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NASAO ANNUAL CONVENTION AND TRADE SHOW

# Performance of Airport Asphalt Pavements Constructed Using State Specifications

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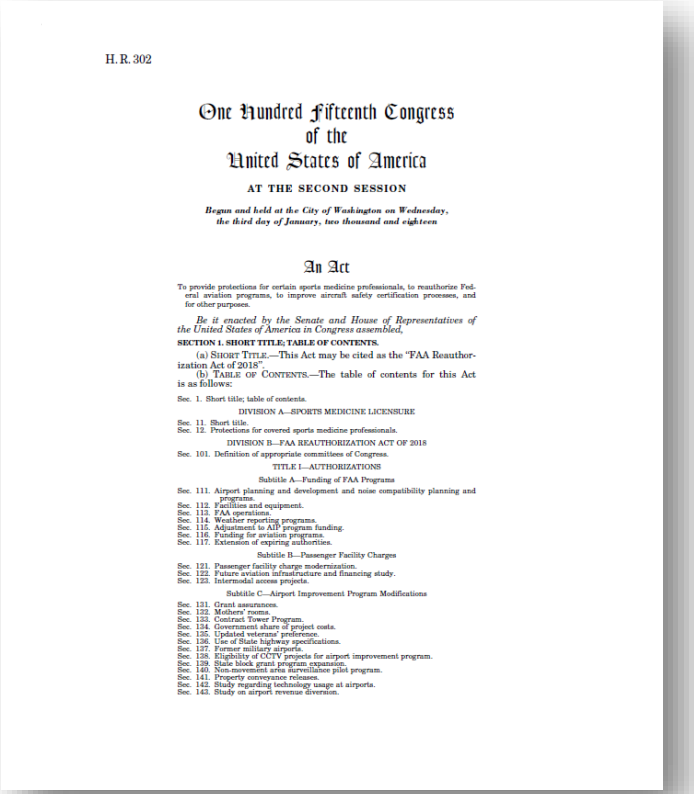
# Federal Aviation Administration (FAA) Reauthorization Act of 2018, Section 136

- Requires FAA to allow the use of state highway specifications for airfield pavement construction at non-primary airports serving aircraft that do not exceed 60,000 pounds gross weight, if:
  - Requested by the state
  - Safety will not be negatively impacted
  - Life of the pavement will not be shorter than if constructed using FAA specifications
- FAA has permitted the use of state highway specifications for airport construction (under certain conditions) since 1977



H. R. 302

One Hundred Fifteenth Congress
of the
United States of America

AT THE SECOND SESSION

*Begun and held at the City of Washington on Wednesday, the third day of January, two thousand and eighteen*

An Act

To provide protections for certain sports medicine professionals, to reauthorize Federal aviation programs, to improve aircraft safety certification processes, and for other purposes.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

**SECTION 1. SHORT TITLE; TABLE OF CONTENTS.**

(a) SHORT TITLE.—This Act may be cited as the "FAA Reauthorization Act of 2018".

(b) TABLE OF CONTENTS.—The table of contents for this Act is as follows:



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# Background

- Significant differences in loads, tire pressures and types of loading between highways and airports
  - Highway specifications were not developed considering those differences
- FAA initiated project to evaluate the performance of previously constructed airport pavements that used highway specifications
  - Compare performance to those constructed using FAA specifications

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# Background

Purpose:

1. Provide the FAA with data to determine if state highway materials and construction specifications can perform satisfactorily at non-primary, public-use airports serving aircraft less than 60,000 pounds gross weight.
2. Identify differences in material requirements in state highway specifications versus FAA standard specifications for flexible pavement materials

# Proposed Methodology

- FAA to identify 30 airports that used state specifications
  - Representing a good cross-section of the country
- NCAT staff to follow-up to acquire project records:
  - Construction plans and specifications
  - Quality control and acceptance test data
  - Aircraft traffic used for pavement thickness design
  - History of any maintenance activities conducted on the airfield
  - Current aircraft traffic and loading data
- NCAT staff were to then conduct an on-site pavement condition assessment in accordance with ASTM D5340 *Standard Test Method for Airport Pavement Condition Index Surveys*.

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# Challenges

- Identifying projects built using state specifications
  - No standardized record storage system
  - Contacted FAA Regional Airport Divisions, Airport Consultants Council, Individual Airports, State DOTs, NAPA, and SAPAs
- Lack of project records
- COVID-19 pandemic
  - Restricted travel

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# Modified Methodology

- Utilized pavement management reports provided by Applied Pavement Technology (APTech)
  - APTech contracts with airports across the U.S. to conduct pavement condition index (PCI) inspections and visual evaluations of pavements
- Narrowed the focus to projects where enough construction and performance data was available, which was primarily in the FAA Great Lakes Region.
  - Construction records provided by State DOT Divisions of Aeronautics/Aviation and by APTech

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# Project Selection

- Challenges associated with acquiring construction and performance data would limit the number of projects from each region
  - Would there be adequate data to actually dram conclusions?
- Using projects primarily in one FAA region provided an adequate number of projects to realistically draw conclusions from
  - Included projects from Illinois, Indiana, Michigan, and Wisconsin.
  - In addition, since data had been acquired from several airport projects in Georgia, these projects were also included

# Project Selection

- Project Age:
  - Excluded projects constructed prior to 2003
    - Assess more recent construction and mix design methodologies
  - Excluded projects build after 2018
    - Too new
- Pavement Type:
  - Original plan included all pavement types (runways, taxiways, aprons, and shoulders);
  - Available data shifted the focus to primarily runways

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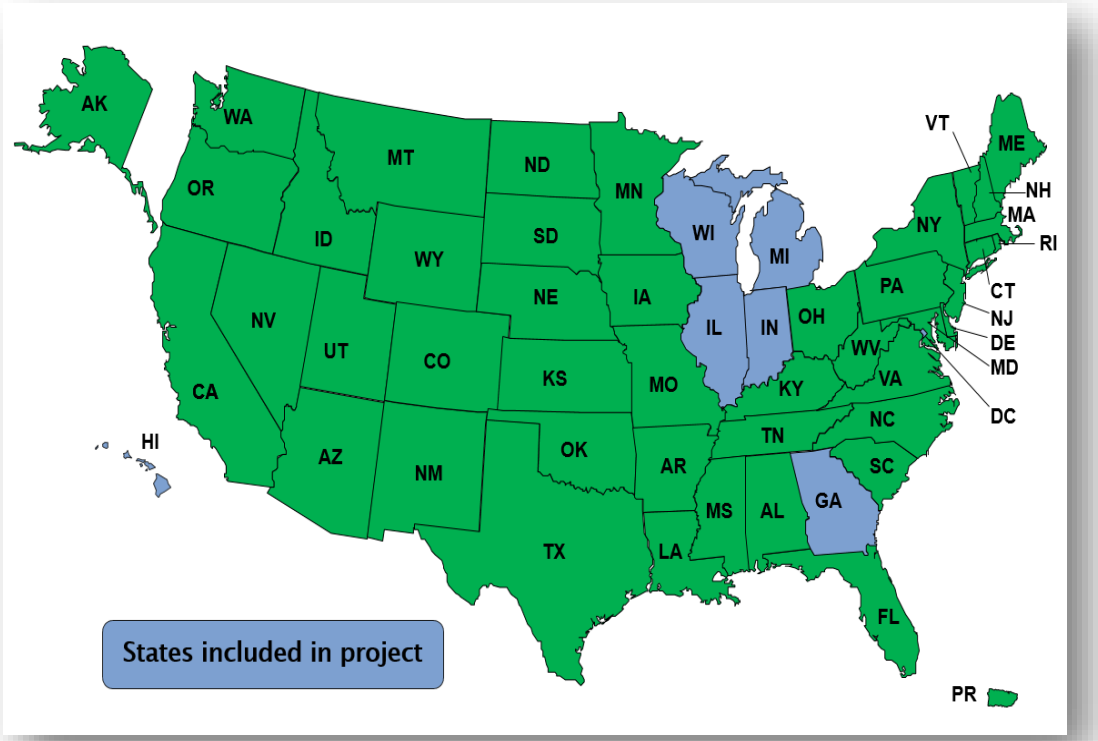
# Selected Projects

- 40 projects/5 States
  - 19 projects used state specifications
  - 21 projects used FAA specifications
- Compiled project summaries:
  - General airport information
  - Summary of construction
  - Summary of aircraft operations
  - Maximum gross weight bearing capacity
  - PCI data

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# Airports included in Evaluation

| Project No. | State | Airport Name | Description | Year Paved | Specifications |
|---|---|---|---|---|---|
| 1 | Georgia | Columbus | Runway 6-24 Rehabilitation | 2010 | FAA |
| 2 | Georgia | Columbus | Runway 13-31 Rehabilitation | 2016 | State |
| 3 | Georgia | Albany – Southwest Georgia Regional Airport | Runway 04-22 Rehabilitation | 2019 | FAA |
| 4 | Georgia | Athens-Ben Epps Airport (AHN) | Rehabilitation of Runway 9-27 | 2018 | FAA |
| 5 | Georgia | Winder-Barrow County Airport (WDR) | Runway 5-23 – Rehabilitation and Overlay | 2009 | FAA |
| 6 | Georgia | Winder-Barrow County Airport (WDR) | Runway 13-31 – Rehabilitation and Overlay | 2016 | FAA |
| 7 | Georgia | Rome- Richard B Russell Regional Airport | Rehabilitation of Runway 7-25 | 2018 | State |
| 8 | Georgia | Dahlonega – Wimpy's Lumpkin County Airport | Runway 15-33 Rehabilitation | 2015 | State |
| 9 | Illinois | Waukegan National Airport | Repair & Overlay RWY 14/32 | 2011 | State |
| 10 | Illinois | Edgar County Airport | Construct Crosswind Runway 18/36 | 2012 | State |
| 11 | Illinois | Bolingbrook Clow International Airport | Remove and Construct Runway 18/36 in new location | 2015 | State |
| 12 | Illinois | DuPage Airport | Rehab Runway 10/28 | 2013 | State |
| 13 | Illinois | Chicago Executive Airport | Rehab Runway 16/34 | 2016 | State |
| 14 | Wisconsin | Prairie du Chien | Runway 11-29 | 2012 | State |
| 15 | Wisconsin | Fort Atkinson | Runway 3/21 reconstruction | 2013 | State |
| 16 | Wisconsin | Crandon | Reconstruct Runway 11-29 | 2012 | State |
| 17 | Wisconsin | Clintonville | Runway 4-22 Reconstruction and Extension | 2014 | State |
| 18 | Wisconsin | Oconto | Rehabilitate runway 11/29 | 2017 | State |
| 19 | Indiana | Anderson Municipal Airport (AID) | Construct Western portion of Taxiway A | 2006 | FAA |
| 20 | Indiana | Anderson Municipal Airport (AID) | Construct Eastern portion of Taxiway A | 2008 | FAA |
| 21 | Indiana | Anderson Municipal Airport (AID) | Construct Central portion of Taxiway A | 2008 | FAA |
| 22 | Indiana | Columbus Municipal (BAK) | Construct majority of Taxiway D | 2012 | FAA |
| 23 | Indiana | Logansport - Cass County (GGP) | Reconstruct Runway 9-27 | 2003 | FAA |
| 24 | Indiana | Peru Municipal (I76) | Construct majority of Runway 1-19 | 2009 | FAA |
| 25 | Michigan | Cheboygan County Airport (SLH) | Reconstruct Runway 17-35 | 2010 | State |
| 26 | Michigan | Houghton County Memorial Airport (CMX) | Reconstruct Runway 7-25 | 2010 | State |
| 27 | Michigan | Kirsch Municipal Airport (IRS) | Reconstruct Runway 6-24 | 2013 | State |
| 28 | Michigan | Marlette Township Airport (77G) | Runway 1-19 Mill and Overlay | 2015 | State |
| 29 | Michigan | Oakland County International Airport (PTK) | Construct Runway 18-36 | 2006 | State |
| 30 | Michigan | St. Clair County International Airport (PHN) | Reconstruct Runway 10-28 | 2005 | FAA |
| 31 | Wisconsin | Amery Municipal Airport (AHH) | Reconstruct Runway 18-36 | 2015 | FAA |
| 32 | Wisconsin | Baraboo-Wisconsin Dells Regional (DLL) | Reconstruct Apron | 2011 | FAA |
| 33 | Wisconsin | Bloyer Field (Y72) | Reconstruct Apron | 2014 | FAA |
| 34 | Wisconsin | Bloyer Field (Y72) | Reconstruct half of Taxiway A | 2014 | FAA |
| 35 | Wisconsin | Cumberland Municipal Airport (UBE) | Reconstruct Apron | 2015 | FAA |
| 36 | Wisconsin | Cumberland Municipal Airport (UBE) | Reconstruct Runway 9-27 | 2015 | FAA |
| 37 | Wisconsin | Cumberland Municipal Airport (UBE) | Reconstruct Taxiway A | 2015 | FAA |
| 38 | Wisconsin | East Troy Municipal Airport (57C) | Reconstruct Runway 8-26 | 2014 | FAA |
| 39 | Wisconsin | East Troy Municipal Airport (57C) | Construct majority of Taxiway B | 2003 | State |
| 40 | Wisconsin | Fond Du Lac County Airport (FLD) | Construct Apron area | 2007 | FAA |
| 41 | Wisconsin | Park Falls Municipal Airport (PKF) | Reconstruct Runway 18-36 | 2015 | FAA |

# Example Project Summary

***Marlette Township Airport (77G)***

Owner: Marlette Township
Manager: Phil Roach
Address: 6725 Airport Road, Marlette, MI 48453
Phone: 810-459-4674

**Description of the Airport:**

Marlette Township Airport is a publicly owned, general aviation airport located in Marlette Township, Michigan. The airport is located approximately 60 miles north of Detroit. It has an FAA service level of general aviation. The airport covers an area of 480 acres at an elevation of 895 ft. It has two paved runways: 01/19 (3,500 ft x 75 ft) and 09/27 (3,795 ft x 75 ft) (see Figure A-48).

This report focuses on Runway 01/19.

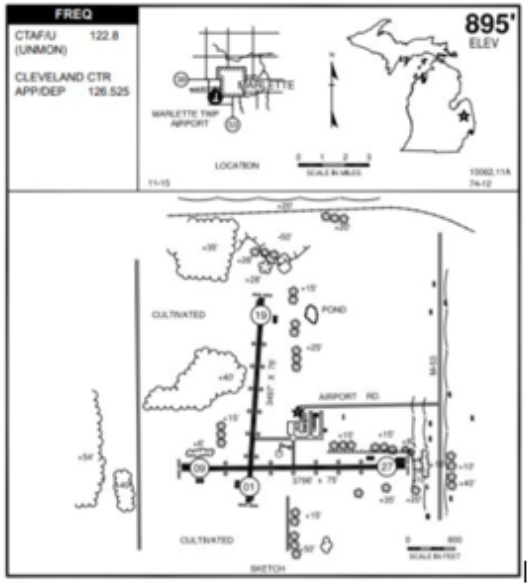


Figure A-48. Marlette Township Airport

**Runway 01/19**

- PCN: NA
- Dimensions: 3,500 ft x 75 ft
- Most recent rehabilitation: 2015
  - Runway 1/19 rehabilitation
  - Federal Project No. F-26-0062-1811

# Example Project Summary

**Plans and Specifications**

The design consultant for the project was C&S Engineers, Inc. of Livonia, Michigan. The plans included a summary of contract quantities, supplemental specifications, construction safety/phasing plans, grading plans, profiles, typical sections and pavement repair details, drainage and soil erosion details, and lighting and electrical plan for the runway. Specifications were from the Michigan Department of Transportation Airports Division, Standard Specification P-411.

The Airport Pavement Design Data shown in the plans indicate the runway was designed for Aircraft Design Group and Aircraft Approach Category IIIB, with an aircraft gross weight of under 12,500 lb and a tire pressure under 100 psi.

The rehabilitation work on the project consisted of milling 3 in. followed by the placement of two layers of bituminous surface course (P-411), each at a thickness of 1.5 in.

The typical section for the main portion of Runway 01/19 can be found in Figure A-49.

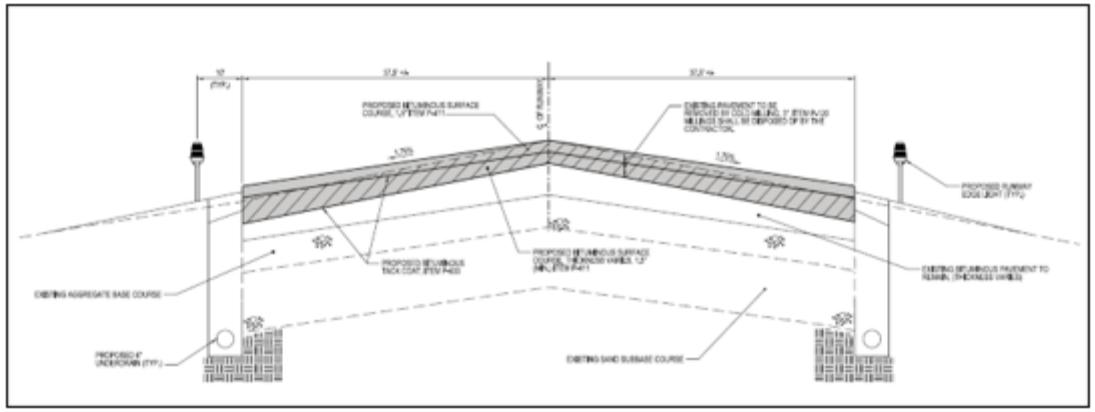

Figure A-49. Runway 06/24 Typical Section

A summary of relevant pay items is shown in Table A-9.

Table A-9. Runway 06/24 Bid Quantities

| Item Number | Description | Units | Quantity |
|---|---|---|---|
| 4000531 | Cold Mill Bituminous Pavement | SY | 36,000 |
| 4110620 | 3" Bituminous Aggregate Surface Course | Tons | 7,900 |

**Mix Design**

The plans indicate that a 20AAX mix design was used. No additional mix design information was available.

# Example Project Summary

**Quality Control and Acceptance Results**

No QC or acceptance data were available.

**Pavement Performance Data**

Based on Pavement Management Reports provided by APTech, the most recent average PCI for Runway 01/19 was 89, last rated in 2020. A plot of the PCI ratings since the project was completed is shown in Figure A-50.

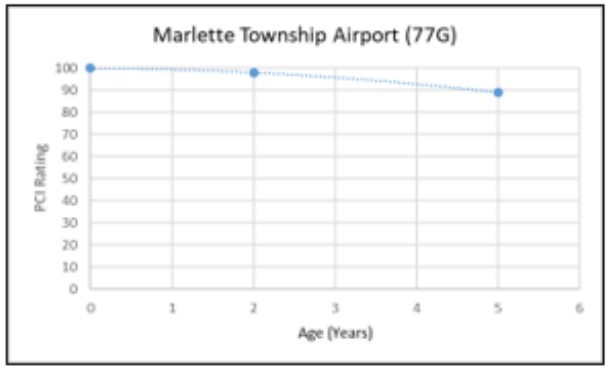


Figure A-50. Marlette Township Airport Project Average PCI Ratings

Primary distresses include low-severity L&T cracking and weathering. One hundred percent of the distress deducts are climate related.

**History of preventive or maintenance activities conducted on the airfield**

There were no records of any preventative maintenance activities conducted on the project.

**Aircraft load and traffic data**

Based on the ADIP, the overall airport traffic operation per year is as follows:

- Air carrier: 0
- Air taxi: 0
- General aviation local: 5,000
- General aviation itinerant: 5,000
- Military: 0
- Total Operations: 10,000

# Pavement Condition Assessments

- Conducted in accordance with ASTM D5340
- Pavement is divided into branches and sections
  - Sections divided into sample units
- The type and severity of pavement distress is assessed by visual inspection of the pavement sample units.
- The distress data are used to calculate the PCI for each section
  - Scale from 0 to 100

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D5340 – 20

## Standard Test Method for Airport Pavement Condition Index Surveys[1]

This standard is issued under the fixed designation D5340; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

**1. Scope**

1.1 This test method covers the determination of airport pavement condition through visual surveys of asphalt-surfaced pavements, including porous friction courses and plain or reinforced jointed portland cement concrete pavements, using the Pavement Condition Index (PCI) method of quantifying pavement condition.

1.2 The PCI is a measurement of the collective judgement of pavement maintenance engineers. It directly relates to M&R needs and indirectly to pavement structural integrity and functional condition indicators. The PCI is not intended to replace the direct measurement of roughness, structural capacity, texture, or friction.

1.3 The PCI for airport pavements was developed by the U.S. Army Corps of Engineers through the funding provided by the U.S. Air Force (1-3).[2] It is further verified and adopted by FAA (4) and the U.S. Naval Facilities Engineering Command (5).

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in Section 6.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

**2. Terminology**

2.1 *Definitions of Terms Specific to This Standard:*

2.1.1 *additional sample*—a sample unit inspected in addition to the random sample units to include nonrepresentative sample units in the determination of the pavement condition. This includes very poor or excellent samples that are not typical of the section and sample units which contain an unusual distress such as a utility cut. If a sample unit containing an unusual distress is chosen at random, it should be counted as an additional sample unit and another random sample unit should be chosen. If every sample unit is surveyed, then there are no additional sample units.

2.1.2 *asphalt concrete (AC) surface*—aggregate mixture with an asphalt cement binder. This term also refers to surfaces constructed of coal tars and natural tars for purposes of this test method.

2.1.3 *pavement branch*—a branch is an identifiable part of the pavement network that is a single entity and has a distinct function. For example, each runway, taxiway, and apron areas are separate branches.

2.1.4 *pavement condition index (PCI)*—a numerical rating of the pavement condition that ranges from 0 to 100, with 0 being the worst possible condition and 100 being the best possible condition.

2.1.5 *pavement condition rating*—a verbal description of pavement condition as a function of the PCI value. Fig. 1 shows two examples of PCI rating scales.

2.1.6 *pavement distress*—external indicators of pavement deterioration caused by loading, environmental factors, or construction deficiencies, or a combination thereof. Typical distresses are cracks, rutting, and weathering of the pavement surface. Distress types and severity levels detailed in Appendix X1 for AC and Appendix X2 for PCC pavements must be used to obtain an accurate PCI value.

2.1.7 *pavement sample unit*—a subdivision of a pavement section that has a standard size range: 20 contiguous slabs (±8 slabs if the total number of slabs in the section is not evenly divided by 20, or to accommodate specific field condition) for PCC airfield pavement and 5000 contiguous square feet (±2000 ft² (450 ± 180 m²) if the pavement is not evenly divided by 5000, or to accommodate specific field condition) for AC airfield pavement and porous friction surfaces.

[1] This test method is under the jurisdiction of ASTM Committee E17 on Vehicle - Pavement Systems and is the direct responsibility of Subcommittee E17.42 on Pavement Management and Data Needs.

Current edition approved Oct. 1, 2020. Published October 2020. Originally approved in 1998. Last previous edition approved in 2018 as D5340 – 12 (2018). DOI: 10.1520/D5340-20.

[2] The boldface numbers in parentheses refer to a list of references at the end of the text.

# Pavement Distresses

1. Alligator or Fatigue Cracking
2. Bleeding
3. Block Cracking
4. Corrugation
5. Depression
6. Jet-Blast Erosion
7. Joint Reflection Cracking from PCC
8. Longitudinal and Transverse Cracking (Non-PCC Joint Reflective)
9. Oil Spillage
10. Patching and Utility Cut Patch
11. Polished Aggregate
12. Raveling/Weathering
13. Rutting
14. Shoving of Asphalt Pavement by PCC Slabs:
15. Slippage Cracking
16. Swell Distress

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# ASTM D5340

- Provides detailed descriptions and pictures of each distress
- Categorizes severity levels: Low, Medium, High

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# Example of a Flexible Pavement Condition Survey Data Sheet

**AIRFIELD ASPHALT PAVEMENT**
**CONDITION SURVEY DATA SHEET**
**FOR SAMPLE UNIT**

**SKETCH:**

**BRANCH** _____ **SECTION** _____ **SAMPLE UNIT** _____
**SURVEYED BY** _____ **DATE** _____ **SAMPLE AREA** *5000 S.F.*

1. Alligator Cracking
2. Bleeding
3. Block Cracking
4. Corrugation
5. Depression
6. Jet Blast
7. Jt. Reflection (PCC)
8. Long. & Trans. Cracking
9. Oil Spillage
10. Patching
11. Polished Aggregate
12. Raveling/Weathering
13. Rutting
14. Shoving from PCC
15. Slippage Cracking
16. Swell

| DISTRESS SEVERITY | QUANTITY | | | | | | | | | TOTAL | DENSITY % | DEDUCT VALUE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *8 L* | *10* | *20* | *15* | | | | | | | *45* | *0.90* | *4.8* |
| *8 M* | *9* | | | | | | | | | *9* | *0.18* | *4.9* |
| *1 L* | *50* | | | | | | | | | *50* | *1.00* | *21.0* |
| *13 L* | *200* | *175* | | | | | | | | *375* | *7.50* | *27.0* |
| *13 M* | *25* | | | | | | | | | *25* | *0.50* | *20.0* |
| *5 L* | *15* | | | | | | | | | *15* | *0.30* | *2.0* |
| *5 M* | *20* | | | | | | | | | *20* | *0.40* | ***9.0*** |
| *10 L* | ***50*** | | | | | | | | | ***50*** | ***1.00*** | ***4.0*** |
| | | | | | | | | | | | | |
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# Example PCI Data

**Waukegan Runway 14-32 Section 1**

| Description | Distress | Severity | Quantity | Quantity Units | Density | Deduct |
|---|---|---|---|---|---|---|
| JT REF. CR | 47 | Low | 625.50 | Ft | 1.85 | 5.25 |
| JT REF. CR | 47 | Medium | 721.50 | Ft | 2.14 | 16.73 |
| L & T CR | 48 | Low | 243.00 | Ft | 0.72 | 4.42 |
| L & T CR | 48 | Medium | 576.00 | Ft | 1.71 | 14.49 |
| WEATHERING | 57 | Medium | 33,750.00 | SqFt | 100.00 | 20.34 |

| % of Distress Deduct | | |
|---|---|---|
| Load | Climate | Other |
| 0 | 100 | 0 |

**Waukegan Runway 14-32 Section 2**

| Description | Distress | Severity | Quantity | Quantity Units | Density | Deduct |
|---|---|---|---|---|---|---|
| JT REF. CR | 47 | Low | 2,232.00 | Ft | 2.20 | 6.06 |
| JT REF. CR | 47 | Medium | 1,548.00 | Ft | 1.53 | 13.00 |
| L & T CR | 48 | Low | 432.00 | Ft | 0.43 | 3.93 |
| L & T CR | 48 | Medium | 864.00 | Ft | 0.85 | 10.47 |
| SWELLING | 56 | Low | 216.00 | SqFt | 0.21 | 1.50 |
| WEATHERING | 57 | Medium | 101,250.00 | SqFt | 100.00 | 20.34 |

| % of Distress Deduct | | |
|---|---|---|
| Load | Climate | Other |
| 0 | 100 | 0 |

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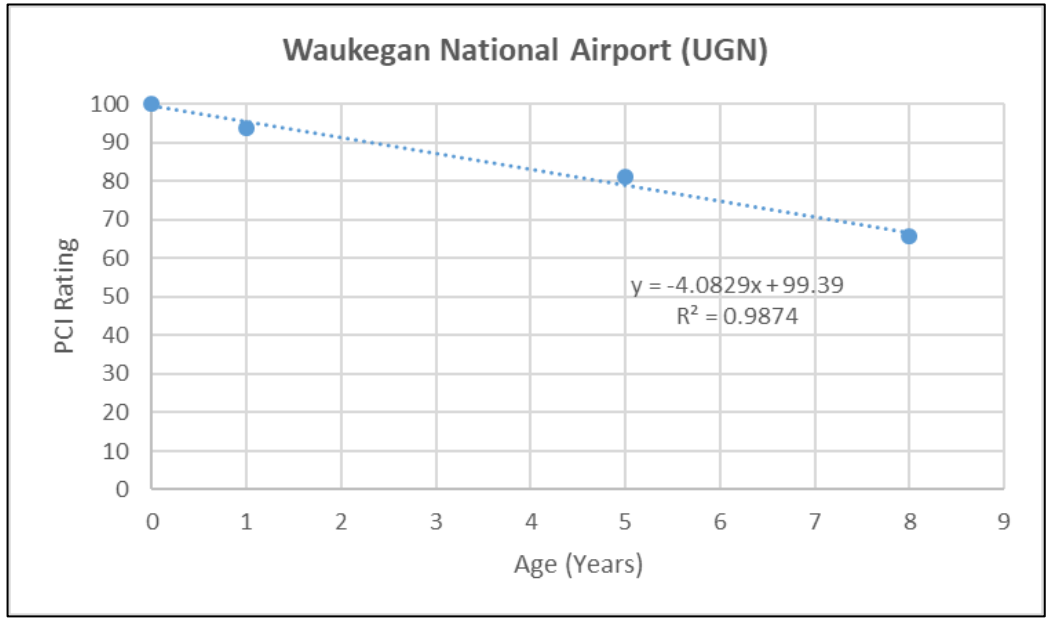
| # | State | Airport Name | Description | Paved Year | Specifications | Notes | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Georgia | Columbus | Runway 6-24 Rehabilitation | 2010 | FAA | Section 10C | | | | | | | | 100 | | 90 | | | | | | 83 | | |
| | | | | 2010 | FAA | Section 10E | | | | | | | | 100 | | 95 | | | | | | 76 | | |
| | | | | 2010 | FAA | Section 10W | | | | | | | | 100 | | 92 | | | | | | 78 | | |
| | | | | 2010 | FAA | **Average** | | | | | | | | **100** | | **92.3** | | | | | | **79** | | |
| 2 | Georgia | Columbus | Runway 13-31 Rehabilitation | 2016 | State | Section 10 | | | | | | | | | | | | | | 100 | | 91 | | |
| | | | | 2016 | State | Section 20 | | | | | | | | | | | | | | 100 | | 90 | | |
| | | | | 2016 | State | Section 30 | | | | | | | | | | | | | | 100 | | 100 | | |
| | | | | 2016 | State | **Average** | | | | | | | | | | | | | | **100** | | **93.7** | | |
| 3 | Georgia | Albany – Southwest Georgia Regional Airport | Runway 04-22 Rehabilitation | 2019 | FAA | | | | | | | | | | | | | | | | | | | |
| 4 | Georgia | Athens-Ben Epps Airport (AHN) | Rehabilitation of Runway 9-27 | 2018 | FAA | | | | | | | | | | | | | | | | | 100 | | |
| 5 | Georgia | Winder-Barrow County Airport (WDR) | Runway 5-23 – Rehabilitation and Overlay | 2009 | FAA | Section 10 | | | | | | | 100 | | | 85 | | | | | | 74 | | |
| 6 | Georgia | Winder-Barrow County Airport (WDR) | Runway 13-31 – Rehabilitation and Overlay | 2016 | FAA | | | | | | | | | | | | | | | 100 | | 89 | | |
| 7 | Georgia | Rome- Richard B Russell Regional Airport | Rehabilitation of Runway 7-25 | 2018 | State | Section 10 | | | | | | | | | | | | | | | | 100 | | |
| 8 | Georgia | Dahlonega – Wimpy's Lumpkin County Airport | Runway 15-33 Rehabilitation | 2015 | State | | | | | | | | | | | | | | 100 | | | 96 | | |
| 9 | Illinois | Waukegan National Airport | Repair & Overlay RWY 14/32 | 2011 | State | Section 1 | | | | | | | | | 100 | 96 | | | | 83 | | | 65 | |
| | | | | 2011 | State | Section 2 | | | | | | | | | 100 | 95 | | | | 82 | | | 65 | |
| | | | | 2011 | State | Section 3 | | | | | | | | | 100 | 93 | | | | 78 | | | 61 | |
| | | | | 2011 | State | Section 4A | | | | | | | | | 100 | 87 | | | | 82 | | | 69 | |
| | | | | 2011 | State | Section 5A | | | | | | | | | 100 | 95 | | | | 82 | | | 71 | |
| | | | | 2011 | State | Section 6 | | | | | | | | | 100 | 95 | | | | 81 | | | 67 | |
| | | | | 2011 | State | Section 7 | | | | | | | | | 100 | 95 | | | | 80 | | | 61 | |
| | | | | 2011 | State | **Average** | | | | | | | | | **100** | **93.7** | | | | **81.1** | | | **65.6** | |
| 10 | Illinois | Edgar County Airport | Construct Crosswind Runway 18/36 | 2012 | State | | | | | | | | | | | 100 | 100 | | | 79 | | | 76 | |
| 11 | Illinois | Bolingbrook Clow International Airport | Remove and Construct Runway 18/36 in new location | 2015 | State | | | | | | | | | | | | | | 100 | 100 | | | 79 | |
| 12 | Illinois | DuPage Airport | Rehab Runway 10/28 | 2013 | State | Section 1 | | | | | | | | | | | 100 | 95 | | | 87 | | | 78 |
| | | | | 2013 | State | Section 2 | | | | | | | | | | | 100 | 97 | | | 89 | | | 82 |
| | | | | 2013 | State | **Average** | | | | | | | | | | | **100** | **96** | | | **88** | | | **80** |
| 13 | Illinois | Chicago Executive Airport | Rehab Runway 16/34 | 2016 | State | Section 1 | | | | | | | | | | | | | | 100 | 89 | | | 83 |
| | | | | 2016 | State | Section 2 | | | | | | | | | | | | | | 100 | 90 | | | 80 |
| | | | | 2016 | State | Section 3 | | | | | | | | | | | | | | 100 | 89 | | | 81 |
| | | | | 2016 | State | Section 4 | | | | | | | | | | | | | | 100 | 91 | | | 79 |
| | | | | 2016 | State | Section 5 | | | | | | | | | | | | | | 100 | 93 | | | 81 |
| | | | | 2016 | State | **Average** | | | | | | | | | | | | | | **100** | **90.4** | | | **80.8** |
| 14 | Wisconsin | Prairie du Chien | Runway 11-29 | 2012 | State | Section 10 | | | | | | | | | | 100 | 98 | | | 81 | | | | 73 |
| | | | | 2012 | State | Section 20 | | | | | | | | | | 100 | 98 | | | 80 | | | | 78 |
| | | | | 2012 | State | **Average** | | | | | | | | | | **100** | **98** | | | **80.5** | | | | **75.5** |
| 15 | Wisconsin | Fort Atkinson | Runway 3/21 reconstruction | 2013 | State | Section 10 | | | | | | | | | | | 100 | | | 92 | | | | 79 |
| | | | | 2013 | State | Section 20 | | | | | | | | | | | 100 | | | 92 | | | | 88 |
| | | | | 2013 | State | Section 30 | | | | | | | | | | | 100 | | | 94 | | | | 90 |
| | | | | 2013 | State | **Average** | | | | | | | | | | | **100** | | | **92.7** | | | | **85.7** |
| 16 | Wisconsin | Crandon | Reconstruct Runway 11-29 | 2012 | State | Section 10 | | | | | | | | | | 100 | 100 | | | 85 | | | | 69 |
| 17 | Wisconsin | Clintonville | Runway 4-22 Reconstruction and Extension | 2014 | State | | | | | | | | | | | | | 100 | | 95 | | | | 84 |
| 18 | Wisconsin | Oconto | Rehabilitate runway 11/29 | 2017 | State | | | | | | | | | | | | | | | | 100 | | 84 | |
| 19 | Indiana | Anderson Municipal Airport (AID) | Construct Western portion of Taxiway A | 2006 | FAA | Section 05 | | | | 100 | | | | | | | 81 | | | 63 | | | 58 | |
| 20 | Indiana | Anderson Municipal Airport (AID) | Construct Eastern/Central portion of Taxiway A | 2008 | FAA | Section 10 | | | | | | 100 | | | | | 99 | | | 77 | | | 72 | |
| | | | | 2008 | FAA | Section 15 | | | | | | 100 | | | | | 95 | | | 66 | | | 61 | |
| | | | | 2008 | FAA | **Average** | | | | | | **100** | | | | | **97** | | | **71.5** | | | **66.5** | |
| 21 | Indiana | Columbus Municipal (BAK) | Construct majority of Taxiway D | 2012 | FAA | Section 10 | | | | | | | | | | 100 | 100 | | | 91 | | | 85 | |
| 22 | Indiana | Logansport - Cass County (GGP) | Reconstruct Runway 9-27 | 2003 | FAA | Section 10 | 100 | | | | | | | | | | | | 69 | | | 60 | | |
| 23 | Indiana | Peru Municipal (I76) | Construct majority of Runway 1-19 | 2009 | FAA | Section 20 | | | | | | | 100 | | | | | | 83 | | | 80 | | |
| 24 | Michigan | Cheboygan County Airport (SLH) | Reconstruct Runway 17-35 | 2010 | State | | | | | | | | | 100 | | | 100 | | | | 89 | | | 80 |
| 25 | Michigan | Houghton County Memorial Airport (CMX) | Reconstruct Runway 7-25 | 2010 | State | | | | | | | | | 100 | | 100 | | | 95 | | | 84 | | |
| 26 | Michigan | Kirsch Municipal Airport (IRS) | Reconstruct Runway 6-24 | 2013 | State | | | | | | | | | | | | 100 | | 96 | | | 84 | | |
| 27 | Michigan | Marlette Township Airport (77G) | Runway 1-19 Mill and Overlay | 2015 | State | | | | | | | | | | | | | | 100 | | 98 | | | 89 |
| 28 | Michigan | Oakland County International Airport (PTK) | Construct Runway 18-36 | 2006 | State | | | | | 100 | | | | | 99 | | | 86 | | | 69 | | | 65 |
| 29 | Michigan | St. Clair County International Airport (PHN) | Reconstruct Runway 10-28 | 2005 | FAA | | | | 100 | | | 93 | | | | 82 | | | 70 | | | 60 | | |
| 30 | Wisconsin | Amery Municipal Airport (AHH) | Reconstruct Runway 18-36 | 2015 | FAA | Section 10 | | | | | | | | | | | | | 100 | 100 | | | | 77 |
| | | | | 2015 | FAA | Section 20 | | | | | | | | | | | | | 100 | 100 | | | | 83 |
| | | | | 2015 | FAA | **Average** | | | | | | | | | | | | | **100** | 100 | | | | **80** |
| 31 | Wisconsin | Baraboo-Wisconsin Dells Regional (DLL) | Reconstruct Apron | 2011 | FAA | Section 10 | | | | | | | | | 100 | 100 | | | 79 | | | 73 | | |
| 32 | Wisconsin | Bloyer Field (Y72) | Reconstruct Apron | 2014 | FAA | Section 10 | | | | | | | | | | | | 100 | | | 93 | | | 87 |
| 33 | Wisconsin | Bloyer Field (Y72) | Reconstruct half of Taxiway A | 2014 | FAA | Section 10 | | | | | | | | | | | | 100 | | | 92 | | | 90 |
| 34 | Wisconsin | Cumberland Municipal Airport (UBE) | Reconstruct Apron | 2015 | FAA | | | | | | | | | | | | | | 100 | 100 | | | | 77 |
| 35 | Wisconsin | Cumberland Municipal Airport (UBE) | Reconstruct Runway 9-27 | 2015 | FAA | Section 20 | | | | | | | | | | | | | 100 | 100 | | | | 75 |
| 36 | Wisconsin | Cumberland Municipal Airport (UBE) | Reconstruct Taxiway A | 2015 | FAA | | | | | | | | | | | | | | 100 | 100 | | | | 83 |
| 37 | Wisconsin | East Troy Municipal Airport (57C) | Reconstruct Runway 8-26 | 2014 | FAA | | | | | | | | | | | | | 100 | 87 | | | 76 | | |
| 38 | Wisconsin | East Troy Municipal Airport (57C) | Construct majority of Taxiway B | 2003 | State | Section 10 | 100 | | 100 | | | | 82 | | | 68 | | | 67 | | | 61 | | |
| 39 | Wisconsin | Fond Du Lac County Airport (FLD) | Construct Apron area | 2007 | FAA | A01FO-30 | | | | | 100 | | 95 | | | 89 | | | 84 | | | | 69 | |
| 40 | Wisconsin | Park Falls Municipal Airport (PKF) | Reconstruct Runway 18-36 | 2015 | FAA | Section 20 | | | | | | | | | | | | | 100 | 100 | | | | 83 |

# Example PCI Data

| No. | State | Airport Name | Description | Paved Year | Specifications | Notes | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | Illinois | Waukegan National Airport | Repair & Overlay RWY 14/32 | 2011 | State | Section 1 | 100 | 96 | | | | 83 | | | 65 | |
| | | | | 2011 | State | Section 2 | 100 | 95 | | | | 82 | | | 65 | |
| | | | | 2011 | State | Section 3 | 100 | 93 | | | | 78 | | | 61 | |
| | | | | 2011 | State | Section 4A | 100 | 87 | | | | 82 | | | 69 | |
| | | | | 2011 | State | Section 5A | 100 | 95 | | | | 82 | | | 71 | |
| | | | | 2011 | State | Section 6 | 100 | 95 | | | | 81 | | | 67 | |
| | | | | 2011 | State | Section 7 | 100 | 95 | | | | 80 | | | 61 | |
| | | | | 2011 | State | **Average** | **100** | **93.7** | | | | **81.1** | | | **65.6** | |

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# PCI Rating Scale

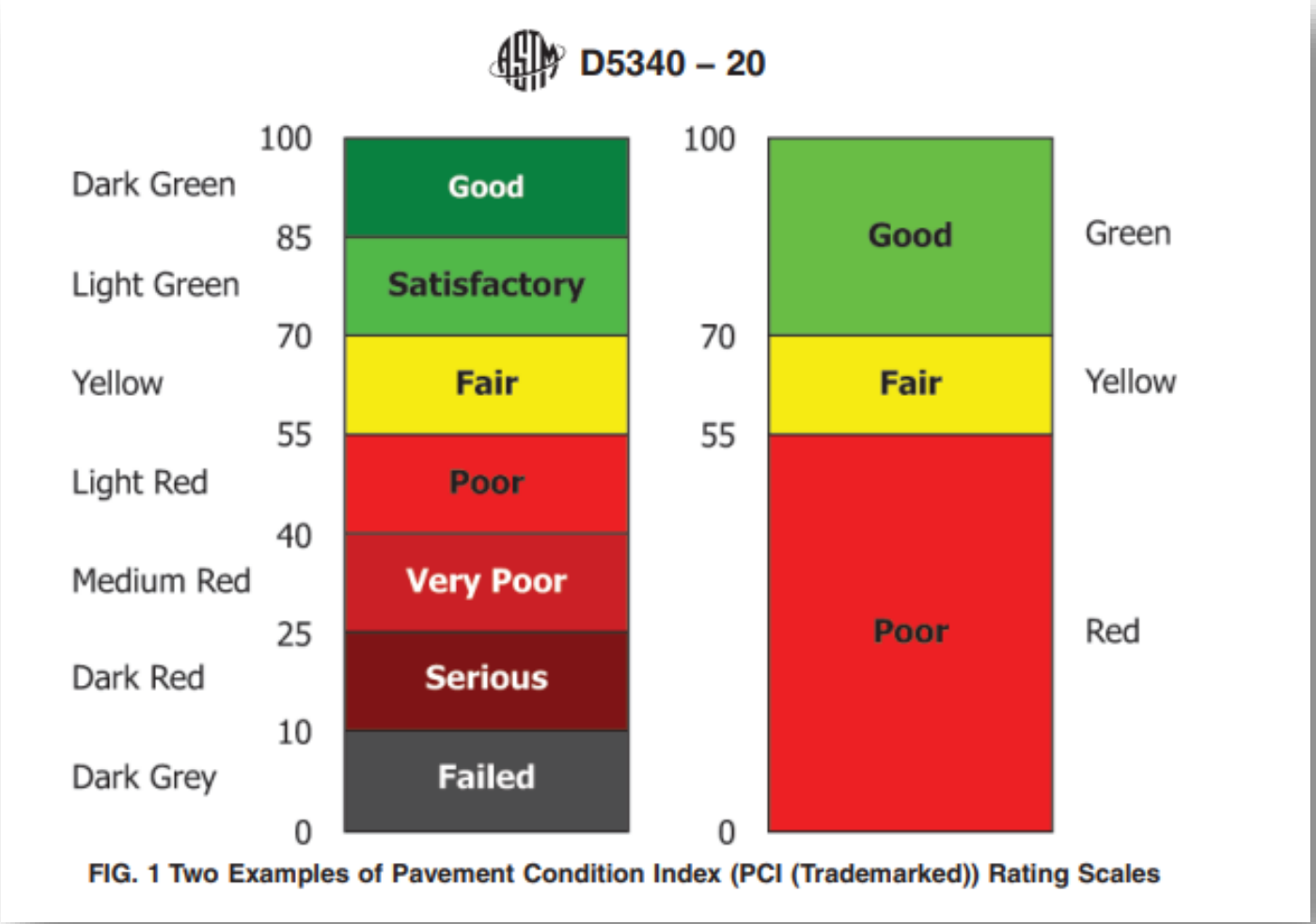


FIG. 1 Two Examples of Pavement Condition Index (PCI (Trademarked)) Rating Scales

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# Specification Reviews

- **FAA**: *Standard Specifications for Construction of Airports*, Advisory Circular No. 150/5370-10H (Item P-401 Asphalt Mix Pavement). Date: 12/21/2018.
- **Georgia**: *Standard Specifications: Construction of Transportation Systems*, published by the Georgia Department of Transportation, Sections 400 and 800.
- **Illinois**: *Illinois Standard Specifications for Construction of Airports*, (Item 401 Bituminous Surface Course – Superpave). Illinois Department of Transportation, Division of Aeronautics. Date: 4/1/2012.
- **Indiana**: *Indiana Department of Transportation Standard Specifications*, Section 401, 2020 Edition.
- **Michigan**: *Standard Specifications* (P-411 Plant Mix Bituminous Pavements). Michigan Department of Transportation, Airports Division. Date: 10/10/2007.
- **Wisconsin**: *Standard Specifications for Airport Construction*, 2021 Edition.

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# Specification Reviews

- Aggregate requirements
- Asphalt Binder
- Mix Design
- Quality Control
- Acceptance
- Construction

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# Findings – PCI Ratings

- The PCI ratings for each of the projects were compiled and summarized based on the type of specifications used (FAA vs. state highway).
- A plot of the data was then made of the PCI ratings by age.

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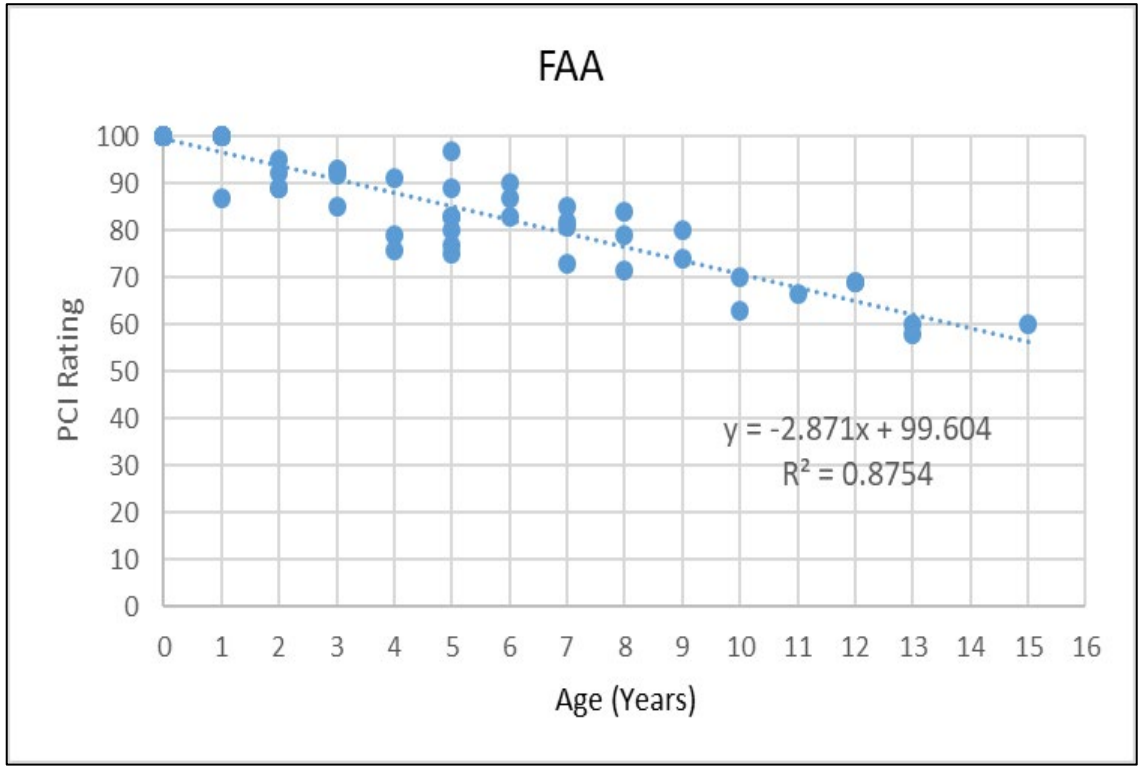
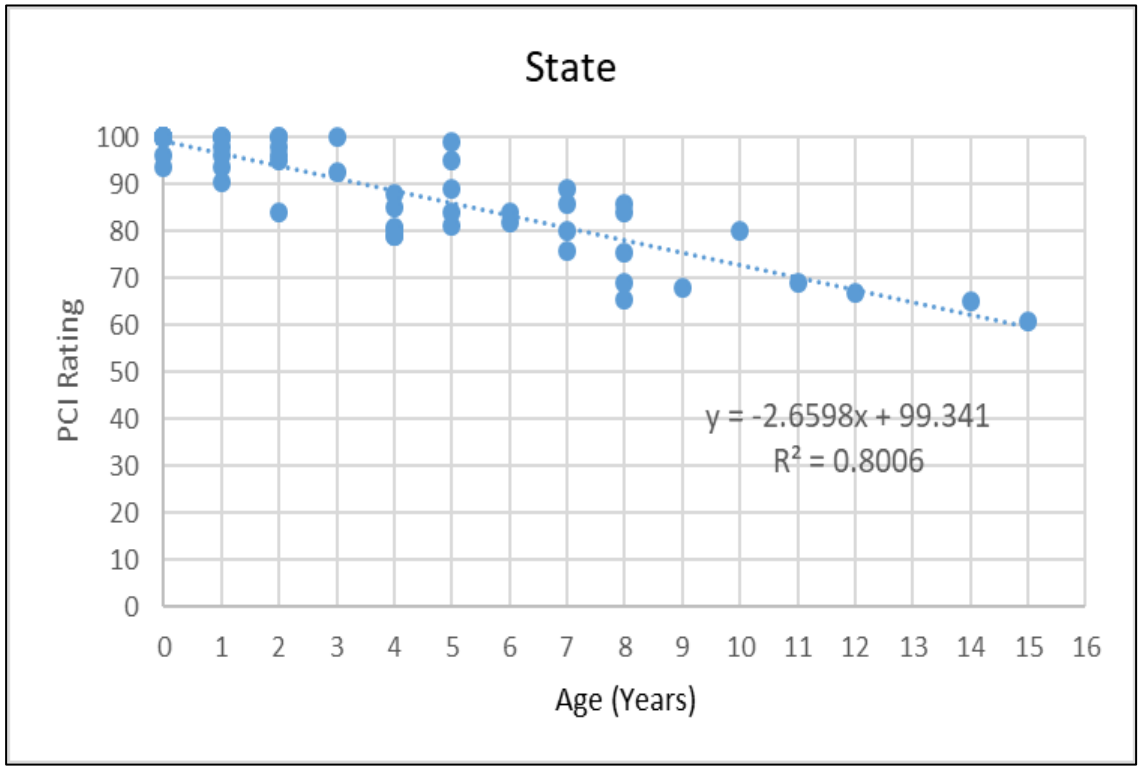
# Findings – PCI Ratings

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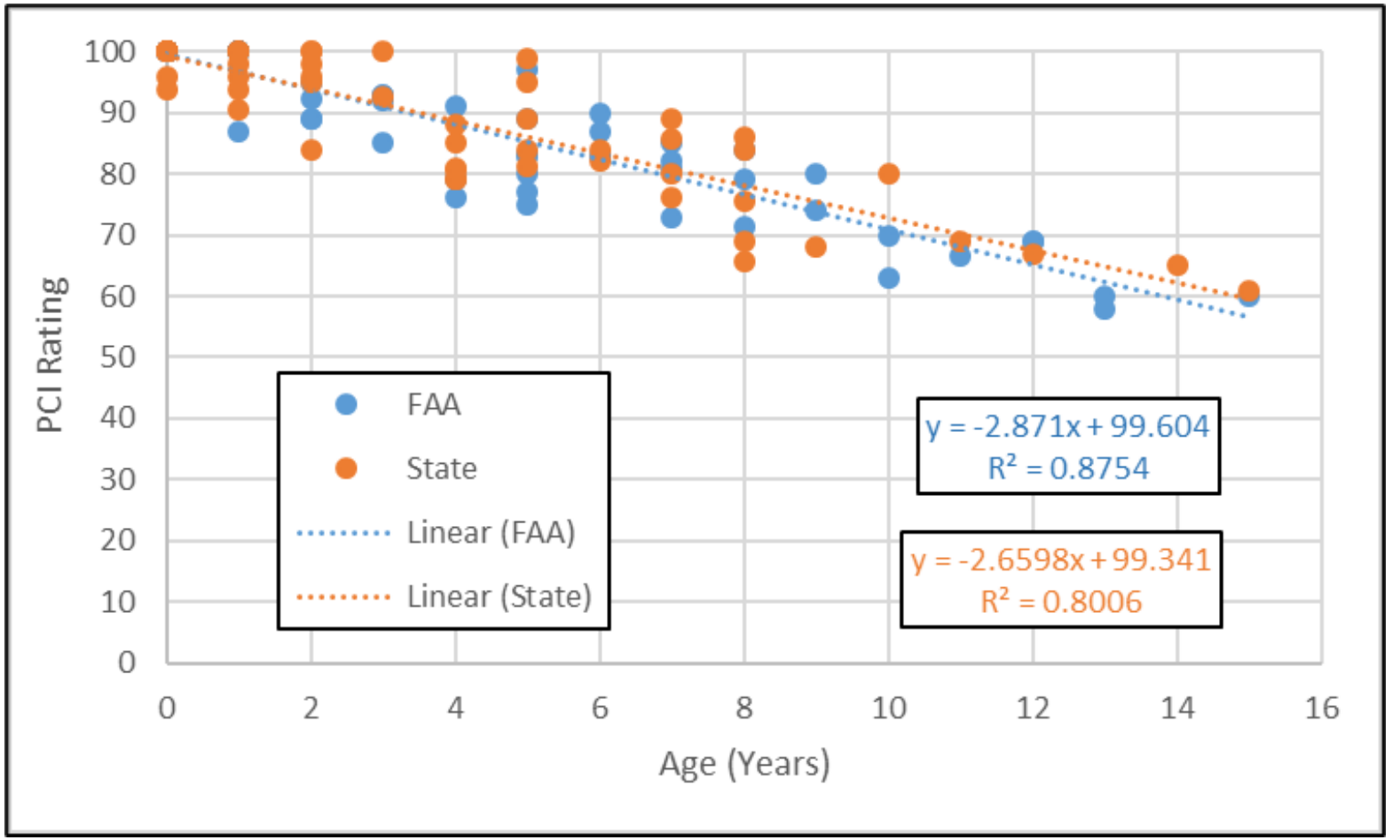
# Findings – PCI Ratings

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# Findings

- PCI versus Age for both types of specifications were fitted with least-squares linear regression equations.
- Both regressions showed a good fit with coefficients of determination ($R^2$) of 0.8754 and 0.8006 for the FAA and the State data sets, respectively.
- The regression equations indicate a PCI rating of approximately 60 at year 14 for both types of specifications.
- Analysis of Variance (ANOVA) indicates the effect of specification type is not statistically significant.

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# Distress Categories

- **Load-Related**: Alligator Cracking, Corrugation, Rutting, and Shoving
- **Climate-Related**: Block Cracking, Joint Reflective Cracking, Longitudinal & Transverse Cracking, Raveling, and Weathering
- **Other Distresses**: Bleeding, Depression, Jet-Blast Erosion, Oil Spillage, Polished Aggregate, Patching & Utility Cut Patch, Slippage Cracking, and Swell Distress

# Impact of Specifications on Type of Distress

| State | Airport | Runway | % of Distress Deducts | | | Specifications |
|---|---|---|---|---|---|---|
| | | | Load | Climate | Other | |
| Georgia | Columbus (CSG) | 06/24 | 0 | 95 | 5 | FAA |
| Georgia | Albany - Southwest Georgia Regional (ABY) | 04/22 | - | - | - | FAA |
| Georgia | Athens-Ben Epps Airport (AHN) | 09/27 | - | - | - | FAA |
| Georgia | Winder-Barrow County Airport (WDR) | 05/23 | 0 | 100 | 0 | FAA |
| Georgia | Winder-Barrow County Airport (WDR) | 13/31 | 0 | 100 | 0 | FAA |
| Indiana | Anderson Municipal Airport (AID) | Taxiway A | 0 | 100 | 0 | FAA |
| Indiana | Anderson Municipal Airport (AID) | Taxiway A | 0 | 100 | 0 | FAA |
| Indiana | Anderson Municipal Airport (AID) | Taxiway A | 15 | 85 | 0 | FAA |
| Indiana | Columbus Municipal (BAK) | Taxiway D | 0 | 100 | 0 | FAA |
| Indiana | Logansport - Cass County (GGP) | 09/27 | 14 | 85 | 1 | FAA |
| Indiana | Peru Municipal (I76) | 01/19 | 0 | 100 | 0 | FAA |
| Michigan | St. Clair County International Airport (PHN) | 10/28 | 0 | 100 | 0 | FAA |
| Wisconsin | Amery Municipal Airport (AHH) | 18/36 | 0 | 100 | 0 | FAA |
| Wisconsin | Baraboo-Wisconsin Dells Regional (DLL) | Apron | 0 | 100 | 0 | FAA |
| Wisconsin | Bloyer Field (Y72) | Apron | 0 | 100 | 0 | FAA |
| Wisconsin | Bloyer Field (Y72) | Taxiway A | 0 | 100 | 0 | FAA |
| Wisconsin | Cumberland Municipal Airport (UBE) | Apron | 21 | 79 | 0 | FAA |
| Wisconsin | Cumberland Municipal Airport (UBE) | 09/27 | 0 | 100 | 0 | FAA |
| Wisconsin | Cumberland Municipal Airport (UBE) | Taxiway A | 0 | 100 | 0 | FAA |
| Wisconsin | East Troy Municipal Airport (57C) | 08/26 | 0 | 100 | 0 | FAA |
| Wisconsin | Fond Du Lac County Airport (FLD) | Apron | 0 | 96 | 4 | FAA |
| Wisconsin | Park Falls Municipal Airport (PKF) | 18/36 | 0 | 100 | 0 | FAA |

# Impact of Specifications on Type of Distress

| State | Airport | Runway | % of Distress Deducts | | | Specifications |
|---|---|---|---|---|---|---|
| | | | Load | Climate | Other | |
| Georgia | Columbus (CSG) | 13/31 | 0 | 100 | 0 | State |
| Georgia | Rome- Richard B Russell Regional Airport | 07/25 | - | - | - | State |
| Georgia | Dahlonega – Wimpy's Lumpkin County Airport (9A0) | 15/33 | 0 | 100 | 0 | State |
| Illinois | Waukegan National Airport (UGN) | 14/32 | 0 | 87 | 13 | State |
| Illinois | Edgar County Airport (PRG) | 18/36 | 0 | 100 | 0 | State |
| Illinois | Bolingbrook's Clow International Airport (1C5) | 18/36 | 0 | 100 | 0 | State |
| Illinois | DuPage Airport (DPA) | 10/28 | 22 | 78 | 0 | State |
| Illinois | Chicago Executive Airport (PWK) | 16/34 | 0 | 100 | 0 | State |
| Michigan | Cheboygan County Airport (SLH) | 17/35 | 17 | 49 | 34 | State |
| Michigan | Houghton County Memorial Airport (CMX) | 07/25 | 0 | 100 | 0 | State |
| Michigan | Kirsch Municipal Airport (IRS) | 06/24 | 0 | 100 | 0 | State |
| Michigan | Marlette Township Airport (77G) | 01/19 | 0 | 100 | 0 | State |
| Michigan | Oakland County International Airport (PTK) | 18/36 | 0 | 100 | 0 | State |
| Wisconsin | Prairie du Chien (PDC) | 11/29 | 14 | 86 | 0 | State |
| Wisconsin | Ft. Atkinson (61C) | 03/21 | 11 | 89 | 0 | State |
| Wisconsin | Crandon (YSS) | 11/29 | 0 | 100 | 0 | State |
| Wisconsin | Clintonville (CLI) | 04/22 | 0 | 100 | 0 | State |
| Wisconsin | Oconto (OCQ) | 11/29 | 0 | 100 | 0 | State |
| Wisconsin | East Troy Municipal Airport (57C) | Taxiway B | 33 | 67 | 0 | State |

# Impact of Specifications on Type of Distress

- For both types of specifications, climate-related distresses were the predominant mode of distress on all projects,
  - Longitudinal and transverse cracking most prevalent.
- Load-related distresses were relatively minor
  - 3 of 21 FAA projects
  - 5 of 19 State projects
  - Types :
    - Medium-Severity Alligator Cracking (1)
    - Low-Severity Alligator Cracking (5)
    - Low-Severity Rutting (2)

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# Conclusions

- Based on PCI ratings, the performance of airport asphalt pavements constructed using state highway specifications is statistically equivalent to pavements constructed using FAA specifications.
  - Note: Three of five states had their own aviation specifications
- Climate-based distresses were the predominant mode of distress for both FAA and state projects
  - Longitudinal and transverse cracking and weathering most prevalent

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# Conclusions

- The number of load-related distresses were relatively low.
  - Eight of the 40 projects
  - Of those projects, five used state specifications and three used FAA specifications.
- Of the six projects with alligator (fatigue) cracking, five of them used state specifications, which could be an indicator that the state specification mixes may have reduced fatigue resistance
- Rutting was observed on only two projects, and both used FAA specifications. This indicates that the use of state specifications does not seem to increase the risk of rutting.

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# Conclusions

- Current FAA specification requirements should result in slightly higher effective binder contents
- FAA density specification more robust than state specifications
  - Majority of the state specifications examined did not include a joint density requirement
- Several of the state specifications used on airport projects in this study were not true “highway” specifications. Of the five states evaluated, three had separate aviation specifications that were used for airport construction.

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# Recommendations

- Data supports the continued use of state highway specifications for airfield asphalt pavements at non-primary airports serving aircraft that do not exceed 60,000 pounds, if requested by the state.
- Additional guidance should be provided for airports using state specifications regarding the construction and acceptance of longitudinal joints
- Based on the amount of climate-related distresses encountered, further research is warranted on the selection and adoption of suitable mixture cracking and durability performance tests during the mix design process

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# Thank You

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