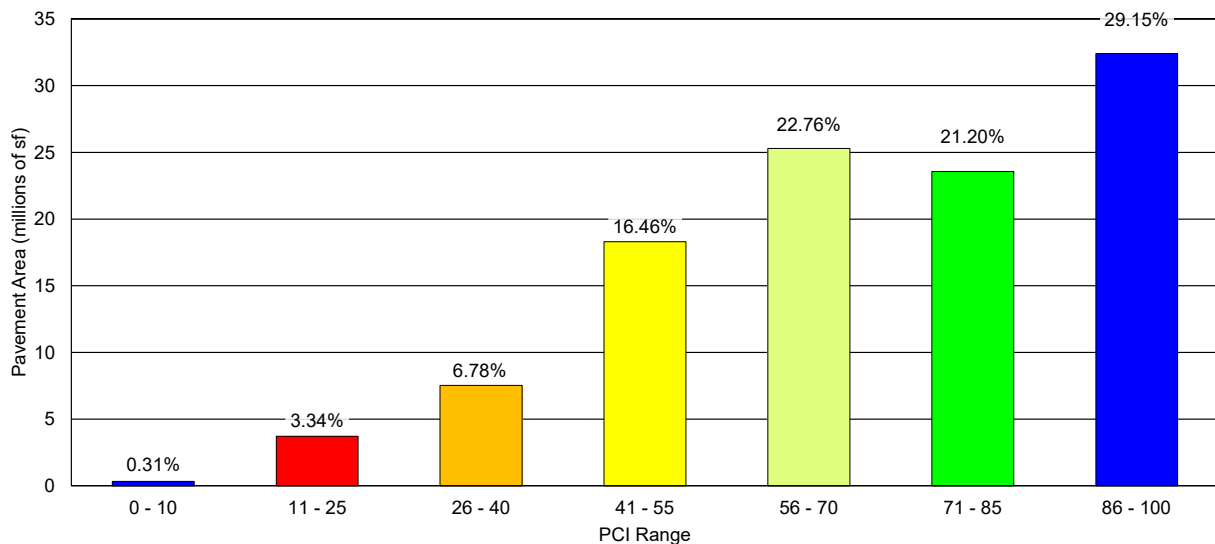
Note: AAC = asphalt overlay on asphalt, AC = asphalt, APC = asphalt overlay on PCC, PCC = portland cement concrete.

Pavement Needs Assessment

The following figure shows the general relationship between a pavement’s condition and the types of work should be performed on a pavement. Preventive maintenance refers to activities such as crack sealing, joint sealing, and patching. Pavement preservation refers to surface treatment applications or nominal resurfacing projects. Rehabilitation includes projects such as cold milling and overlay, or projects that aren’t full depth removal and replacement but that do result in the placement of a new pavement surface. Reconstruction involves replacement of the entire pavement cross section and may include subgrade and/or subbase replacement.



Based on these general relationships, approximately 50 percent of Indiana’s airport pavements are at a condition level where they will benefit from preventive maintenance actions, such as crack sealing, patching, and surface treatments. Approximately 39 percent of the pavement infrastructure is in need of more extensive rehabilitation such as an overlay or surface reconstruction, while about 10 percent have deteriorated to the point where reconstruction may be the only viable option to repair the pavement. The distribution of pavement area by condition range is shown in the figure below.



Analyzing the Results

A five-year M&R program was developed for the Indiana airports using the PAVER pavement management software. An inflation rate of five percent was used to determine the future cost of work. Preventive maintenance, surface treatments, resurfacing, and major rehabilitation were considered during this analysis.

Critical PCIs

Critical PCI values represent a condition level that INDOT and managers should strive to maintain pavement above for as long as possible. These values are used to determine when a more extensive pavement repair than preventive maintenance or pavement preservation is recommended for a pavement. The following table identifies the critical PCI values established for the Indiana APMS based on an airport's role or the length of an airport's primary runway.

Pavement Use	Primary	Large GA >4500' Rwy	Small GA <4500' Rwy
Runway	70	60	55
Taxiway	60	55	50
Apron, or Less	55	50	50

Funding Levels

If no funding is provided for pavement M&R, Indiana's entire airport pavement system will experience a slow but steady decline in condition, with an anticipated PCI of 58 by the end of 2028. This decrease would result in a greater need for major rehabilitation/reconstruction and in turn substantially increase the costs incurred to keep the pavement system in a safe and serviceable condition.

In Summary

- Sixty-seven airports are included in the Indiana APMS. These airports represent 111.2 million square feet of pavement. During 2021, twenty-two airports were inspected comprising 35.8 million square feet of pavement. During 2022, twenty-two airports were inspected comprising 44.3 million square feet of pavement. During 2023, twenty-three airports were inspected comprising 31.1 million square feet of pavement.
- The entire pavement system of sixty-seven airports has a 2023 area-weighted PCI of 69.
- If no funding is provided, the overall area-weighted PCI of the system will fall to an estimated 58 by the end of 2028.
- If all M&R needs are funded, the anticipated 2026 PCI for the twenty-two airports updated in 2021 would be 86 and require a total of approximately \$141.2 million.
- If all M&R needs are funded, the anticipated 2027 PCI for the twenty-two airports updated in 2022 would be 85 and require a total of approximately \$173.2 million.
- If all M&R needs are funded, the anticipated 2028 PCI for the twenty-three airports updated in 2023 would be 85 and require a total of approximately \$105.5 million.



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