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Pavement Condition Report

Michigan City Municipal Airport

Project 16801839

Prepared for:
Indiana Department of Transportation
Office of Aviation
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Indianapolis, IN 46204

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Executive Summary

Background

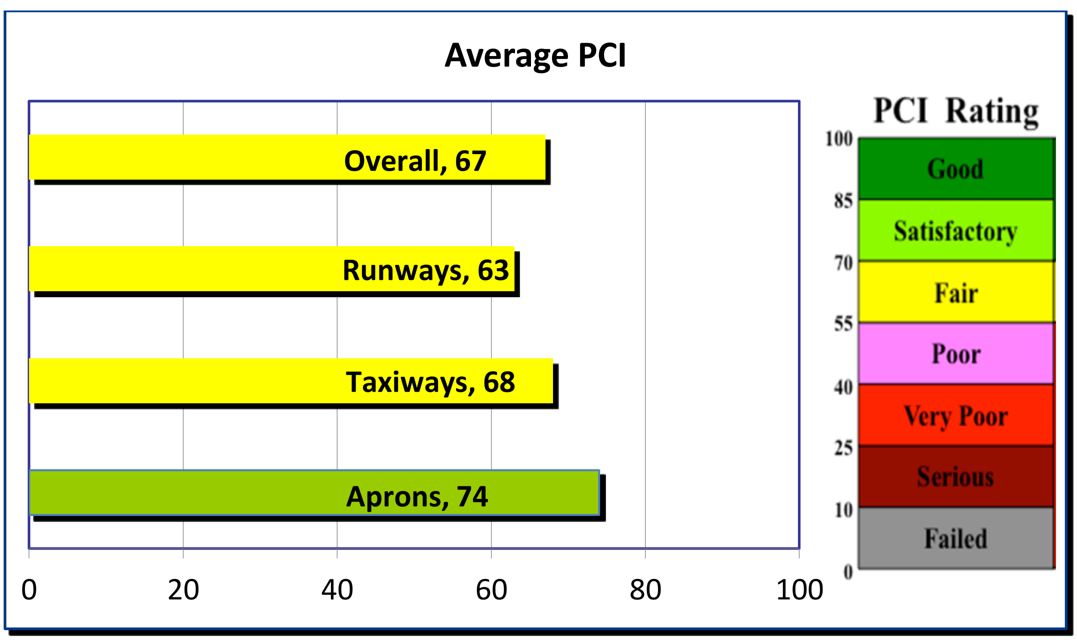
Since 1995, airports have been required to implement a pavement maintenance-management program to receive funding for any project constructed using Federal money. To assist individual airports in meeting this requirement and help improve airport pavement conditions statewide, the Indiana Department of Transportation, Office of Aviation contracted with Applied Research Associates, Inc. to provide pavement evaluation surveys at local airports. This report documents pavement condition at Michigan City Municipal Airport in September 2015.

A primary objective of the pavement management program is to determine maintenance and rehabilitation needs by comparing pavement condition to a standardized benchmark called the minimum service level (MSL), defined as the minimum pavement condition acceptable in managing Indiana's airfield pavements. The benchmark MSL values used to trigger rehabilitation are shown below.

Runway	Taxiway	Apron
60	55	55

Pavement Condition

The average inspected Pavement Condition Index (PCI) for all the airfield pavements was 67. Runways had an average inspected PCI of 63 and were above the desired MSL of 60. Taxiways had an average inspected PCI of 68, and ramps had an average inspected PCI of 74.



Capital Improvement Program

The table below provides a summary of the projected pavement rehabilitation needs for the next 5 years of the capital improvement program, starting in 2016. The estimated cost for the rehabilitation actions that provide the greatest increase in pavement service life is approximately $663,000 in 2016 dollars. If no action is taken, the overall PCI is projected to drop from 67 to 56 by 2020.

Project Year	Calendar Year	Amount
Year 1	2016	210,822
Year 2	2017	-
Year 3	2018	18,080
Year 4	2019	425,128
Year 5	2020	9,098
	5-Year Total	**663,128**

Maintenance

Analysis of potential maintenance projects identified approximately 16,000 linear feet of crack sealing and crack repair, and nearly 2,400 square feet of patching needs, at an estimated total cost of approximately $40,000.

Specific recommendations to help prioritize airfield maintenance are found in chapter 4 of this report. A summary of all identified maintenance needs is shown in the table below and in the figure on the following page.

Work Item	Quantity	Unit	Cost
AC PATCH	2,294	SF	$19,905
AC RESTORATIVE CRACK REPAIR	14,220	LF	$17,632
AC SUSTAINING CRACK REPAIR	1,501	LF	$1,299
PCC PATCH	66	SF	$1,113
Total:			**$39,949**

AC = asphalt concrete; PCC = portland cement concrete; S.F. = square feet; L.F. = linear feet

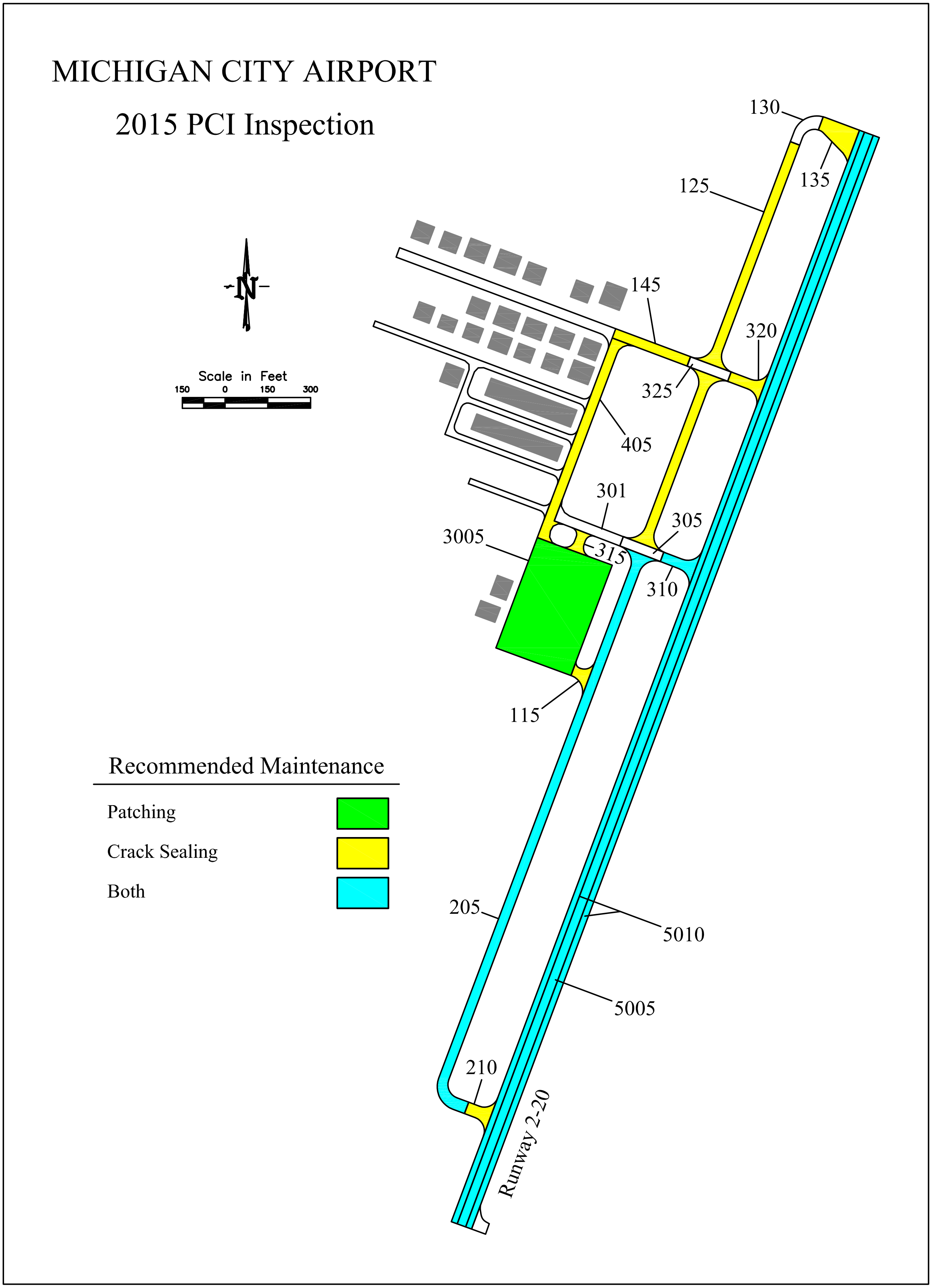

MICHIGAN CITY AIRPORT
2015 PCI Inspection
N
Scale in Feet
150 0 150 300
Recommended Maintenance
Patching
Crack Sealing
Both
130
135
125
145
320
325
405
301
305
3005
315
310
115
205
5010
5005
210
Runway 2-20

Table of Contents

Table of Figures

Table of Tables

GLOSSARY OF ABBREVIATIONS

AC	-	asphalt concrete
AAC	-	asphalt overlay on existing asphalt
APC	-	asphalt overlay on existing concrete
APMS	-	airport pavement management system
ARA	-	Applied Research Associates, Inc.
CADD	-	computer-aided design and drafting
CIP	-	capital improvement program
FAA	-	Federal Aviation Administration
FOD	-	foreign object damage
GIS	-	geographic information system
INDOT	-	Indiana Department of Transportation
L&T	-	longitudinal and transverse
LTD	-	longitudinal, transverse, and diagonal
M&R	-	maintenance and rehabilitation
MSL	-	minimum service level
PCC	-	portland cement concrete
PCI	-	Pavement Condition Index
PCN	-	Pavement Classification Number
PDF	-	portable electronic document

1. Introduction

1.1 Objective and Scope

The Indiana Department of Transportation, Office of Aviation (INDOT) retained Applied Research Associates, Inc., (ARA) to provide airfield pavement inspection, pavement evaluation, and pavement management services for Indiana's statewide network of airfield pavements. The pavement evaluations documented in this report were performed under purchase order number 16801839.

A primary objective of INDOT's ongoing pavement evaluation and management program is to determine maintenance and rehabilitation (M&R) needs by comparing the Pavement Condition Index (PCI) to a standardized benchmark called the minimum service level (MSL). The MSL is defined as the minimum pavement condition acceptable in managing INDOT's airside pavement. The benchmark MSL values used to trigger rehabilitation vary by airport classification and are shown in Table 1-1.

Table 1-1. Minimum Service Levels

Facility	Primary	Commercial Service	Large GA > 3600'Rwy	Small GA < 3600'Rwy
Runway	70	65	60	55
Taxiway	65	60	55	50
Apron	65	60	55	50

Additional goals of this project were to implement a software program to manage the pavement network, develop performance curves based on historical rates of pavement deterioration, forecast future pavement conditions, identify and recommend specific M&R actions to address the root cause of the documented pavement distress, and estimate the cost and ideal timing of the recommend M&R. The following tasks were performed in support of the project goals:

- Review record documents
- Define the pavement network
- Conduct an airfield condition survey
- Update the AIRPAV database & software
- Develop a 5-year airfield M&R work plan
- Report findings to INDOT

1.2 Description of Tasks Performed

1.2.1 Records Review

A detailed records review was performed to determine the airport's construction history and the as-built cross section for each pavement feature. Plan sets for recent projects were provided to ARA in computer-aided design and drafting (CADD) format. Older plans sets were provided as hard copies or in portable electronic document (PDF) format.

1.2.2 Define Pavement Network

Prior to the field survey, a pavement network map was developed using available aerial photography and construction plans. The map was divided into facilities, features, and sample units. A facility is defined as a complete area of the airfield that is used for a particular type of operation. Facilities are typically named for complete functional elements of pavement, such as Runway 11-29, Taxiway A, or North Terminal Apron. After facilities are defined, they are divided into features based on pavement type, construction, structure, and usage. Note that the terms branch and section may be used interchangeably with facility and feature throughout this report.

Features are divided into sample units as prescribed by ASTM D5340-12, *Standard Test Method for Airport Pavement Condition Index Surveys*. A sample unit is a subdivision of a section used exclusively to aid in the inspection process and reduce the effort needed to determine distress quantities and the PCI. The specified sample unit size for an asphalt concrete (AC) pavement is 5,000 ft^2 ± 2,000 ft^2. Sample units on portland cement concrete (PCC) pavements contain 20 ± 8 slabs.

To allow users to search, sort, and identify airport pavement quickly, a numbering system is used in conjunction with the facility, feature, and sample unit convention. The format starts with facility, then feature, and finally identifies the sample unit. The number 1605.300 is parsed as an example in Figure 1-1. Most pavement references in this report are presented in this format.

Using statistical sampling methods, the PCI procedure provides a high confidence level in evaluating overall pavement condition while sampling only a portion of the pavement surface. Table 1-2 shows the network-level inspection density used on this project. Where appropriate, "additional sample units" were identified and inspected to record pavement areas with distress patterns not representative of the overall pavement condition. The unique distress types documented in additional sample units are not extrapolated across the entire feature.

As the surveyors inspected the pavement, they were mindful to ensure that the pre-survey airfield map depicted the actual pavement, otherwise known as a "ground-truth" survey. Noticeable differences between what was present in the field and what was displayed on the maps were adjusted by a CADD technician.

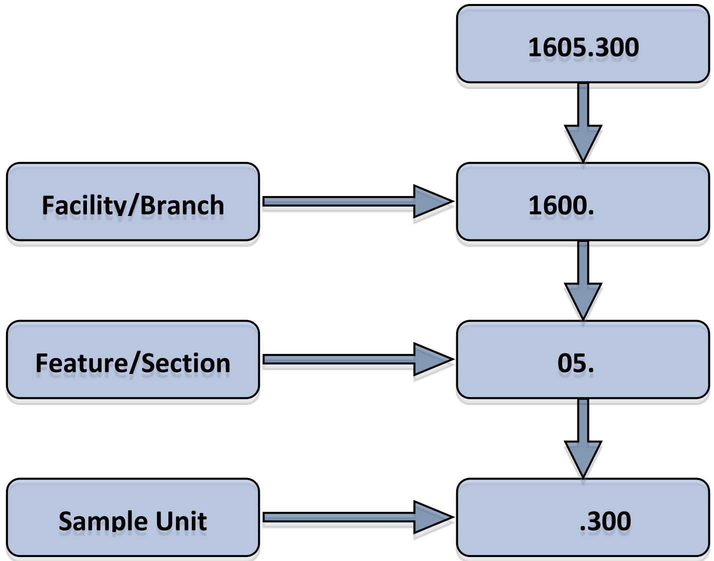


Figure 1-1. Pavement Numbering System

Table 1-2. Inspection Density

Sample Unit in Feature	Inspected Sample Units
1-2	ALL
3-4	2
5-7	3
8-10	4
11-14	5
15-19	6
20-25	7
26-30	8
31-37	9
38-45	10
46-55	11
56-80	12
> 80	15%

1.2.3 Conduct Airfield Condition Survey

The pavement condition surveys were performed in accordance with ASTM D5340-12. The procedure is based on the identification and measurement of visible distress at the pavement surface. Each PCI distress will deduct from the pavement's perfect condition of 100. Using pavement management software (or curves provided in ASTM D5340-12), a deduct value is determined for each combination of distress type, severity, and measured quantity. The PCI value is then determined from the unique combination of these variables.

A primary benefit of the PCI procedure is the ability to perform objective evaluations and compare pavement condition with an easy-to-understand numerical rating. Because the combined impact of multiple distresses is not cumulative, ASTM D5340-12 provides an additional family of curves to adjust for multiple distresses. The PCI is determined by applying the individual deduct value for each distress type along with any required correction factors to account for multiple distress types.

Figure 1-2 shows the relationship between PCI values and descriptive ratings. Generally, pavement maintenance is most cost-effective when the pavement is still in satisfactory condition. Rehabilitation, such as an asphalt mill and inlay, is typically performed for pavements with PCI values between 55 and 70. When the PCI value drops below 55, a mill an inlay may not provide the desired performance and complete reconstruction often becomes the most cost-effective means of repairing the pavement.

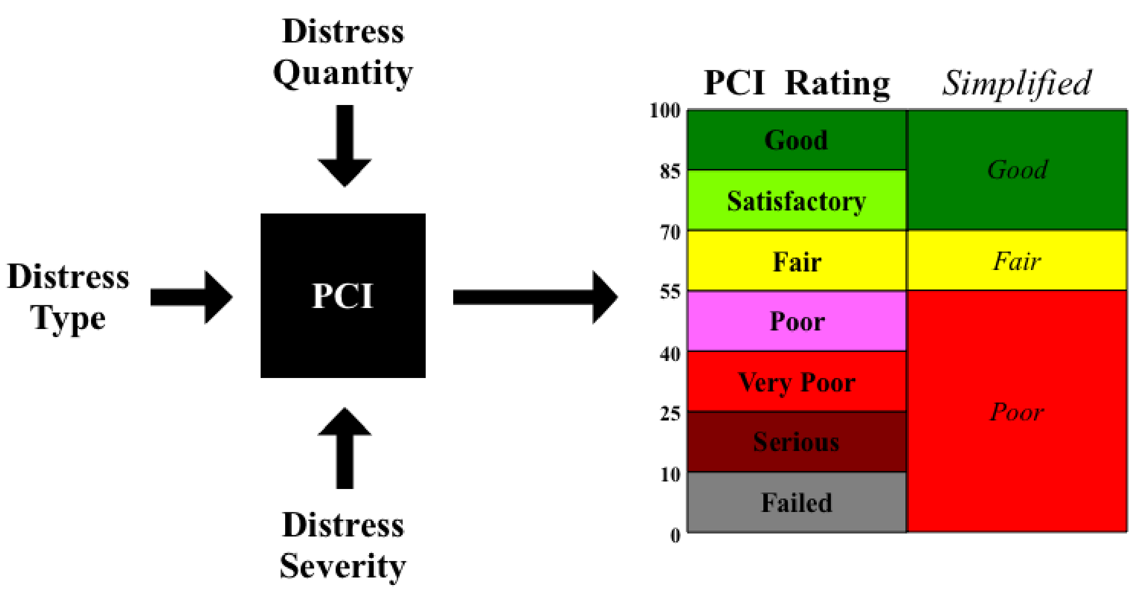


Figure 1-2. PCI Value and Descriptive Rating

1.2.4 Update AIRPAV Database & Software

The network definition, construction history, and data from the survey were entered into the AIRPAV pavement management system (APMS) software. After all data were entered, family curves were developed to model the change in pavement condition over time. These family curves are used to estimate future pavement condition. Typically, several curves are developed, with separate curves defined for different pavement surface types, such as AC, PCC, asphalt overlay on existing asphalt (AAC), and asphalt overlay on existing concrete (APC). The latest version of AIRPAV containing all survey data, deterioration curves, M&R policies, budgets, and construction history, was provided to INDOT on CD-ROM.

1.2.5 Develop 5-Year Airfield M&R Work Plans

A 5-year capital improvement program (CIP) was developed showing the year that each pavement feature was expected to fall below the MSL. The 5-year plan detailed in chapter 3 shows rehabilitation alternatives for each feature based on the PCI and the individual distress types observed during the pavement evaluation. The timing of each project is shown as the year that the PCI falls below the MSL and does not consider other important factors. Using reports like this for each airport in the State, INDOT engineers and planners develop a final 5-year statewide CIP plan that balances the sometimes conflicting priorities of pavement condition, operational constraints, construction staging considerations, and available funding.

1.2.6 Report Finding to INDOT

This report includes background information, PCI results and recommendations, and M&R budget scenarios. Photographs depicting typical pavement conditions observed during the survey are included in chapter 2. Appendix A contains general information about the AIRPAV pavement management software. Appendix B contains a summary of general maintenance techniques and best practices. Appendix C provides a detailed summary of the airfield pavement condition. Appendix D describes common airfield distress types. Appendix E provides an analysis of each pavement section based on recorded distress, and Appendix F contains exhibits to help the airport owner manage the airfield pavement system.

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2. Pavement Condition Evaluation

2.1 Overview

Approximately 654,000 ft^2 of total airside pavement is represented herein. Using statistical sampling methods approximately 221,000 ft^2 of AC pavement and 35,000 ft^2 of PCC pavement was surveyed as part of this assessment. The average inspected PCI for all pavements was 67 (Fair). The average inspected PCI for the runways, taxiways, and ramps were as follows: 63 (Fair), 68 (Fair), and 74 (Satisfactory). Table 2-1 provides a general description of the PCI rating categories, including a simplified rating scale of Good, Fair, and Poor. This table also shows the associated distress levels and general M&R requirements for each rating category.

Table 2-1. Definition and Distribution of PCI Ratings

Simplified PCI Rating	PCI Range	Definition	Pavement Area (ft^2)	Pavement Area (%)
Good	86-100	GOOD: Pavement has minor or no distresses and requires only routine maintenance.	-	0%
	71-85	SATISFACTORY: Pavement has scattered low-severity distresses that need only routine maintenance.	171,718	26%
Fair	56-70	FAIR: Pavement has a combination of generally low- and medium-severity distresses. M&R needs are routine to major in the near future.	466,342	71%
Poor	41-55	POOR: Pavement has low-, medium-, and high-severity distresses that probably cause some operational problems. Near-term maintenance and repair needs may range from routine up to a requirement for reconstruction.	15,633	3%
	26-40	VERY POOR: Pavement has predominantly medium- and high-severity distresses that cause considerable maintenance and operational problems. Near-term maintenance and repair needs will be intensive in nature.	-	0%
	11-25	SERIOUS: Pavement has mainly high-severity distresses that cause operational restrictions; immediate repairs are needed.	-	0%
	0-10	FAILED: Pavement deterioration has progressed to the point that safe operations are no longer possible; complete reconstruction is required.	-	0%

The pavement within each of the PCI condition categories is shown in Figure 2-1. The inspected PCI is summarized by branch use in Figure 2-2, and the photographs in Figure 2-3 through Figure 2-5 provide examples of the condition categories.

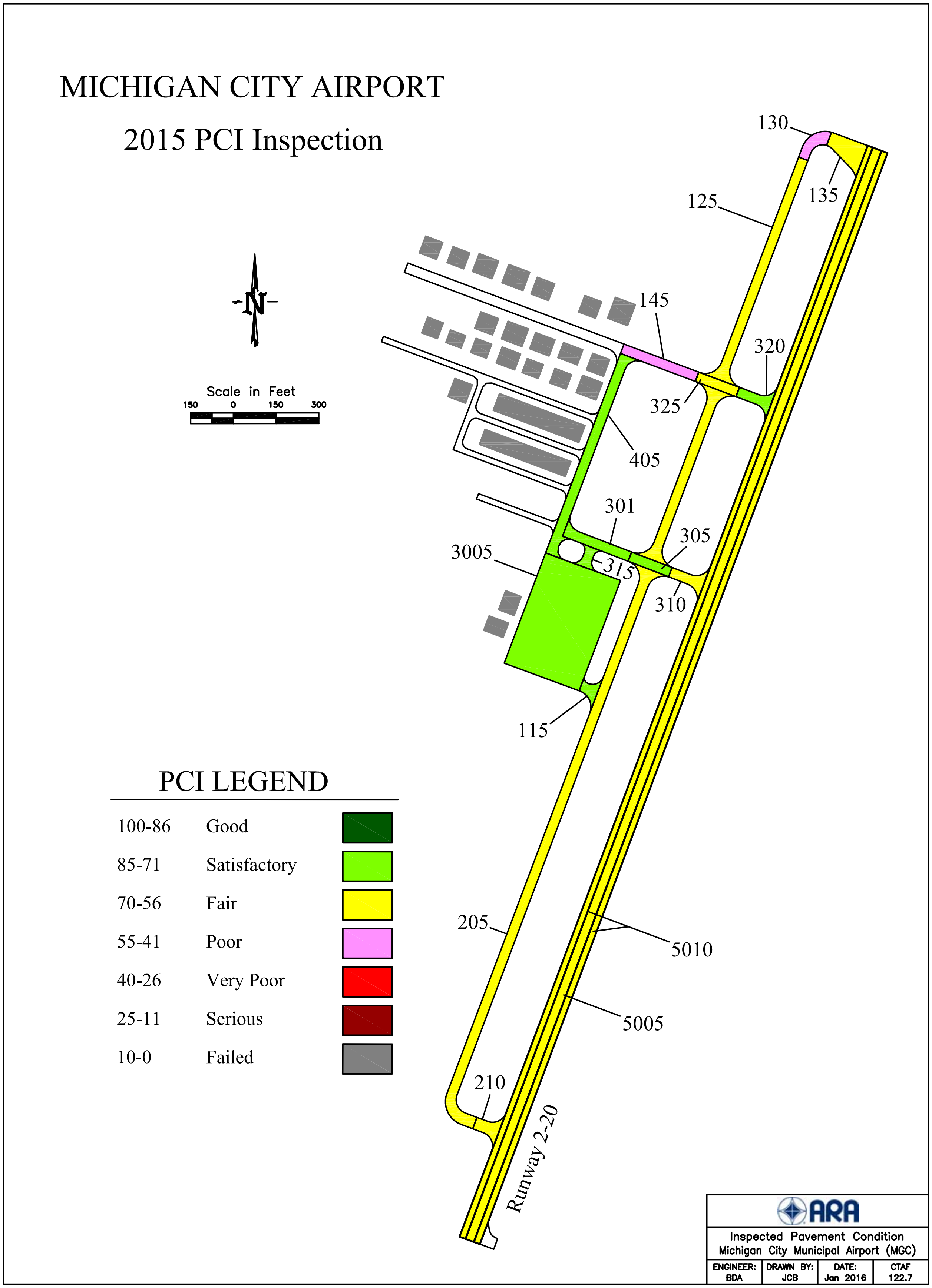

Figure 2–1. Inspected Pavement Condition at Michigan City Municipal Airport (MGC).

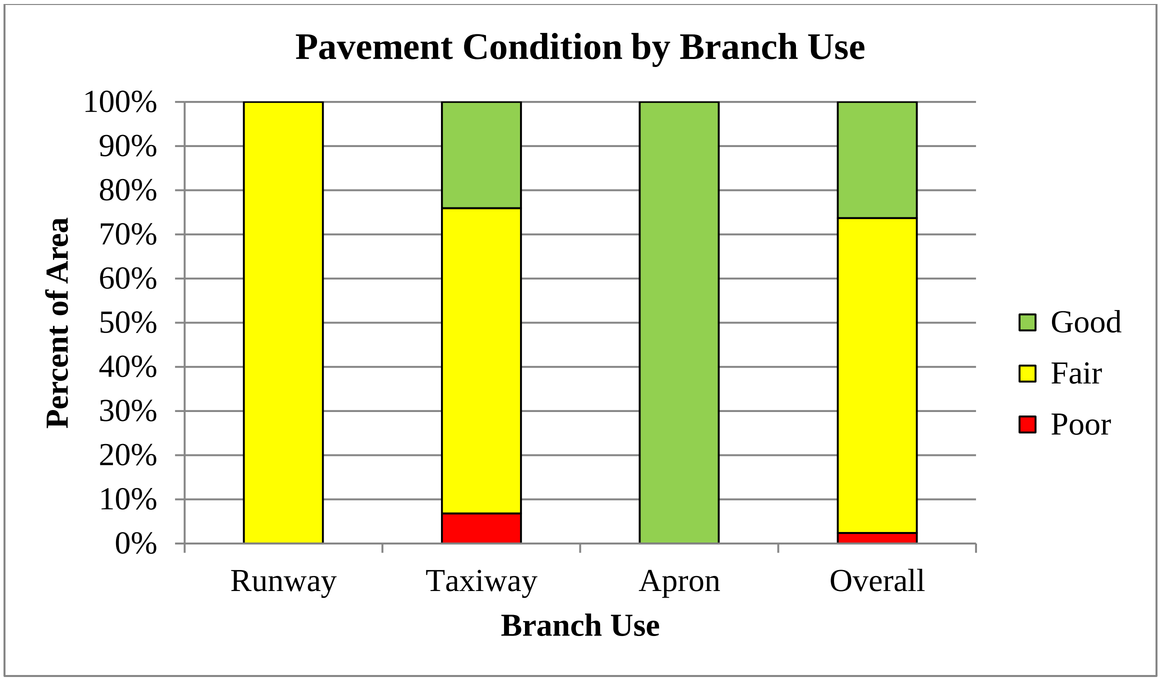

Figure 2-2. Pavement Condition by Branch Use

Figure 2-3. Typical PCC Pavement in Good Condition (Feature 3005)

Figure 2-4. Typical AC Pavement in Good Condition (Feature 315)

Figure 2-5. Typical AC Pavement in Fair Condition (Feature 325)

Figure 2-6. Typical AC Pavement in Poor Condition (Feature 130)

2.2 Distress Types and Frequency

The inspectors surveyed approximately 221,000 ft^2 of AC pavement. The frequency of each distress type is shown in Table 2-2. The recorded distress types were L&T cracking, weathering, patching, patching, alligator cracking, swell, rutting, depressions, raveling, and block cracking. L&T and block cracking are age-related distresses.

Table 2-2. Distress Frequency in AC Pavement

Distress	Sample Units	% Inspected Sample Units
L&T CRACKING	51	100
WEATHERING	39	77
PATCHING	19	37
ALLIGATOR CRACKING	10	20
SWELL	10	20
RUTTING	4	8
DEPRESSIONS	3	6
RAVELING	3	6
BLOCK CRACKING	1	2

The inspectors surveyed approximately 35,000 ft^2 of PCC pavement. The frequency of each distress type is shown in Table 2-3. The recorded distress types were L&T cracking, patching, settlement/faulting, shrinkage cracks, corner break, joint spalling, shattered slab and ASR. Patching is an indicator of an active maintenance program.

Table 2-3. Distress Frequency in PCC Pavement

Distress	Sample Units	% Inspected Sample Units	Slabs	% Inspected Slabs
LONG/TRANS/DIAG CRACKS	9	100	38	18
PATCHING SMALL	8	89	11	5
SETTLEMENT OR FAULTING	6	67	18	9
SHRINKAGE CRACKS	5	56	7	3
CORNER BREAK	4	44	9	4
JOINT SPALLING	4	44	4	2
SHATTERED SLAB	1	11	1	1
ASR	1	11	1	1

2.3 PCI Summary

The branch and section PCI values are shown below, along with the surface type, area, and last year construction occurred. Feature 135 had new crack seal and feature 3005 had crack seal patching and slab replacements.

Table 2-4. PCI Results

Branch ID	Branch PCI	Section	Surface	Area (sf)	Built	2012 PCI	2015 PCI
100	66	115	AC/AC	3,450	2013	48	78
		125	AC	56,120	1998	72	69
		130	AC/AC	5,825	1999	59	51
		135	AC/AC	11,250	1999	65	68
		145	AC	9,808	2006	66	55
200	62	205	AC	76,569	1995	67	62
		210	AC/AC	4,918	1999	64	62
300	76	301	AC/AC	9,106	2013	25	80
		305	AC	6,125	2013	42	84
		310	AC	5,670	1999	80	66
		315	AC	4,150	2013	31	84
		320	AC/AC	5,448	1999	84	79
		325	AC	5,425	1998	76	62
400	82	405	AC	27,342	2013	45	82
3000	74	3005	PCC	116,097	1989	59	74
5000	63	5005	AC/AC	130,772	1999	68	61
		5010	AC/AC	175,618	1999	69	65

2.4 Analysis Commentary

The following pages provide a brief overview of the 2015 inspected pavement conditions for each facility. Comments are based primarily on the AIRPAV analysis but also include field notes and remarks from the pavement condition inspectors. Where appropriate, individual pavement sections are referenced within the larger facility.

2.4.1 Runways

The runways consisted of two sections of AC pavement. The runway had a total area of 306,390 ft² with an area-weighted average PCI of 63 (Fair). L&T cracking and patches were the most common recorded distress types. The distribution of runway pavement by PCI range is shown in Table 2-5.

Table 2-5. Runway Condition Distribution

PCI Range	Rating	Number of Sections	Pavement Area (ft²)	Pavement Area (%)
100-71	Good	-	-	0%
70-56	Fair	2	306,390	100%
55-0	Poor	-	-	0%

2.4.2 Taxiways

The taxiways consisted of 14 sections of AC pavement. The total area of the taxiways was 231,206 ft² with an area-weighted average PCI of 68 (Fair). The taxiway pavements had L&T cracking and weathering as the most recorded distress type. Lower performing pavements also had alligator cracking and rutting. Features 115,301, 305, 315 and 405 had a thin overlay with a steep deterioration with a lot of the underlying cracking already reflecting through.Taxiway pavement distribution by PCI range is shown in Table 2-6.

Table 2-6. Taxiway Condition Distribution

PCI Range	Rating	Number of Sections	Pavement Area (ft²)	Pavement Area (%)
100-71	Good	6	55,621	24%
70-56	Fair	6	159,952	69%
55-0	Poor	2	15,633	7%

2.4.3 Aprons

The aprons consisted of one sections of PCC pavement. The total area of apron pavements was 116,097 ft², and the area-weighted average PCI was 74 (Good). Corner breaks and LTD cracks, were the most recorded distress types. Feature 3005 had a lot of maintenance in the form of patching and slab replacements. The distribution of pavement area and sections by PCI range are shown in Table 2-7.

Table 2-7. Apron Condition Distribution

PCI Range	Rating	Number of Sections	Pavement Area (ft²)	Pavement Area (%)
100-71	Good	1	116,097	100%
70-56	Fair	-	-	0%
55-0	Poor	-	-	0%

3. Capital Improvement Program

3.1 Analysis

The individual feature analyses shown in appendix E document viable rehabilitation projects that address the causes of each pavement section's distress while restoring the pavement to a condition above the desired MSL. The recommended timing of each improvement action is defined as the year that the pavement condition is projected to reach the MSL. By establishing benchmark MSL targets, it is possible to plan objectively for future needs against a standard set of performance criteria. This section categorizes the identified viable options into CIP strategies based on cost and expected service life.

The airport may find it desirable to adjust the timing of projects detailed in the CIP to meet fiscal and operational constraints. For example, if different sections of a runway were projected to reach the MSL in various years ranging from 2016 to 2018, it is not operationally feasible to stage rehabilitation over a 3-year period. Instead, runway rehabilitation would be programmed in a manner that balanced the need to minimize the length of the runway closure while maximizing the remaining service life.

3.2 Cost Estimates

Project costs were estimated based on the pavement area and the unit costs shown in Table 3-1 for specific M&R activities. Project costs are presented so planners and managers can compare the relative magnitude of funding required for various alternatives. The two-page AIRPAV feature analysis (see appendix E) provides cost estimates for each identified project. These cost estimates are for planning purposes only and do not constitute an engineering estimate.

Furthermore, these cost estimates represent the improvement of existing pavement structures and associated incidental work only. Other potential project line items, such as lighting, navigational aids, and drainage modifications are not included, and estimates for those items must be developed separately and incorporated into an overall project cost.

Typical examples of work that might be included in alternatives evaluated by AIRPAV are outlined on the following pages. These example projects would meet the requirements for each selected option; however, the descriptions are not intended to imply required, or even preferred, design configurations. Rehabilitation decisions, such as overlay thickness design, should be made in conjunction with engineering design analysis.

Table 3-1. Unit Costs

Rigid Pavement (PCC)	
Reconstruction	$12.90 /sf
Slab Replacement & Full Depth Patching	$12.48 /sf
Patching (Partial Depth)	$16.70 /sf
Slab Repair & Overlay	$4.69 /sf + $0.41 /sf/in > 4"
Joint Seal Replacement	$2.24 /lf
Joint Seal Repair	$0.87 /lf
Undersealing	$4.16 /sf
Flexible Pavement (AC)	
Reconstruction	$5.36 /sf
Resurfacing	$1.44 /sf
Structural Overlay	$2.25 /sf + $0.41 /sf/in > 4"
Surface Treatment	$0.39 /sf
Patching	$9.78 /lf
Crack Repair (Restorative)	$1.24 /lf
Crack Repair (Sustaining)	$0.85 /lf

3.2.1 Rigid Pavement Work Descriptions

The following descriptions provide additional information about the typical work items covered by the unit costs shown in Table 3-1.

3.2.1.1 Reconstruction

Reconstruction is recommended when the pavement defects would not be corrected by less extensive measures. Unit prices assume removal of the existing pavement to the subgrade and reconstruction with 8 inches of high strength PCC pavement on 6 inches of aggregate subbase.

3.2.1.2 Repair and Overlay

This procedure usually consists of a rubblize or a crack and seat process, where the existing pavement is broken into segments of approximately 2 ft on a side by dropping a heavy breaker bar onto the pavement. Properly done, aggregate interlock between pavement segments is retained and reflective cracking is reduced. A flexible surface is then placed over the recycled PCC base.

3.2.1.3 Slab Replacement
Slab replacements are typically required for high-severity blow ups, scaling, and shattered slabs. Unit prices assume removal of the selected slab to the subgrade. Prepare subgrade to bearing strength equivalent to surrounding subgrade. Provide subbase support equivalent to existing and install load transfer steel as required. Place PCC pavement level with existing surface.

3.2.1.4 Patching (Partial Depth)
While partial depth patching is most commonly used to repair joint and corner spalls, it is effective for a wide variety of distress types. Saw cut and remove area of pavement to sound concrete above reinforcing steel. Treat existing concrete to ensure firm bond. Place PCC level with existing surface.

3.2.1.5 Joint Seal Replacement
Rout joints and cracks to a depth of at least 1-1/4 inches, clean joint wall surfaces to expose fresh vital concrete, install backing rope, and apply rubberized sealant meeting ASTM D3405 specification, or equivalent.

3.2.1.6 Joint Seal Repair
Press existing sealant into joint for use as backer material; apply joint sealant meeting ASTM D3405 specification, or equivalent.

3.2.1.7 Undersealing
Undersealing is used to repair faulting between slabs or when corner breaks have settled relative to the slab. High-pressure injection is used to force material into the underlying voids and continues until the settled pavement is restored to its original elevation. Several materials have been used for undersealing, including cement grout, asphalt slurries, and proprietary formulations of expansive Styrofoam.

3.2.2 Flexible Pavement Work Descriptions

3.2.2.1 Reconstruction

Reconstruction is recommended when the pavement defects would not be corrected by less extensive measures. Unit prices assume removal of existing pavement to subgrade. Scarify and compact subgrade to 6-inch depth. Construct 4 inches of P401 AC surface course on 8 inches of aggregate base course.

3.2.2.2 Resurfacing

Resurfacing assumes a nominal 2-inch asphalt mill and inlay on existing prepared pavement.

3.2.2.3 Structural Overlay

Structural overlays are used to address load related distress or to increase pavement load bearing capacity. Apply a 4-inch AC overlay on existing prepared pavement. Add additional thickness as needed to achieve required strength.

3.2.2.4 Surface Treatment

Apply a high-quality, penetrating rejuvenating sealer

3.2.2.5 Patching

High-performance cold patching products can be used for short term repairs. Long-term patches should be made with plant mixed hot asphalt meeting FAA P401 specs.

3.2.2.6 Crack Repair (Restorative)

Rout existing crack to a minimum depth of 1-1/4 inches, install backing rope and apply rubberized crack filler meeting ASTM D3405 specification.

3.2.2.7 Crack Repair (Sustaining)

This is typically spot repairs of existing crack sealant.

3.3 Capital Improvement Strategies

Figure 3-1 shows a projection of the overall airport pavement condition for the next 10 years based on implementing one of three capital improvement strategies:

- No Action: No capital improvement action is undertaken
- Longest Life: The most comprehensive repair and longest life rehabilitation option
- Lowest Cost: The rehabilitation option with the projected lowest annual cost

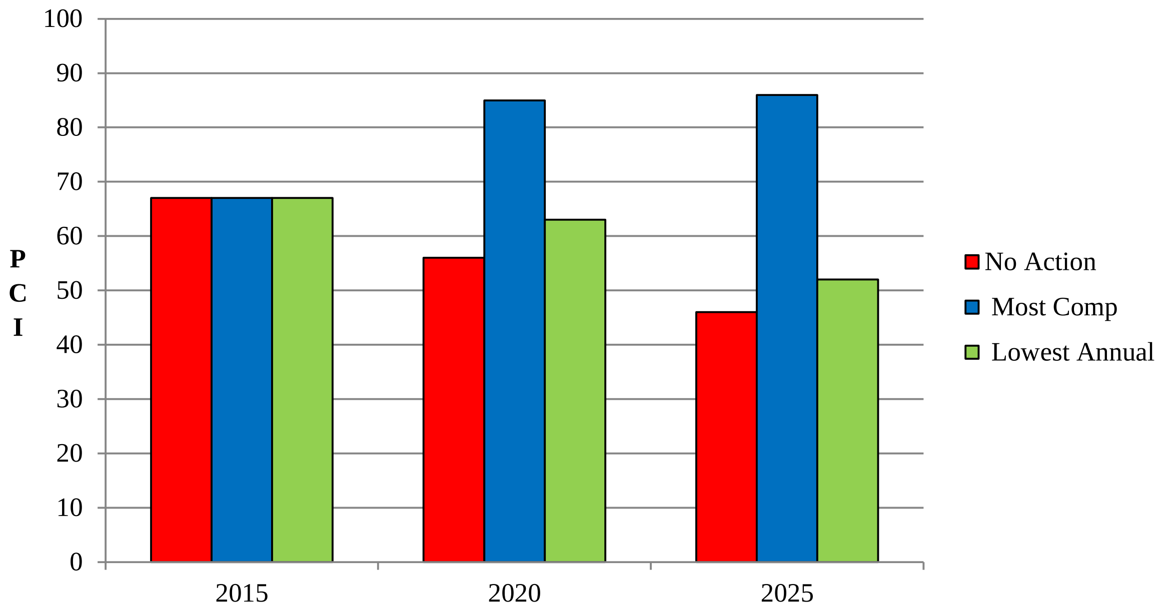

Figure 3-1. Programmed CIP

The longest life CIP scenario for all of the pavement projected to fall below the MSL is projected to cost approximately **$2,266,000** over the next 10 years. The corresponding lowest annual cost scenario is also projected to cost approximately **$187,000** over the next 10 years. Examples of each capital improvement strategy and a complete listing of all viable capital projects are presented in Table 3-2 through Table 3-4.

Table 3-2. Most Comprehensive Repair

Feature	Built	Description	Action Yr	Work Item	Cost, $
115	2013	TAXIWAY CONNECTOR	2018	Resurfacing	4,968
125	1998	TAXIWAY B	2024	Resurfacing	80,812
130	1999	TAXIWAY B	2015	Resurfacing	8,388
135	1999	TAXIWAY B	2023	Resurfacing	16,200
145	2006	TAXIWAY A2	2016	Resurfacing	14,123
205	1995	TAXIWAY B	2019	Resurfacing	110,259
210	1999	TAXIWAY B	2020	Structural Overlay	9,098
301	2013	TAXIWAY A1	2018	Resurfacing	13,112
305	2013	TAXIWAY A1	2019	Resurfacing	8,820
310	1999	TAXIWAY A1	2022	Resurfacing	8,164

Feature	Built	Description	Action Yr	Work Item	Cost, $
315	2013	TAXIWAY B1	2019	Resurfacing	5,976
325	1998	TAXIWAY A2	2019	Resurfacing	7,812
405	2013	TAXIWAY B2	2019	Resurfacing	39,372
3005	1989	RAMP	2023	Reconstruction	1,497,651
5005	1999	RUNWAY 2-20 KEEL	2016	Resurfacing	188,311
5010	1999	RUNWAY 2-20 WING	2019	Resurfacing	252,889
				Total	**2,265,955**

Table 3-3. Lowest Annual Cost Repair

Feature	Built	Description	Action Yr	Work Item	Cost, $
115	2013	TAXIWAY CONNECTOR	2018	Resurfacing	4,968
125	1998	TAXIWAY B	2024	Surface Treatment	22,860
130	1999	TAXIWAY B	2015	Surface Treatment	2,313
135	1999	TAXIWAY B	2023	Resurfacing	16,200
145	2006	TAXIWAY A2	2016	Resurfacing	14,123
205	1995	TAXIWAY B	2019	Crack Repair	7,635
210	1999	TAXIWAY B	2020	Crack Repair	279
301	2013	TAXIWAY A1	2018	Resurfacing	13,112
305	2013	TAXIWAY A1	2019	Crack Repair	274
310	1999	TAXIWAY A1	2022	Crack Repair	230
315	2013	TAXIWAY B1	2019	Crack Repair	224
325	1998	TAXIWAY A2	2019	Surface Treatment	2,146
405	2013	TAXIWAY B2	2019	Resurfacing	39,372
3005	1989	RAMP	2023	Joint/Crack Repair	387
5005	1999	RUNWAY 2-20 KEEL	2016	Surface Treatment	51,001
5010	1999	RUNWAY 2-20 WING	2019	Crack Repair	12,359
				Total	**187,483**

Table 3-4. All Viable Options

Feature	Built	Description	Action Yr	Work Item	Cost, $
115	2013	TAXIWAY CONNECTOR	2018	Resurfacing	4,968
125	1998	TAXIWAY B	2024	Crack Repair	7,139
125	1998	TAXIWAY B	2024	Resurfacing	80,812
125	1998	TAXIWAY B	2024	Surface Treatment	22,860
130	1999	TAXIWAY B	2015	Resurfacing	8,388
130	1999	TAXIWAY B	2015	Surface Treatment	2,313
135	1999	TAXIWAY B	2023	Resurfacing	16,200
135	1999	TAXIWAY B	2023	Surface Treatment	4,484
145	2006	TAXIWAY A2	2016	Resurfacing	14,123
145	2006	TAXIWAY A2	2016	Surface Treatment	4,068
205	1995	TAXIWAY B	2019	Crack Repair	7,635
205	1995	TAXIWAY B	2019	Resurfacing	110,259
205	1995	TAXIWAY B	2019	Surface Treatment	29,861
210	1999	TAXIWAY B	2020	Crack Repair	279
210	1999	TAXIWAY B	2020	Structural Overlay	9,098
210	1999	TAXIWAY B	2020	Surface Treatment	2,042
301	2013	TAXIWAY A1	2018	Crack Repair	669
301	2013	TAXIWAY A1	2018	Resurfacing	13,112

Feature	Built	Description	Action Yr	Work Item	Cost, $
305	2013	TAXIWAY A1	2019	Crack Repair	274
305	2013	TAXIWAY A1	2019	Resurfacing	8,820
310	1999	TAXIWAY A1	2022	Crack Repair	230
310	1999	TAXIWAY A1	2022	Resurfacing	8,164
310	1999	TAXIWAY A1	2022	Surface Treatment	2,372
315	2013	TAXIWAY B1	2019	Crack Repair	224
315	2013	TAXIWAY B1	2019	Resurfacing	5,976
325	1998	TAXIWAY A2	2019	Crack Repair	787
325	1998	TAXIWAY A2	2019	Resurfacing	7,812
325	1998	TAXIWAY A2	2019	Surface Treatment	2,146
405	2013	TAXIWAY B2	2019	Resurfacing	39,372
3005	1989	RAMP	2023	Joint/Crack Repair	387
3005	1989	RAMP	2023	Patching / Joint Repair	1,841
3005	1989	RAMP	2023	Reconstruction	1,497,651
3005	1989	RAMP	2023	Repair and Overlay	639,694
3005	1989	RAMP	2023	Slab Replacement	34,829
3005	1989	RAMP	2023	Slab Replacement / Joint Seal	35,216
3005	1989	RAMP	2023	Slab Replacement / Patching / Joint Seal	36,670
5005	1999	RUNWAY 2-20 KEEL	2016	Crack Repair	14,674
5005	1999	RUNWAY 2-20 KEEL	2016	Resurfacing	188,311
5005	1999	RUNWAY 2-20 KEEL	2016	Surface Treatment	51,001
5010	1999	RUNWAY 2-20 WING	2019	Crack Repair	12,359
5010	1999	RUNWAY 2-20 WING	2019	Resurfacing	252,889
5010	1999	RUNWAY 2-20 WING	2019	Surface Treatment	74,136

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4. Maintenance Management Program

4.1 General Comments

Most pavement distress types are classified by severity (low, medium, or high). As a general rule, high-severity distresses should be patched, and medium-severity distress should be sealed. A detailed matrix of recommended maintenance policies to address various distress types is provided near the end of this section.

4.1.1 Inspected Crack Severity

Of the inspected pavement, 78 percent of the cracks were rated at low severity and require no maintenance beyond ongoing inspection and spot repair. About 20 percent of the cracks were rated at medium severity and would benefit from sealing and repair. Two percent of the cracks were rated at high severity requiring patching.

4.1.2 Other Distress

In the inspected asphalt pavement area measured distresses such as rutting, depressions, alligator cracks, and raveling were recorded as follows: 96 percent at low severity, 4 percent at medium severity, and none at high severity.

4.2 Recommended Maintenance Actions

The following illustrations and tables show pavement areas that have maintenance and repair needs. Ongoing development of capital improvement projects may address some of these maintenance needs. To help budgeting and prevent duplication of effort, all pavement features recommended for maintenance should be compared to planned improvements prior to finalizing a maintenance program strategy.

Table 4-1. Recommend Maintenance Actions

Work Item	Quantity	Unit	Cost
AC PATCH	2,294	SF	$19,905
AC RESTORATIVE CRACK REPAIR	14,220	LF	$17,632
AC SUSTAINING CRACK REPAIR	1,501	LF	$1,299
PCC PATCH	66	SF	$1,113
		Total:	**$39,949**

4.2.1 Crack Seal

Table 4-2. Recommend AC Restorative Crack Repair

Feature	Work Item	Amount	Insp. PCI	Change	Est. PCI
205	AC RESTORATIVE CRACK REPAIR	1,613	62	3	65
210	AC RESTORATIVE CRACK REPAIR	225	62	2	64
310	AC RESTORATIVE CRACK REPAIR	145	66	14	80
315	AC RESTORATIVE CRACK REPAIR	181	84	3	87
5005	AC RESTORATIVE CRACK REPAIR	2,915	61	5	66
5010	AC RESTORATIVE CRACK REPAIR	9,141	65	10	75
	TOTAL:	14,220	L.F.		
EQUIPMENT: AIR COMPRESSOR, HEATING KETTLE, HAND TOOLS					
EST. MATERIALS: 2,844 POUNDS ASTM D3405 SEALANT OR EQUIVALENT					
EST. MATERIAL COST: $2,844					
EST. CREW HOURS: 71.1					
EST. CREW COST: $14,788					
EST. PROJECT COST: $17,632					

Table 4-3. Recommend AC Sustaining Crack Repair

Feature	Work Item	Amount	Insp. PCI	Change	Est. PCI
115	AC SUSTAINING CRACK REPAIR	37	78	N/A	78
125	AC SUSTAINING CRACK REPAIR	863	69	N/A	69
135	AC SUSTAINING CRACK REPAIR	132	68	N/A	68
145	AC SUSTAINING CRACK REPAIR	164	55	N/A	55
305	AC SUSTAINING CRACK REPAIR	33	84	N/A	84
320	AC SUSTAINING CRACK REPAIR	38	79	N/A	79
405	AC SUSTAINING CRACK REPAIR	232	82	N/A	82
	TOTAL:	1499	L.F.		
EQUIPMENT: AIR COMPRESSOR, HEATING KETTLE, HAND TOOLS					
EST. MATERIALS: 300 POUNDS ASTM D3405 SEALANT OR EQUIVALENT					
EST. MATERIAL COST: $300					
EST. CREW HOURS: 6.5					
EST. CREW COST: $998					
EST. PROJECT COST: $1,299					

4.2.2 Patching

Table 4-4. Recommend AC Patching

Feature	Work Item	Amount	Insp. PCI	Change	Est. PCI
205	AC PATCH	265	62	14	76
310	AC PATCH	61	66	7	73
5005	AC PATCH	729	61	8	69
5010	AC PATCH	1,239	65	6	71
	TOTAL:	2,294	S.F.		
EQUIPMENT: SAW, AIR COMPRESSOR, HEATING KETTLE, HAND TOOLS					
EST. MATERIALS: 28 TONS ASPHALT PATCH					
EST. MATERIAL COST: $2,860					
EST. CREW HOURS: 65.6					
EST. CREW COST: $17,044					
EST. PROJECT COST: $19,905					

Table 4-5. Recommend PCC Patching

Feature	Work Item	Amount	Insp. PCI	Change	Est. PCI
3005	PCC PATCHING	66	74	-	74
	TOTAL:	66	S.F.		
EQUIPMENT: SAW, AIR COMPRESSOR, JACK HAMMER, MIXER, HAND TOOLS					
EST. MATERIALS: 1 CUBIC YARDS CONCRETE MIX					
EST. MATERIAL COST: $175					
EST. CREW HOURS: 6.7					
EST. CREW COST: $937					
EST. PROJECT COST: $1,113					

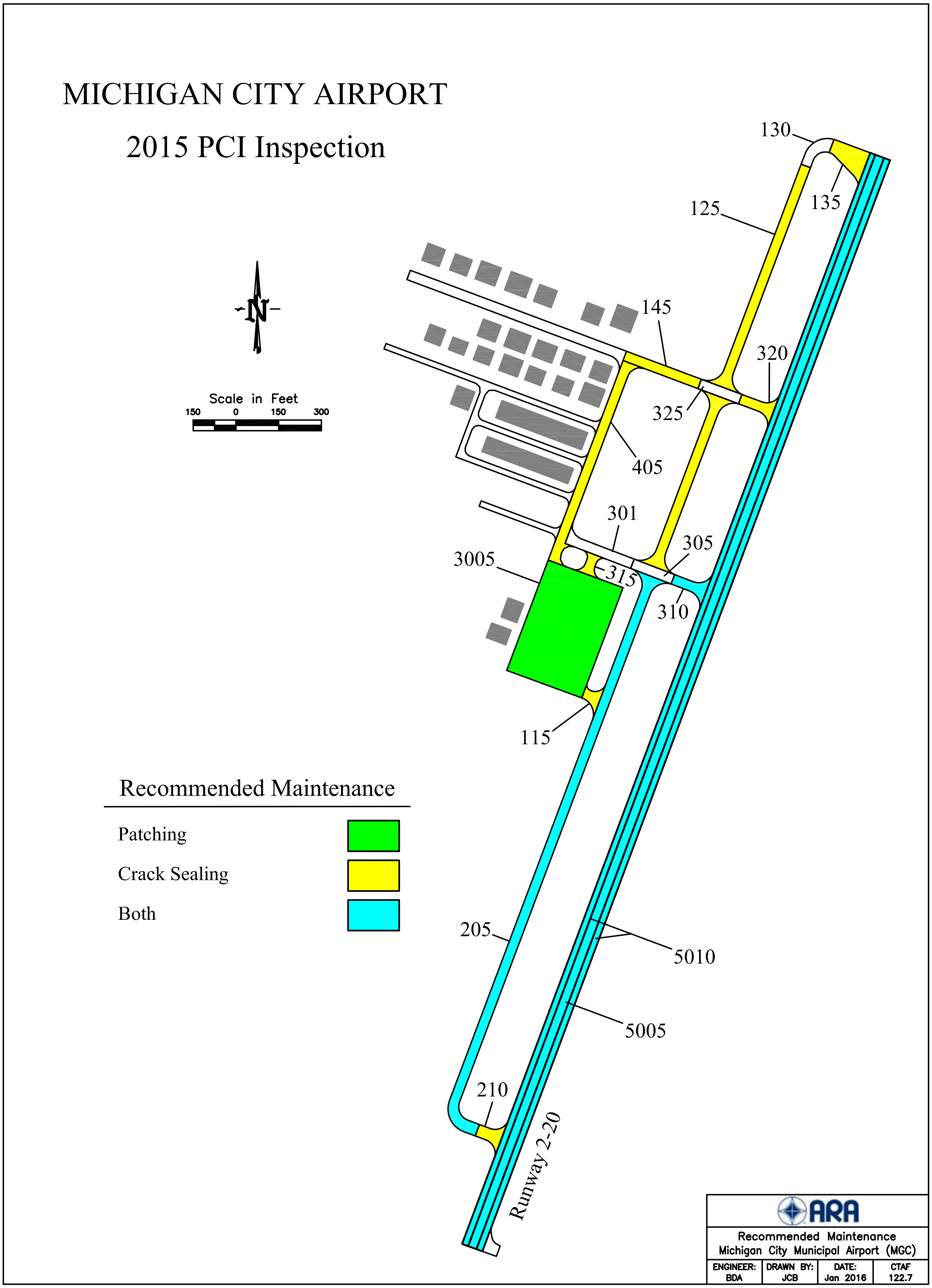


Figure 4–1. Recommended Maintenance at Michigan City Municipal Airport (MGC).

4.3 Pavement Deterioration

Before implementing maintenance and repairs, it helps to understand pavement performance and pavement deterioration. The factors that contribute most to deterioration are environmental, materials, and/or load related. Brief discussions of each are presented in the following sections.

4.3.1 Environmental/Age-Related Deterioration

Seasonal and daily temperature changes cause expansion and contraction of the pavement materials. The shear stresses created by expansion and contraction can cause transverse cracking in flexible pavement and mid-slab cracking in rigid pavement. Further, expansion and contraction will cause cracks, and rigid pavement joints, to open and close with changes in temperature.

Flexible pavement oxidizes as it ages, losing its lighter, volatile, components and becoming brittle with time. Surface treatments and seal coats are designed, in part, to provide a protective barrier and slow this type of oxidation.

Subsurface water can have the greatest impact on pavement deterioration. A wet subgrade greatly reduces the ability of a pavement to support wheel loads, and the results often show up as rutting and cracking of flexible pavement. The fine materials in a wet base can be pumped up through the cracks and eventually result in a loss of support. This loss of support can be evidenced as corner breaks and faulting in rigid pavement. Moisture inside a pavement system expands when it freezes, creating stresses that cause the pavement surface to heave. Subsequent freeze-thaw cycles leave voids in the pavement structure that enable further rutting and breaking. Repeated freeze-thaw cycles eventually cause the pavement to disintegrate. Freeze-thaw deterioration requires frost-susceptible material, sub-zero temperatures, and water. If one of these factors is removed, freeze-thaw damage will not occur. One of the best ways to ensure pavement longevity is to provide drainage and keep it dry.

4.3.2 Materials-Related Deterioration

The pavement thickness and type of subgrade play a large role in the formation and spacing of transverse cracks. If the subgrade and base materials are smooth or rounded and allow for relatively free movement of the pavement surface, transverse cracks will often be spaced far apart (>60 feet). If the subgrade and base material are rough or angular and provide greater resistance to movement of the pavement surface, transverse cracks will be spaced more closely (<40 feet). The distance between transverse cracks also depends on the pavement thickness, as a thicker pavement can resist cracking for longer lengths. At general aviation airport pavements, around 50 feet is typical transverse crack spacing.

Aggregate is the biggest component of any pavement structure. It is the contact between the aggregate particles that actually transfers the load and provides the strength. Aggregate durability and shape are major factors affecting pavement performance. Durability is the ability of the aggregate to perform satisfactorily over time and resist deterioration. Sharp, well-angled aggregates that interlock, compact densely, and resist movement are the most desirable.

In flexible pavement, the selection of asphalt cement can have a significant impact on pavement performance. Asphalt is visco-elastic, which means it is stiff at low temperatures and flows at high temperatures. With this in mind, asphalt pavement should be designed to remain stiff on hot summer days to resist plastic deformation (rutting and shoving). In addition asphalt pavement should have sufficient cold temperature flexibility on cold winter days to resist transverse cracking. The proper selection of asphalt cement grade and maintaining adequate mix volumetrics (air voids, voids in the mineral aggregate, etc.) are key factors in the performance of flexible pavement.

As water freezes, it expands and occupies a greater volume than in its liquid state. In PCC pavement, interconnected, well-distributed air voids are required to allow for expansion of moisture within the PCC. PCC mixes with insufficient air entrainment are susceptible to freeze-thaw damage, as the expansive forces have been shown to cause concrete deterioration. Small, closely spaced, interconnected air voids provide the greatest degree of protection.

Asphalt paving mixes also require air voids, but for reasons different than for PCC pavement. When a well-constructed asphalt pavement is subjected to vehicle loading, it will nevertheless experience some minor secondary consolidation. Air voids allow for the safe movement of the asphalt binder within the mix. With insufficient air voids, the asphalt binder will migrate to the surface of the pavement—it will in essence, get squeezed out of the mix. This phenomenon is called flushing. In addition, these mixes become unstable and are prone to rutting in the wheel paths.

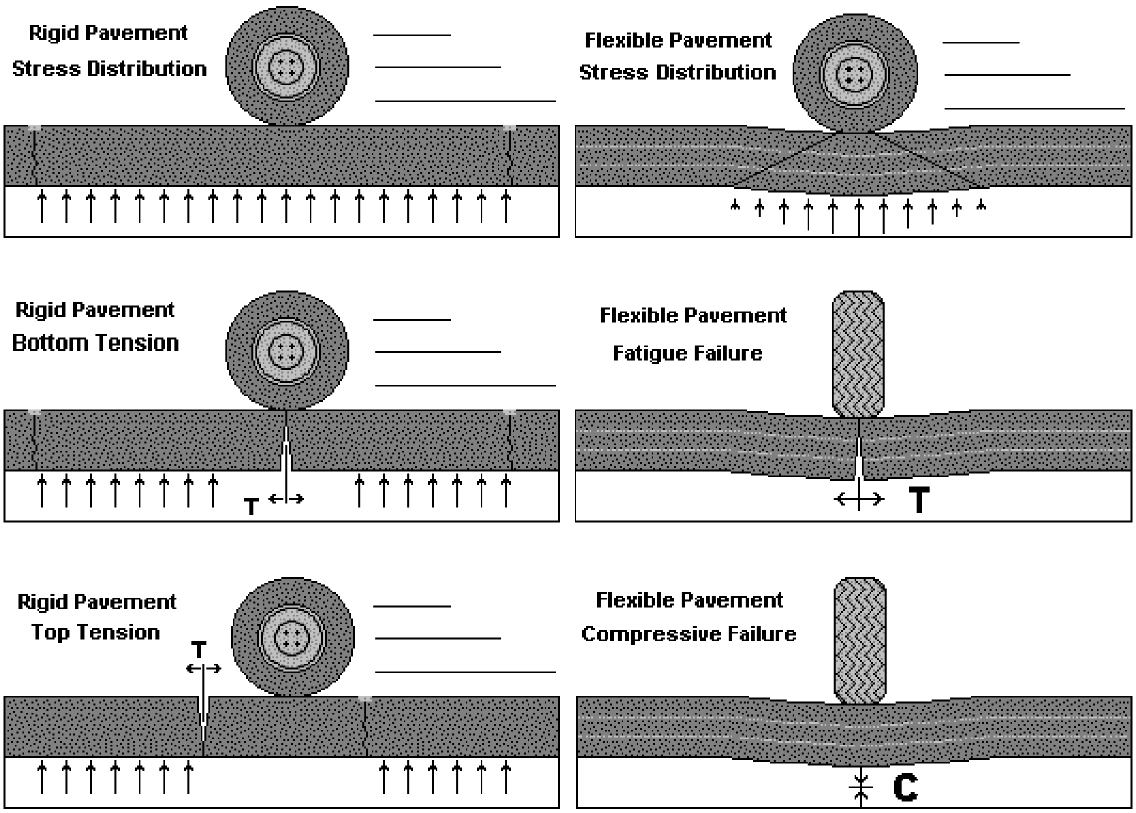
However, if the air voids become too high, air and water can penetrate the pavement, reducing both durability and flexibility. Air infiltration will accelerate oxidization of the binder, while water penetration will increase the moisture susceptibility of the mix (i.e., stripping of the asphalt cement from the aggregate). Air voids in flexible pavement should be kept low enough to prevent water and air from penetrating the asphalt layers, but high enough to minimize the potential of plastic deformation.

Regardless of whether the pavement binder is AC or PCC, binder materials are mixed with aggregate to coat all aggregate particles with a thin binder film. Durability of flexible asphalt pavement is increased with a thicker binder film, and the pavement becomes more resistant to age hardening; however, if the film is too thick, the asphalt acts like a lubricant, promoting ruts, shoving, and bleeding. Each asphalt mix should be customized for materials available locally.

With a concrete pavement, aggregate interlock supports the wheel loads, and the hydrated cement binder further interlocks the aggregate particles to inhibit all movement. "Hydration" is the term for the chemical reaction of portland cement with water. In the hydration process, dry cement particles react with water to form gels, and then crystals, that grow and bond with the aggregate and form a rigid interlocking structure. Hydration can continue for years, but much of the ultimate strength will be reached within 28 days. Hydration is a sensitive chemical process. Typically, any admixtures used to accelerate the hydration process will reduce durability, and admixture use should be considered carefully or avoided.

4.3.3 Load-Related Deterioration

As illustrated below, rigid and flexible pavements differ in the way loads are distributed. A concrete slab resists bending and transfers loads evenly, while an asphalt pavement is designed to bend, gradually spreading loads over wider areas.



Load-related cracks can start at the top or bottom of a pavement section. In asphalt sections, load-related (fatigue) cracks start at the bottom. If a load-related crack reaches the surface, it usually indicates structural deficiency. In rigid pavement, corner breaks are caused by tensile forces at the top of the slab, and the crack propagates downward. Mid-slab LTD cracks are distress examples resulting from tensile forces at the bottom of the slab.

Both wheel loads and environmental factors can cause spalls anytime there is movement between adjacent slabs. If non-compressible material (such as a small rock) is allowed into a joint, stresses will build up between adjacent slabs and can cause a spall. Keeping joint and crack sealant intact can help to reduce the infiltration of non-compressible material and minimize spalling.

4.4 Best Practices

4.4.1 Flexible Pavement

L&T cracks at medium severity should be filled with a good quality crack sealant material. High-severity cracks normally must be patched.

Cracks rated at low severity may be narrow unsealed cracks or sealed cracks up to 3 inches wide. The PCI procedure does not distinguish between narrow unfilled cracks and wider filled cracks. Some L&T cracks at low severity are included in the estimated sealing quantities and costs in this maintenance plan. In general, when medium- or high-severity cracking constitutes less than 25 percent of the total crack quantity, sustaining maintenance usually is more cost-effective. When 25 percent or more of the total crack quantity is at medium or high severity, a restorative program typically becomes more cost-effective.

Existing patches rated as medium and high severity should be replaced with new patches. Small areas (usually less than 100 square feet per patch) of alligator cracking and rutting at medium and high severity also may be repaired cost-effectively by patching. Larger patches should be considered if equipment can be made available to accomplish the work. Patching to repair up to 10 percent of the surface of a pavement feature that is otherwise serviceable can result in significant cost savings as compared to rehabilitation of the entire feature.

An example maintenance policy treatment matrix for flexible pavement is shown in Table 4-6. Examples of various maintenance techniques are provided in appendix B.

4.4.2 Rigid Pavement

Joint seal damage rated at medium and high severity should be repaired. If medium- and high-severity damage is limited to less than about 25 percent of the total joint length, sustaining maintenance is recommended. If medium- and high-severity damage exceeds 25 percent of the total joint length, the joint sealant should be removed and replaced under a restorative repair project.

LTD cracks at low and medium severity should be considered for sealing as part of the joint sealing project. High-severity LTD cracks require sealing, patching, or slab replacement, depending on the extent of deterioration.

Small patches are typically used to repair medium- and high-severity spalls or to replace deteriorated older patches. Restorative small patches are typically partial-depth repairs, usually to a maximum depth of 1/3 the slab thickness. Large patches and corner breaks at medium and high severity should be repaired by full-depth large patches.

High-severity LTD cracks and shattered slabs are candidates for patching and slab replacement. Low-severity shattered slabs can be left in place pending further deterioration.

An example maintenance policy treatment matrix for rigid pavement is shown in Table 4-6. Examples of various maintenance techniques are provided in appendix B.

Table 4-6. General Maintenance Policy (AC)

Distress Type	Distress Severity	Maintenance Action
Alligator Cracking	Low	Crack Sealing - AC
	Medium	Patching - AC Deep
	High	Patching - AC Deep
Bleeding	N/A	Monitor
Depression	Low	Monitor
	Medium	Patching - AC Shallow
	High	Patching - AC Deep
Jet Blast	N/A	Patching - AC Shallow
Longitudinal, Transverse, Joint Reflective, & Block Cracking	Low	Monitor
	Medium	Crack Sealing - AC
	High	Patching - AC Deep
Oil Spill	N/A	Patching - AC Shallow
Patching	Low	Monitor
	Medium	Crack Sealing - AC
	High	Patching - AC Deep
Polished Aggregate	N/A	Monitor
Weathering / Raveling	Low	Monitor
	Medium	Surface Treatment
	High	Patching - AC Shallow
Rutting, Corrugation and Swell	Low	Monitor
	Medium	Patching - AC Deep
	High	Patching - AC Deep
Shoving	Low	Monitor
	Medium	Patching - AC Shallow
	High	Patching - AC Deep
Slippage Cracking	N/A	Patching - AC Shallow

Table 4-7. General Maintenance Policy (PCC)

Distress Type	Distress Severity	Maintenance Action
Blow Up	Low	Patching - PCC Partial Depth
	Medium	Slab Replacement - PCC
	High	Slab Replacement - PCC
Longitudinal, Transverse & Diagonal Cracking	Low	Monitor
	Medium	Crack Sealing - PCC
	High	Patching - PCC Full Depth
Durability Cracking	Low	Monitor
	Medium	Patching - PCC Full Depth
	High	Slab Replacement - PCC
Large Patch & Corner Break	Low	Monitor
	Medium	Patching - PCC Full Depth
	High	Patching - PCC Full Depth
Popout / Shrinkage Cracks	N/A	Monitor
Scaling	Low	Monitor
	Medium	Patching - PCC Partial Depth
	High	Slab Replacement - PCC
Faulting	Low	Monitor
	Medium	Grinding (Localized)
	High	Grinding (Localized)
Shattered Slab	Low	Monitor
	Medium	Crack Sealing - PCC
	High	Slab Replacement - PCC
Joint Spall, Corner Spall & Small Patch	Low	Monitor
	Medium	Patching - PCC Partial Depth
	High	Patching - PCC Partial Depth
Alkali Silica Reaction	Low	Monitor
	Medium	Slab Replacement - PCC
	High	Slab Replacement - PCC

4.5 Pavement Repair Materials

New pavement repair materials are introduced and improved regularly. This section provides information on products compatible with airport needs.

4.5.1 Joint and Crack Sealer

Hot-poured, pressure-injected, polymeric rubberized asphalt sealant meeting ASTM D3405 specifications is suitable for most sealing requirements. This product is relatively inexpensive, durable, and suitable for both rigid and flexible pavements. Other, more expensive, hot-applied sealants that promise longer life are being developed for specialty applications. Twin component cold applied sealants also have been used with success. Contact your local distributor.

4.5.2 Flexible Pavement Patch

High-performance plant mixed cold patching products that can be stockpiled on-site can be used for short term repairs to maintain safety. Long-term patches should be made with high-quality plant mixed hot asphalt having a ¾-inch maximum aggregate size and meeting Federal Aviation Administration (FAA) P401, or highest quality highway specifications. Low-quality packaged materials available from local hardware type stores should be avoided.

4.5.3 Rigid Pavement Patch

Permanent patches in rigid pavement should be made with air-entrained concrete with 1-inch maximum size aggregate. If the area must be quickly opened to traffic, high early concrete should be considered. Concrete should have zero slump and a coarse texture. As with asphalt patches, low-quality packaged materials should be used only as temporary patches to maintain safety and service until a more permanent repair can be made.

4.6 Pavement Repair Equipment

Many pavement repair and sealing products are available. Specialized tools and equipment help ensure high-quality repairs. This section discusses equipment compatible with airport needs.

4.6.1 Air Compressor

Used to remove non-compressible sand and debris from prepared cracks and joints, the compressor should have a sustained capacity of 120 cubic feet per minute with a nozzle velocity of 100 psi. Trailer-mounted compressors typically have capacities in this range.

4.6.2 Concrete Saw

A saw capable of making a minimum 3-inch-deep cut is required. The saw should be capable of making cuts in both asphalt and concrete. Gasoline-powered 5- to 25-hp wheel-mounted saws typically are preferred for this type of work, but electric and pneumatic tools also are available.

4.6.3 Heating Kettle

Applying sealant is the most time-consuming operation, and a sealing machine with heating and pressure application capabilities is a critical item in a successful sealing program. The capacity of the sealing equipment dictates the rate at which a crew progresses. For large sealing projects, a minimum 100-gallons/hour sustained capacity is recommended. The unit should be a double boiler type, with mechanical agitators or continuous recirculation. Kettle temperature must be monitored to ensure that the sealant is not "burned." Overheating the sealant will prematurely age harden the material.

4.6.4 Router

A concrete saw can be used to prepare joints, but for random cracking, a mechanical router with a vertical impact mechanism is preferred. When cracks are being routed, this activity will dictate the speed of the crew. Crack routers in the 25-hp range are commonly used and are available from a variety of manufacturers.

4.6.5 Sand Cleaner

A sand blaster helps to clean loose particles and dust from prepared cracks. The unit must have sufficient force to expose fresh, vital pavement to bond with sealant and patching materials.

4.6.6 Vibratory Roller or Plate Compactor

Required to compact plant mixed and packaged patching materials properly. Small rollers are best for pothole type applications; plate compactors are best for large areas.

4.6.7 Other Equipment

Other general use equipment that can be helpful in a maintenance program includes bucket loaders, dump trucks, water tanks, and a power sweeper unit.

Appendix A. AIRPAV Software

The Software

Data analysis was performed using the AIRPAV pavement evaluation and management software. In addition to calculating and documenting PCI values, AIRPAV evaluates the collected inspection data and recommends rehabilitation actions that address the cause of pavement distress. AIRPAV can incorporate traffic and structural capacity evaluations into the pavement evaluation matrix, and AIRPAV also performs preliminary life cycle cost analysis of the various rehabilitation alternatives, providing guidance on the lowest annual cost repair strategy.

A complete database, along with an updated version of AIRPAV, is provided on INDOT computers for ongoing management of the INDOT pavement systems.

Capital Improvements

AIRPAV creates interactive CIPs, providing the user with the ability to input unit costs, develop new projects, move projects between years, and even increase or decrease the scope and cost of individual projects.

Maintenance

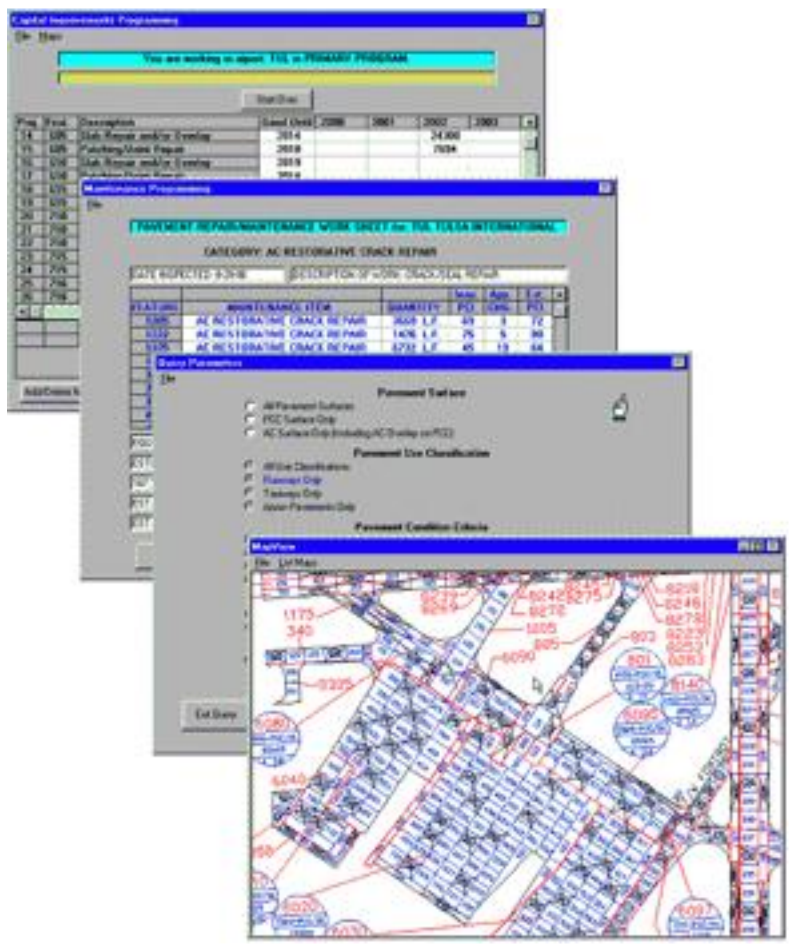
AIRPAV calculates and develops maintenance work orders organized by type of work. Maintenance work orders can be printed and issued directly to maintenance crews.

Traffic

AIRPAV provides the ability to model aircraft ground movements. Traffic can be sorted by airline, aircraft type, destination gate or ramp, and runway used. The program graphically displays each taxi path, accumulates total operations, automatically determines design aircraft, and calculates structural overlay requirements for each pavement feature. The software can provide Pavement Classification Numbers (PCN) for each pavement feature or report results directly as inches of overlay required.

Maps

AIRPAV permits viewing and printing of PCI maps. Inspection layout, pavement condition, and other views are available from within the software.



Query

The AIRPAV query function is a powerful search tool that allows users to extract useful reports meeting various criteria. For example, lists can be created for taxiway pavement, asphalt pavement, or areas below MSL at the time of inspection.

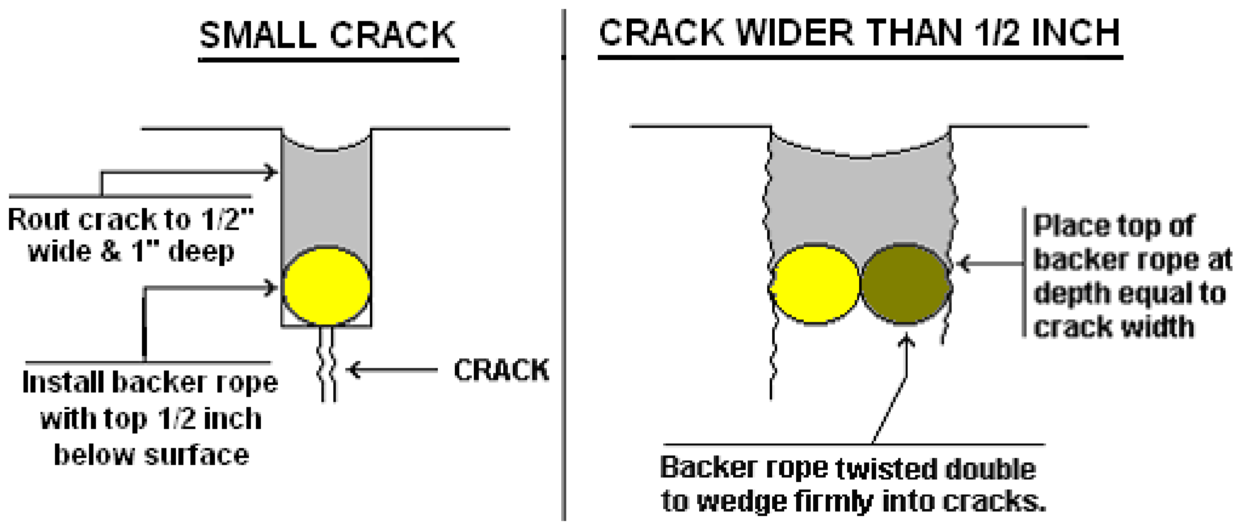
Global Information System (GIS) Integration

AIRPAV is fully GIS-enabled. A single click in AIRPAV exports all data to an MS Access database that can be linked to shape files used in an ESRI product. In this way, virtually all data in the pavement management database can be accessed in GIS format.

Appendix B. General Maintenance Techniques

Crack Sealing

- Cracks over ¼ inches wide should be sealed.
- Cracks wider than 3 inches should be patched.
- Sealant depth above the backer rope should be equal to the width of the reservoir, or as recommended by the manufacturer.
- Routed cracks should be sand blasted, to prepare for bonding with the sealant.
- Clean cracks with compressed air prior to sealing.
- Backing material should always be placed into the cracks. Commercial products are available. Several sizes of rope should be available to accommodate various crack sizes.
- Apply sealant after placing the backer rope. Follow the manufacturer's instructions. Sealant should be applied to within ¼ inch of the pavement surface.
- The final activity is to clean the surrounding pavement areas. A vacuum sweeper works well for this. Allow the sealant time to set before using a broom.
- Consider hot-applied, pourable patch material for cracks > ½ inch and any subsidence or depressions.



Overband Technique

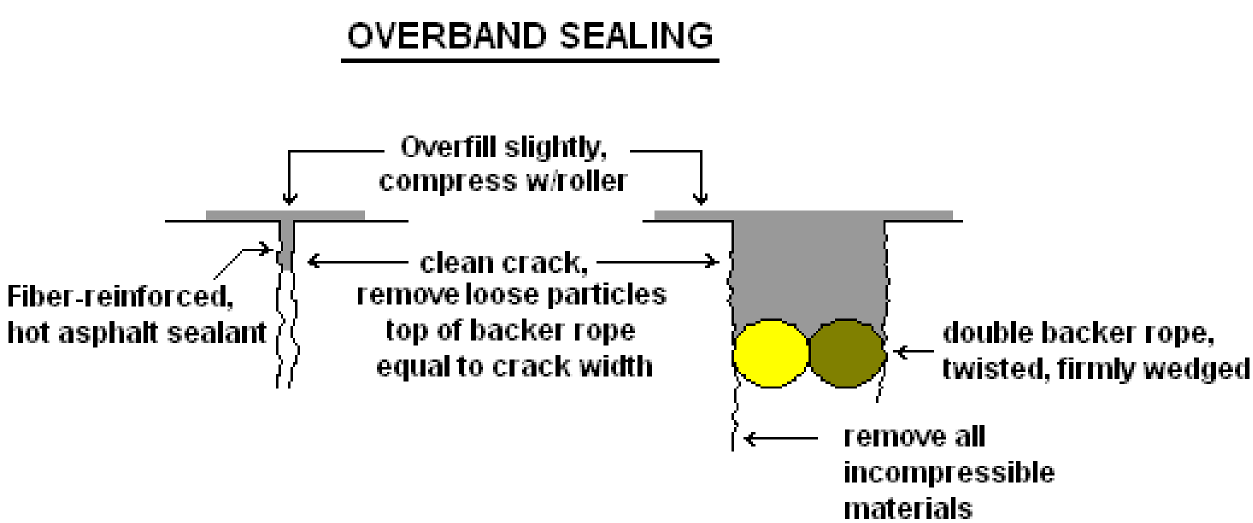
An alternate crack sealing technique using the procedures outlined below.

Material

- Blend grade 20 or equivalent asphalt cement and latex rubber at 5 percent by weight asphalt.
- Again, at 5 percent by weight of asphalt, add polyester fibers into agitator tank.
- Maintain blended asphalt temperature at least 20 degrees below flash point.
- Continuously recycle hot blended asphalt through pumps and hoses when heating kettle is in standby mode.

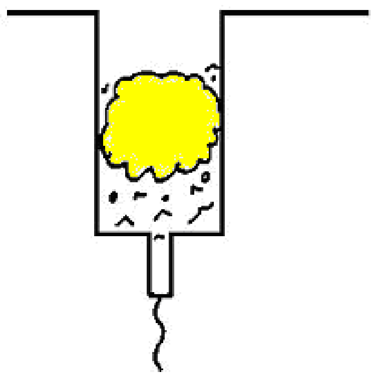
Application

- Sealant should be applied to dry pavement, with ambient temperatures above 40 degrees.
- Cracks should be sand cleaned and blown free of debris immediately before sealing.
- Application of sealant immediately follows cleaning of the crack.
- Sealant should be pressure applied from a wand-type applicator with "overband" nozzle.
- Seat the sealant with a steel-wheeled roller immediately after placement.
- In wider cracks, a backer rope is recommended to limit material quantities required.

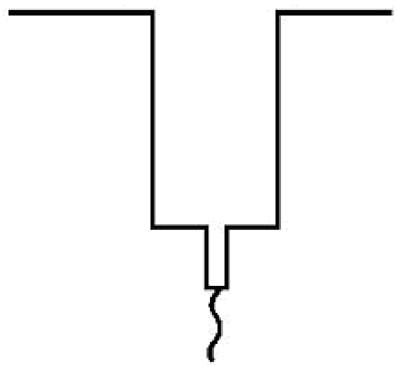


Joint Repair (portland cement)

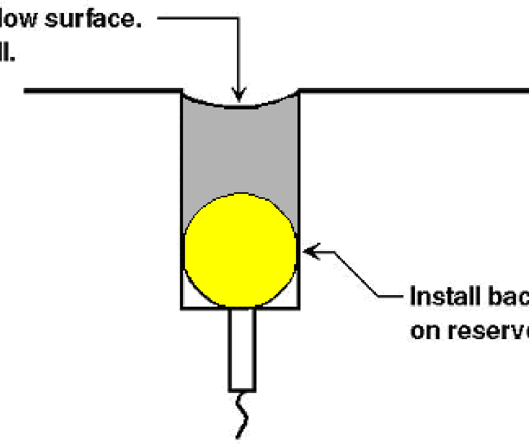
- Rout a reservoir for the sealant ½ inch wide and 1 inch deep.
- Cracks wider than ½ inch should have reservoirs ¼ inch wider than the crack. Reservoir height above backer rope should be less than reservoir width, or as recommended by manufacturer.
- Routed cracks should be cleaned to expose fresh, vital pavement on the vertical crack edge.
- Cracks should be cleaned to remove all sand, debris, and other materials from the crack.
- Backing material should be placed into the crack.
- Apply sealant to within ¼ inch of pavement surface, following manufacturer's instructions.
- Clean the surrounding pavement area.



Typical failed joint sealant, w/ debris and incompressibles.

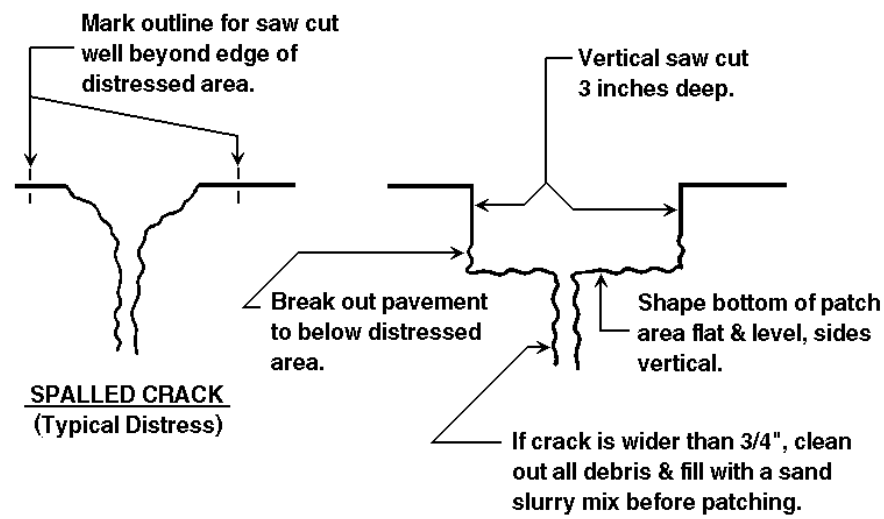


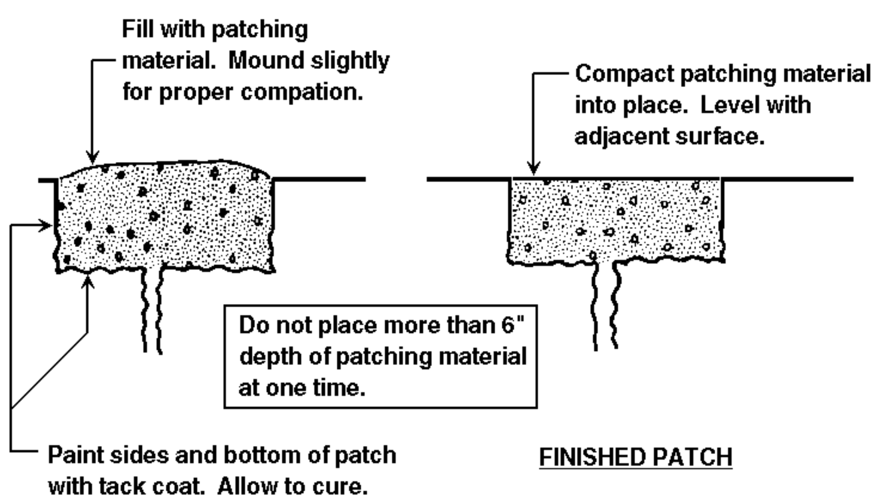
Clean joints exposing fresh, clean concrete and stone. Retain existing resevoir shape.



Patching (bituminous material)

- Examine distressed area and mark patch outline.
- Cut patch area with saw, no less than 3 inches deep.
- Remove enclosed pavement, leaving the vertical sawed edges undamaged.
- Clean sides and bottom and blow out with compressed air
- Paint sides and bottom with rapid curing asphalt tack coat. Prevent pooling on bottom.
- Allow tack coat to cure until it reaches a gummy consistency.
- Place hot mixed asphalt concrete and mound slightly, allowing for compaction.
- Compact with vibratory roller or plate compactor, in layers no greater than 6 inches.



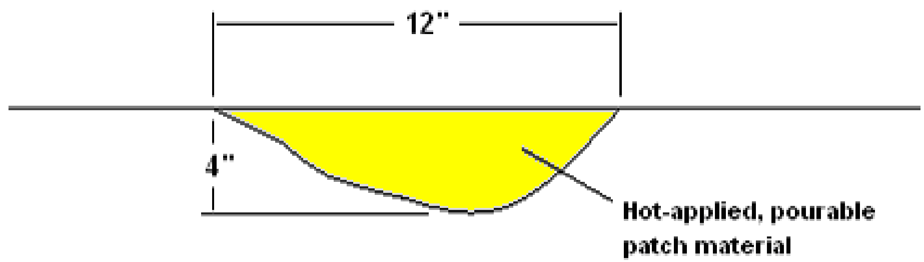


Patching (pourable materials)

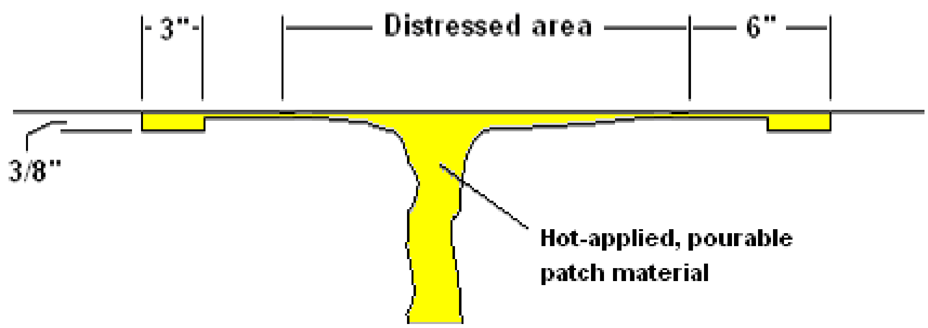
Hot-applied, pourable materials generally are used to repair deficiencies larger than can be repaired by sealants, but smaller than those where traditional techniques would be required. Suggested uses for this type of repair include cracks over 2 inches wide, potholes less than 4 inches deep, as a leveling for small depressions, as a cap for settled utility cuts, and as a skin patch for areas of alligator cracking.

- Examine and mark the patch outline. Boundaries should extend to sound pavement.
- Apply patch material to clean, dry surfaces.
- A heating lance to preheat or dry existing pavement is recommended in cold or wet conditions.
- Patch material should be poured into the area to be repaired and leveled as appropriate.
- Patch edges should be sealed after application to assure good adhesion, preventing surface moisture from migrating under patch edges.

Simple Fill



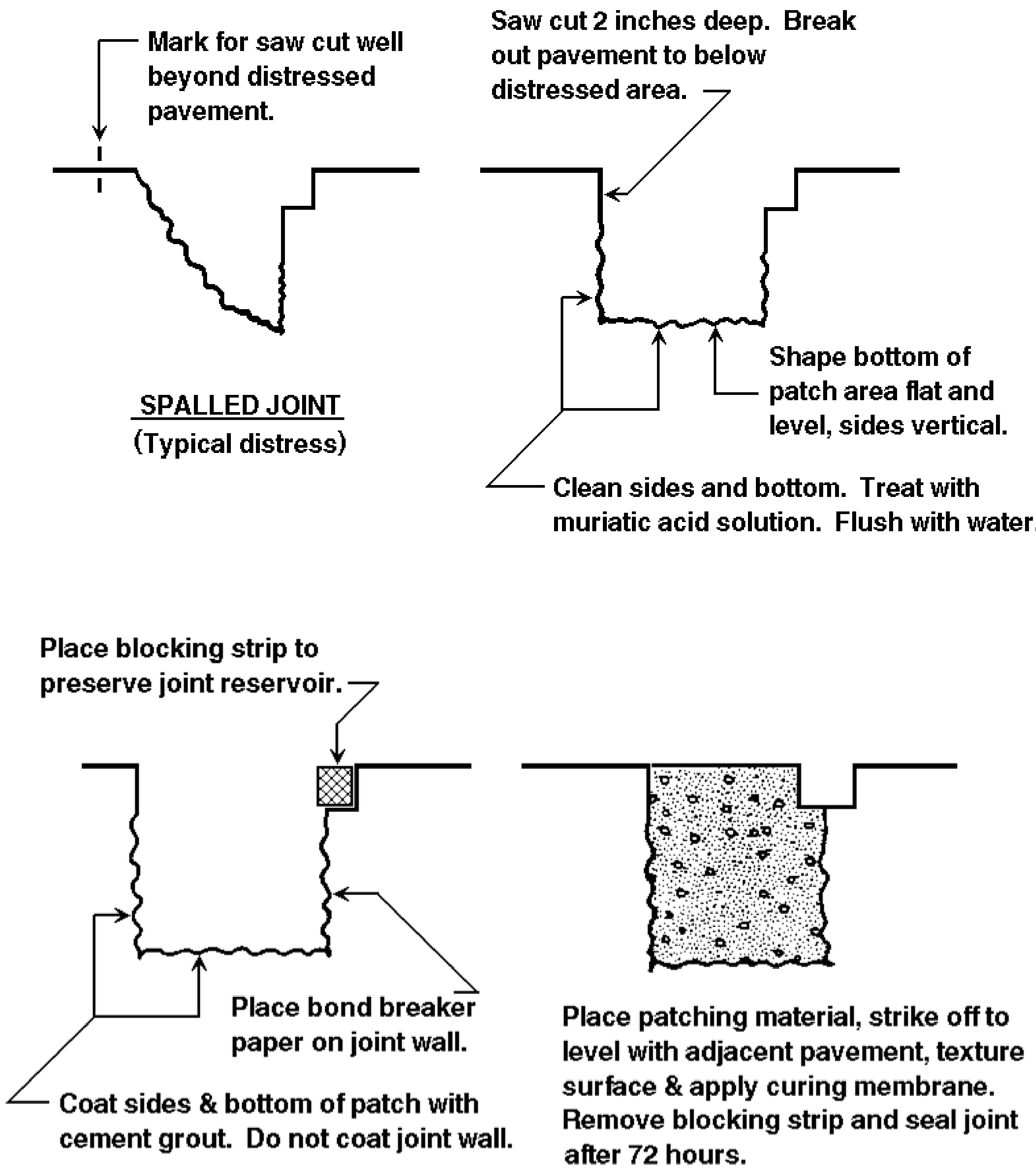
Optional Milling



Patching (PCC)

The technique outlined here simulates a thin bonded PCC overlay. This procedure has been proven effective in service throughout the country.

- Examine and mark patch outline.
- Saw cut area to a depth of 2 inches. The enclosed area is then chipped or jack hammered to solid pavement, but not less than a 2-inch nominal depth.
- The sides and bottom are sand cleaned and air-blasted to expose vital, clean concrete.
- A 25 percent solution of muriatic acid is applied to all exposed surfaces within the patch.
- The muriatic acid solution is thoroughly flushed from the patch area with water.
- Compressed air is used to remove excess water from the area, but exposed concrete must be maintained in a moist condition.
- The sides and bottom of the area are then coated with approximately a 1/16-inch layer of cement grout applied at the consistency of paste. The grout acts as an adhesive to bond the fresh concrete to existing concrete.
- If the patch is adjacent to joints, the continuity of the joint must be maintained by placing inserts approximately the shape of the desired joint against the wall of the patch.
- Before concrete grout begins to dry, concrete is placed in the patch area and is compacted into position with hand tampers or a vibrating plate tamper.
- When the patch has been struck to the proper slope and elevation, a surface texture is applied to approximate the texture of adjacent pavement.
- Joint edges may be edged slightly to remove sharp edges. The patch should be covered with polyethylene or sprayed with a curing compound.
- Clean the surrounding pavement before concrete spillover has a chance to set up.
- The patch may be open to traffic in 72 hours.


Mark for saw cut well beyond distressed pavement.
Saw cut 2 inches deep. Break out pavement to below distressed area.
SPALLED JOINT
(Typical distress)
Shape bottom of patch area flat and level, sides vertical.
Clean sides and bottom. Treat with muriatic acid solution. Flush with water.
Place blocking strip to preserve joint reservoir.
Place bond breaker paper on joint wall.
Coat sides & bottom of patch with cement grout. Do not coat joint wall.
Place patching material, strike off to level with adjacent pavement, texture surface & apply curing membrane. Remove blocking strip and seal joint after 72 hours.

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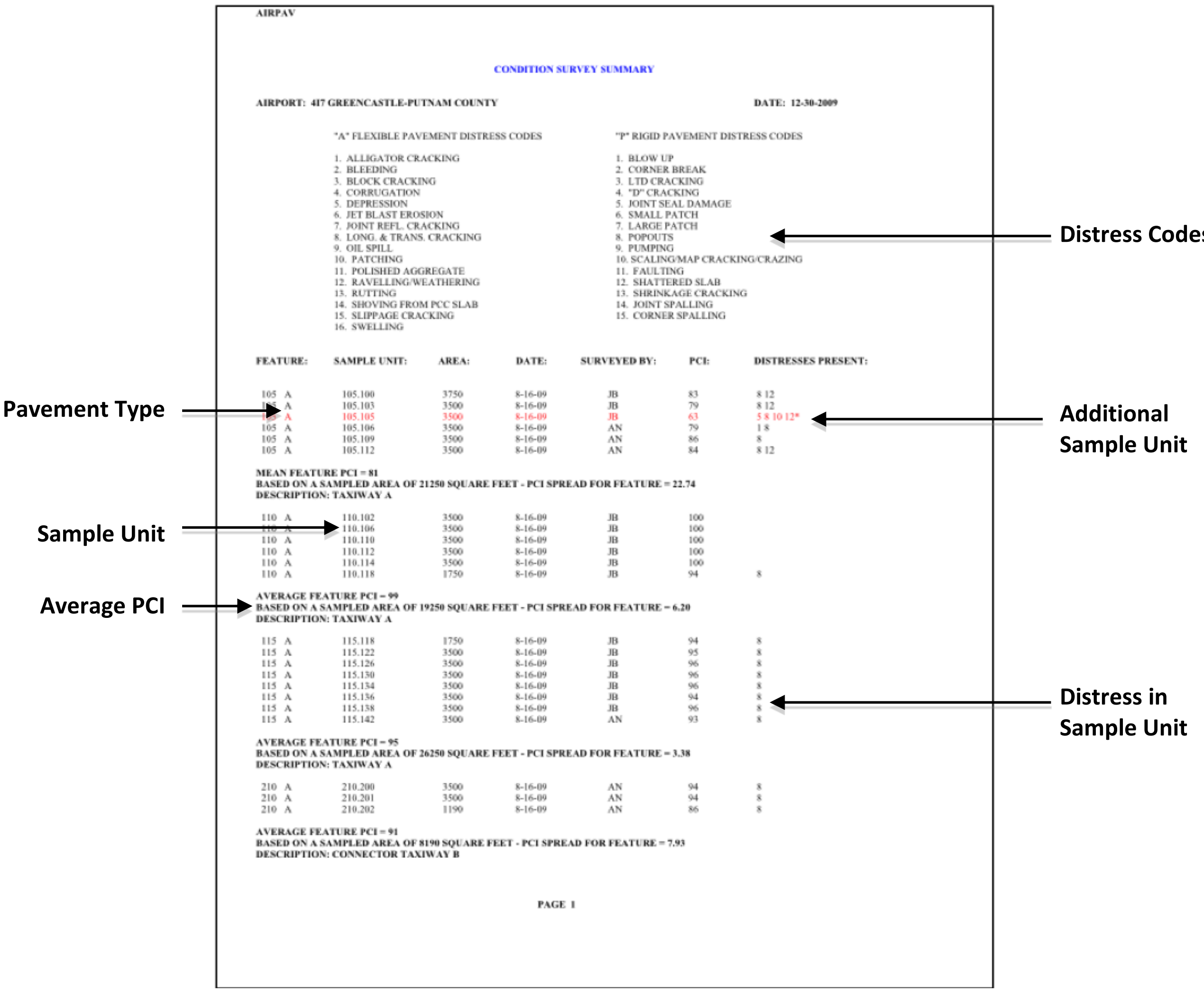
Appendix C. PCI Summary

The PCI summary provides an index of pavement conditions at the airport. The letter in the first column indicates the type of pavement, asphalt or portland cement. The last column lists the distress types found in each sample unit. The distress types are listed by a numbering code for each type of pavement, shown at the beginning of the summary.



AIRPAV

CONDITION SURVEY SUMMARY

AIRPORT: 417 GREENCASTLE-PUTNAM COUNTY

DATE: 12-30-2009

"A" FLEXIBLE PAVEMENT DISTRESS CODES

1. ALLIGATOR CRACKING
2. BLEEDING
3. BLOCK CRACKING
4. CORRUGATION
5. DEPRESSION
6. JET BLAST EROSION
7. JOINT REFL. CRACKING
8. LONG. & TRANS. CRACKING
9. OIL SPILL
10. PATCHING
11. POLISHED AGGREGATE
12. RAVELLING/WEATHERING
13. RUTTING
14. SHOVING FROM PCC SLAB
15. SLIPPAGE CRACKING
16. SWELLING

"P" RIGID PAVEMENT DISTRESS CODES

1. BLOW UP
2. CORNER BREAK
3. LTD CRACKING
4. "D" CRACKING
5. JOINT SEAL DAMAGE
6. SMALL PATCH
7. LARGE PATCH
8. POPOUTS
9. PUMPING
10. SCALING/MAP CRACKING/CRAZING
11. FAULTING
12. SHATTERED SLAB
13. SHRINKAGE CRACKING
14. JOINT SPALLING
15. CORNER SPALLING

FEATURE:	SAMPLE UNIT:	AREA:	DATE:	SURVEYED BY:	PCI:	DISTRESSES PRESENT:
105 A	105.100	3750	8-16-09	JB	83	8 12
105 A	105.103	3500	8-16-09	JB	79	8 12
105 A	105.105	3500	8-16-09	JB	63	5 8 10 12*
105 A	105.106	3500	8-16-09	AN	79	1 8
105 A	105.109	3500	8-16-09	AN	86	8
105 A	105.112	3500	8-16-09	AN	84	8 12

MEAN FEATURE PCI = 81
BASED ON A SAMPLED AREA OF 21250 SQUARE FEET - PCI SPREAD FOR FEATURE = 22.74
DESCRIPTION: TAXIWAY A

110 A	110.102	3500	8-16-09	JB	100	
110 A	110.106	3500	8-16-09	JB	100	
110 A	110.110	3500	8-16-09	JB	100	
110 A	110.112	3500	8-16-09	JB	100	
110 A	110.114	3500	8-16-09	JB	100	
110 A	110.118	1750	8-16-09	JB	94	8

AVERAGE FEATURE PCI = 99
BASED ON A SAMPLED AREA OF 19250 SQUARE FEET - PCI SPREAD FOR FEATURE = 6.20
DESCRIPTION: TAXIWAY A

115 A	115.118	1750	8-16-09	JB	94	8
115 A	115.122	3500	8-16-09	JB	95	8
115 A	115.126	3500	8-16-09	JB	96	8
115 A	115.130	3500	8-16-09	JB	96	8
115 A	115.134	3500	8-16-09	JB	96	8
115 A	115.136	3500	8-16-09	JB	94	8
115 A	115.138	3500	8-16-09	JB	96	8
115 A	115.142	3500	8-16-09	AN	93	8

AVERAGE FEATURE PCI = 95
BASED ON A SAMPLED AREA OF 26250 SQUARE FEET - PCI SPREAD FOR FEATURE = 3.38
DESCRIPTION: TAXIWAY A

210 A	210.200	3500	8-16-09	AN	94	8
210 A	210.201	3500	8-16-09	AN	94	8
210 A	210.202	1190	8-16-09	AN	86	8

AVERAGE FEATURE PCI = 91
BASED ON A SAMPLED AREA OF 8190 SQUARE FEET - PCI SPREAD FOR FEATURE = 7.93
DESCRIPTION: CONNECTOR TAXIWAY B

PAGE 1

Sample units marked with an asterisk (*) are additional sample units. Additional sample units do not represent the typical condition of surrounding sample units in the pavement features.

The PCI summary provides a quick overview of the pavement condition and consistency. Are the distress types similar? Do the individual sample units have consistent PCI ratings? Answering these questions is a start to understanding your dynamic pavement system.

CONDITION SURVEY SUMMARY

AIRPORT: MGC MICHIGAN CITY MUNICIPAL **DATE: 09-24-2015**

"A" FLEXIBLE PAVEMENT DISTRESS CODES

1. ALLIGATOR CRACKING
2. BLEEDING
3. BLOCK CRACKING
4. CORRUGATION
5. DEPRESSION
6. JET BLAST EROSION
7. JOINT REFL. CRACKING
8. LONG. & TRANS. CRACKING
9. OIL SPILL
10. PATCHING
11. POLISHED AGGREGATE
12. RAVELLING
13. RUTTING
14. SHOVING FROM PCC SLAB
15. SLIPPAGE CRACKING
16. SWELLING
17. WEATHERING

"P" RIGID PAVEMENT DISTRESS CODES

1. BLOW UP
2. CORNER BREAK
3. LTD CRACKING
4. "D" CRACKING
5. JOINT SEAL DAMAGE
6. SMALL PATCH
7. LARGE PATCH
8. POPOUTS
9. PUMPING
10. SCALING/MAP CRACKING/CRAZING
11. FAULTING
12. SHATTERED SLAB
13. SHRINKAGE CRACKING
14. JOINT SPALLING
15. CORNER SPALLING
16. ALKALI SILICA REACTION

FEATURE:	SAMPLE UNIT:	AREA:	DATE:	SURVEYED BY:	PCI:	DISTRESSES PRESENT:
115 A	115.100	3450	9-17-15	EOJ	78	8

AVERAGE FEATURE PCI = 78
BASED ON A SAMPLED AREA OF 3450 SQUARE FEET - PCI SPREAD FOR FEATURE = 0.00

FEATURE:	SAMPLE UNIT:	AREA:	DATE:	SURVEYED BY:	PCI:	DISTRESSES PRESENT:
125 A	125.124	3500	9-17-15	EOJ	69	8 17
125 A	125.126	3500	9-17-15	ABN	68	8 17
125 A	125.128	3500	9-17-15	ABN	60	1 8 17
125 A	125.130	3500	9-17-15	ABN	69	8 17
125 A	125.132	3500	9-17-15	ABN	75	8 17
125 A	125.135	3500	9-17-15	ABN	73	8 17

AVERAGE FEATURE PCI = 69
BASED ON A SAMPLED AREA OF 21000 SQUARE FEET - PCI SPREAD FOR FEATURE = 14.94

FEATURE:	SAMPLE UNIT:	AREA:	DATE:	SURVEYED BY:	PCI:	DISTRESSES PRESENT:
130 A	130.137	1575	9-17-15	EOJ	46	8 12 17
130 A	130.138	4250	9-17-15	EOJ	55	1 3 8 17

AVERAGE FEATURE PCI = 51
BASED ON A SAMPLED AREA OF 5825 SQUARE FEET - PCI SPREAD FOR FEATURE = 9.22

FEATURE:	SAMPLE UNIT:	AREA:	DATE:	SURVEYED BY:	PCI:	DISTRESSES PRESENT:
135 A	135.139	11250	9-17-15	ARA	68	1 8 16 17

AVERAGE FEATURE PCI = 68
BASED ON A SAMPLED AREA OF 11250 SQUARE FEET - PCI SPREAD FOR FEATURE = 0.00

FEATURE:	SAMPLE UNIT:	AREA:	DATE:	SURVEYED BY:	PCI:	DISTRESSES PRESENT:
145 A	145.103	3500	9-17-15	ARA	52	8 13 16 17
145 A	145.105	3500	9-17-15	ARA	58	5 8 16 17

AVERAGE FEATURE PCI = 55
BASED ON A SAMPLED AREA OF 7000 SQUARE FEET - PCI SPREAD FOR FEATURE = 5.14

FEATURE:	SAMPLE UNIT:	AREA:	DATE:	SURVEYED BY:	PCI:	DISTRESSES PRESENT:
205 A	205.101	3500	9-17-15	EOJ	34	1 5 8 12 13 17*
205 A	205.102	3500	9-17-15	ABN	54	1 8 12 17
205 A	205.105	3500	9-17-15	EOJ	69	8 17
205 A	205.108	3500	9-17-15	ABN	70	8 17
205 A	205.111	3500	9-17-15	EOJ	73	8 17
205 A	205.114	3500	9-17-15	ABN	68	1 8 17

FEATURE:	SAMPLE UNIT:	AREA:	DATE:	SURVEYED BY:	PCI:	DISTRESSES PRESENT:
205 A	205.117	3500	9-17-15	EOJ	63	1 8 17
205 A	205.120	3500	9-17-15	ABN	51	1 8 13 16 17

MEAN FEATURE PCI = 62
BASED ON A SAMPLED AREA OF 28000 SQUARE FEET - PCI SPREAD FOR FEATURE = 39.62

210 A	210.100	3475	9-16-15	ABN	62	8 10 13 16 17

AVERAGE FEATURE PCI = 62
BASED ON A SAMPLED AREA OF 3475 SQUARE FEET - PCI SPREAD FOR FEATURE = 0.00

301 A	301.103	3500	9-16-15	ABN	80	8
301 A	301.104	3500	9-16-15	ABN	80	8

AVERAGE FEATURE PCI = 80
BASED ON A SAMPLED AREA OF 7000 SQUARE FEET - PCI SPREAD FOR FEATURE = 0.87

305 A	305.101	2625	9-16-15	ABN	86	8
305 A	305.102	3500	9-16-15	ABN	82	8

AVERAGE FEATURE PCI = 84
BASED ON A SAMPLED AREA OF 6125 SQUARE FEET - PCI SPREAD FOR FEATURE = 3.69

310 A	310.100	4900	9-16-15	ABN	66	8 10 17

AVERAGE FEATURE PCI = 66
BASED ON A SAMPLED AREA OF 4900 SQUARE FEET - PCI SPREAD FOR FEATURE = 0.00

315 A	315.100	4150	9-16-15	EOJ	84	8

AVERAGE FEATURE PCI = 84
BASED ON A SAMPLED AREA OF 4150 SQUARE FEET - PCI SPREAD FOR FEATURE = 0.00

320 A	320.100	4900	9-16-15	EOJ	79	8 17

AVERAGE FEATURE PCI = 79
BASED ON A SAMPLED AREA OF 4900 SQUARE FEET - PCI SPREAD FOR FEATURE = 0.00

325 A	325.101	2625	9-16-15	ARA	54	1 5 8 17
325 A	325.102	2800	9-16-15	ARA	69	1 8

AVERAGE FEATURE PCI = 62
BASED ON A SAMPLED AREA OF 5425 SQUARE FEET - PCI SPREAD FOR FEATURE = 15.11

405 A	405.101	3500	9-16-15	EOJ	80	8
405 A	405.103	3500	9-16-15	EOJ	82	8
405 A	405.105	3500	9-16-15	EOJ	84	8
405 A	405.106	3500	9-16-15	EOJ	81	8

AVERAGE FEATURE PCI = 82
BASED ON A SAMPLED AREA OF 14000 SQUARE FEET - PCI SPREAD FOR FEATURE = 4.29

3005 P	3005.102	3750	9-16-15	EOJ	64	3 6 11 13
3005 P	3005.105	4650	9-16-15	ABN	64	2 3 11
3005 P	3005.200	3975	9-16-15	ABN	78	2 3 6 11
3005 P	3005.203	3750	9-16-15	EOJ	82	3 6 11 14
3005 P	3005.206	3975	9-17-15	ABN	76	3 6 12 13
3005 P	3005.301	3975	9-16-15	ABN	80	3 6 11 13
3005 P	3005.304	4650	9-16-15	EOJ	72	2 3 6 11 13 14 16
3005 P	3005.405	3200	9-16-15	EOJ	84	3 6 14
3005 P	3005.406	2750	9-16-15	EOJ	67	2 3 6 13 14

AVERAGE FEATURE PCI = 74
BASED ON A SAMPLED AREA OF 34675 SQUARE FEET - PCI SPREAD FOR FEATURE = 19.99

5005 A	5005.101	4500	9-16-15	EOJ	62	8 10 17
5005 A	5005.105	4500	9-16-15	EOJ	63	8 10 17
5005 A	5005.108	4500	9-16-15	EOJ	50	8 10 16
5005 A	5005.111	4500	9-16-15	EOJ	65	8 10 17

FEATURE:	SAMPLE UNIT:	AREA:	DATE:	SURVEYED BY:	PCI:	DISTRESSES PRESENT:
5005 A	5005.113	4500	9-16-15	EOJ	50	8 10 16 17*
5005 A	5005.114	4500	9-16-15	EOJ	62	8 10 16 17
5005 A	5005.117	4500	9-16-15	EOJ	64	8 10 17
5005 A	5005.120	4500	9-16-15	EOJ	64	8 10 17
5005 A	5005.123	4500	9-16-15	EOJ	64	8 10 17

MEAN FEATURE PCI = 61
BASED ON A SAMPLED AREA OF 40500 SQUARE FEET - PCI SPREAD FOR FEATURE = 15.02

5010 A	5010.301	6750	9-16-15	ABN	64	8 10 17
5010 A	5010.305	6750	9-16-15	ABN	62	8 10 17
5010 A	5010.308	6750	9-16-15	ABN	63	8 10 17
5010 A	5010.311	6750	9-16-15	ABN	66	8 10 17
5010 A	5010.314	6750	9-16-15	ABN	67	8 10 17
5010 A	5010.317	6750	9-16-15	ABN	65	8 10 17
5010 A	5010.320	6750	9-16-15	ABN	66	8 10 16 17
5010 A	5010.323	6750	9-16-15	ABN	65	8 10 16 17

AVERAGE FEATURE PCI = 65
BASED ON A SAMPLED AREA OF 54000 SQUARE FEET - PCI SPREAD FOR FEATURE = 5.18

TOTAL NUMBER OF INSPECTED FEATURES = 17
TOTAL NUMBER OF INSPECTED SAMPLE UNITS = 60

TOTAL AREA OF INSPECTED PAVEMENT = 255,675 S.F.

* INDICATES "ADDITIONAL" SAMPLE UNITS.

Appendix D. Distress Identification

This chapter describes pavement distress types commonly identified during airport PCI inspections.

Rigid Pavement Distress

Longitudinal, Transverse & Diagonal Cracking

LTD cracking is often a result of load or temperature deformations. External loads cause flexure. Temperature changes can cause curling. When any of these stresses exceed the slab strength, cracking occurs.

LTD cracking is recorded at low, medium, or high severity, depending on the width of crack opening and degree of deterioration.

At low severity, a crack is less than 1/8 inch wide with little spalling, and no corrective action is indicated. At medium severity, LTD cracks can be up to 1 inch wide with moderate spalling and should be repaired using procedures similar to joint sealing. At high severity, cracks exceed 1 inch in width and may be severely spalled. High-severity LTD cracking is evidence of serious load failure, and correction may require patching or slab replacement. If distress occurs in several adjacent slabs at medium or high severity, major rehabilitation of that area is indicated.

A slab divided into four or more pieces is said to be "divided" or "shattered." Shattered slab is a separate distress category and indicates a significant structural failure. A shattered slab has lost its ability to distribute loads. Shattered slabs are rated in three severities, but the recommended action in any case is slab replacement.

Shrinkage Cracking

Shrinkage cracks are small, non-working cracks visible at the pavement surface but not penetrating the full depth of concrete. Shrinkage cracks most commonly occur shortly after construction due to concrete shrinkage during the curing process.

Shrinkage cracks are usually so small that they are not visible until staining or loss of material at crack edges begins to take place. Shrinkage cracks do not represent structural weakness, and no corrective action is prescribed.

Durability Cracking

Durability cracking (D-cracking) is caused by environmental factors, the most common being freeze/thaw. D-cracking usually appears as either a pattern of hairline cracks running parallel to a joint or crack, or in a corner, where water tends to collect. D-cracking eventually leads to disintegration of the pavement, creating foreign object damage (FOD) potential.

At low severity, D-cracking is evident, but no disintegration has occurred. Medium severity is evident over a significant area of the slab, and some disintegration and FOD potential exist. High-severity D-cracking is evidenced by extensive cracking with loose and missing pieces and significant FOD potential.

Joint Spall and Corner Spall

Spalls at slab joints and corners are caused by excessive internal stress in the pavement. Spalls occur when these stresses exceed the shear strength of the concrete.

Spalling usually results from thermal expansion during hot weather when slabs push and expand against one another. If the joints are filled with incompressible material, such as sand, stresses can become severe, causing spalls. Spalling can be reduced significantly by maintenance of joint sealant.

Spall repair requires patching. The extent and severity of spalling suggests the appropriate action. At low severity, spalled concrete remains securely in place in the slab. A low-severity spall should be monitored closely for further deterioration and should be patched when spalled particles become loose, or during the next scheduled patching activity. Medium- and high-severity spalls should be repaired immediately to prevent FOD. If the pavement can be restored to serviceable condition, spalls should be patched for long-term service. If the pavement is beyond repair, temporary patching should be considered to control FOD.

Patches, Large and Small

Large and small patches, by PCI inspection criteria, are distress conditions. Patches indicate deterioration and aging of pavement that contributes to shortened service life. However, patching also indicates that pavement is being maintained.

A patch that is performing well and shows no outward distress is recorded at low severity, and no corrective action is required. Medium-severity patches are serviceable but are beginning to deteriorate. Maintenance or replacement is indicated. At high severity, replacement is indicated.

By definition, small patches are smaller than 5 square feet in surface area, and they usually result from spall repair at slab joints and corners.

Large patches also may be the result of spall repair, but they often indicate more serious deficiencies, such as corner breaks or other full-depth failure smaller than panel size.

Joint Seal Damage

When joint sealant is in perfect condition (no damage), there is no distress.

At low severity, at least 10 percent of the sealant is debonded but still in contact with the joint edges. Medium-severity joint seal damage is recorded when at least 10 percent of the sealant has visible gaps smaller than 1/8 inch and is an indicator that replacement should be programmed as soon as is practical. In the meantime, aggressive inspection and sustaining maintenance is recommended to minimize subsurface damage from moisture penetration. At high severity, visible gaps exceed 1/8 inch, and the amount and degree of joint seal damage typically requires complete removal and replacement of the existing sealant.

On serviceable pavement, deteriorated joint sealant should be repaired or replaced to preserve pavement and subgrade integrity and prolong service life. The issue is not so clear-cut with unserviceable pavement. Pavement that can be restored to serviceable condition by maintenance activities such as patching and joint seal repair, or by slab replacement, should be so maintained as long as the process is cost-effective. However, when age and condition preclude economical return to serviceable condition by such means, joint seal repair would no longer be cost-effective and should be suspended except for an interim maintenance program to control FOD potential.

Flexible Pavement Distress

Longitudinal & Transverse Cracking

L&T cracks are caused by age, construction, and subsurface conditions. Age-related cracking occurs as oxidizing pavement loses components to the atmosphere and becomes more brittle. Consistent application of seal coats can help to prevent age-related cracks.

Construction-related cracking often develops along paving joints. Ensuring that joints are made when both sides are still hot, and near the same temperature, is one of the best ways to mitigate this potential problem.

Seasonal movement caused by changes in subsurface moisture or temperature differences also can cause pavement cracking. Asphalt pavement placed over a PCC pavement or cement stabilized base course may evidence reflective cracking from the underlying material. Wheel loads do not cause L&T cracks, although traffic may worsen their condition.

Low-severity L&T cracks are less than ¼ inch wide, or if sealed with suitable filler material in satisfactory condition can be any width less than 3 inches, if they are not spalled. Maintenance usually is not indicated for low-severity cracking. Moderately spalled cracks and cracks wider than ¼ inch which are not satisfactorily sealed are at medium severity. Medium-severity cracks should be sealed with a high-quality crack filling material. Severely spalled cracks and cracks wider than 3 inches are at high severity. High-severity L&T cracks normally require patching.

Alligator Cracking

Alligator cracks are a series of interconnected load-related cracks caused by fatigue of the asphalt surface. Alligator cracking is a significant structural distress and develops only in places subject to traffic loads. These cracks typically initiate at the bottom of the asphalt layer and propagate upward. Once a fatigue crack is visible at the surface, significant damage has already occurred.

At low severity, alligator cracks are evidenced by a series of parallel hairline cracks (usually in a wheel path). Medium-severity alligator cracking is a well-defined pattern of interconnected cracks, and some spalling may be present. High-severity alligator cracks have lost aggregate interlock between adjacent pieces, and the cracks may be severely spalled with FOD potential. Most likely, the pieces will move freely under traffic.

Alligator cracking is a serious structural failure that cannot be repaired with sealant. The proper repair is patching.

Raveling/Weathering

Raveling and weathering are the wearing away of the pavement surface. Failure can be caused by the dislodging of aggregate particles or the loss of asphalt binder. These distresses are usually evident over large areas and may indicate that the asphalt binder has hardened significantly.

Raveling is the loss of coarse aggregate, weathering is the loss of fine aggregate or binder.

Raveling: At low severity, 5 to 20 coarse aggregate particles are missing per square yard. Medium severity is defined by 20 to 40 missing coarse aggregate particles per square yard. At high severity, more than 40 coarse aggregate particles are missing per square yard, and the top layer of aggregate has eroded away.

Weathering: At low severity, edges of coarse aggregate are exposed less than 1 mm. At medium severity, loss of fine aggregate is noticeable and edges of coarse aggregate are exposed up to 6 mm (1/4 inch). High severity weathering has edges of coarse aggregate exposed > 6 mm, with considerable loss of fine aggregate matrix and potential for loss of coarse aggregate.

Rutting

Ruts are localized areas of pavement having elevations lower than the surrounding sections.

Rutting is due to base and subgrade consolidation caused by excessive wheel loads or poor compaction. Ruts indicate structural failure and can cause hydroplaning.

At low severity, ruts have an average depth of ¼ to ½ inches. At medium severity, ruts have an average depth of ½ to 1 inch. At high severity, ruts have an average depth greater than 1 inch. Patching is the appropriate repair for ruts.

Appendix E. Feature Analysis

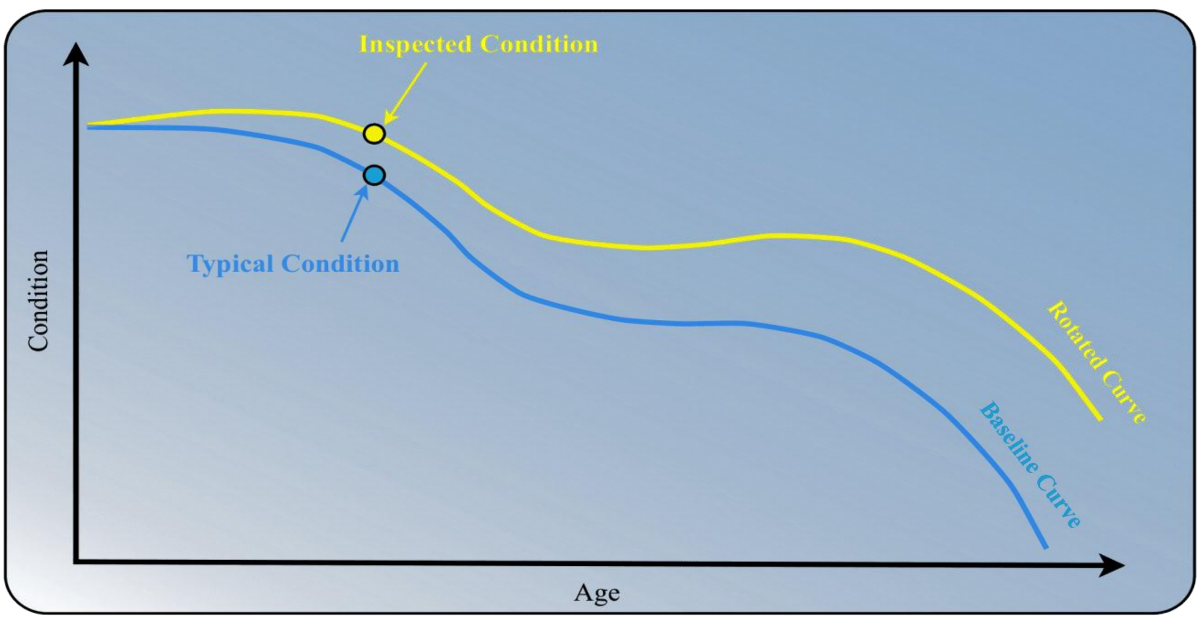
Pavement Performance Models

Projected performance is determined by relating current pavement condition to expected pavement condition. Projected performance varies based on pavement type. There are four pavement types in Indiana: AC, PCC, AAC, and APC. Each pavement type has a unique deterioration curve, created by plotting all data for that group as PCI vs. age and then finding a performance curve to best fit the data. These curves represent the historic performance of pavement in the group and become the baseline for future projections. The baseline curves are modeled with a third order polynomial equation as shown below.

$$PCI = X(Age)^3 + Y(Age)^2 + Z(Age)^1 + C$$

Current Condition (rotating the curves)

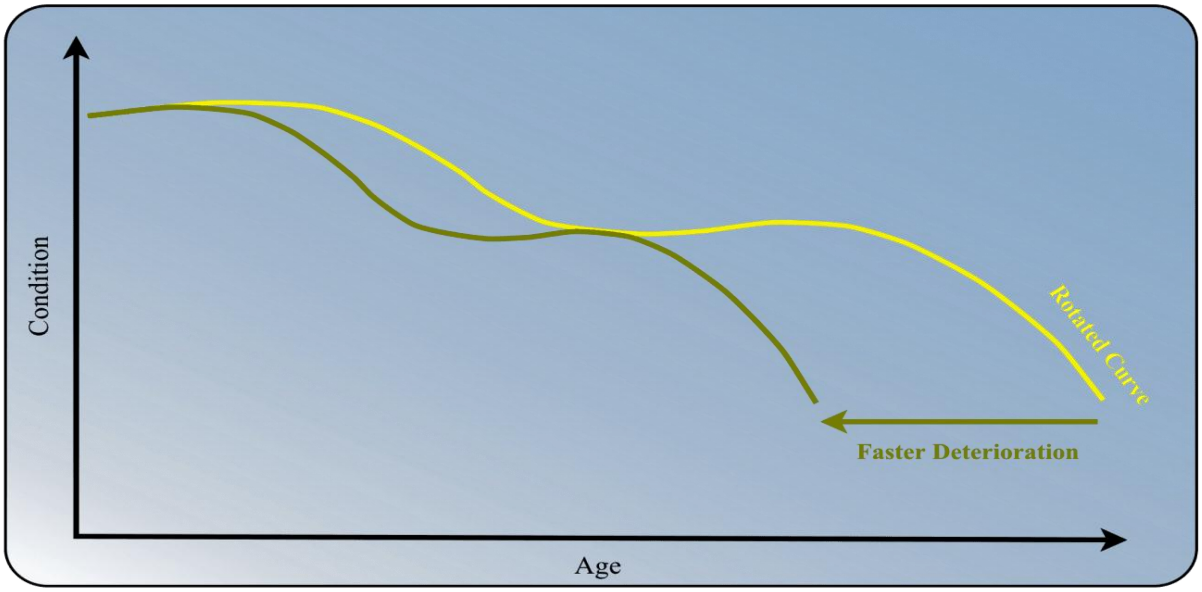
Starting with the baseline curve for comparison, current pavement condition is plotted, and the baseline curve is rotated to meet the current condition. The rotated curve provides the starting point for projecting the future pavement condition.



Advanced Analysis (accounting for distress)

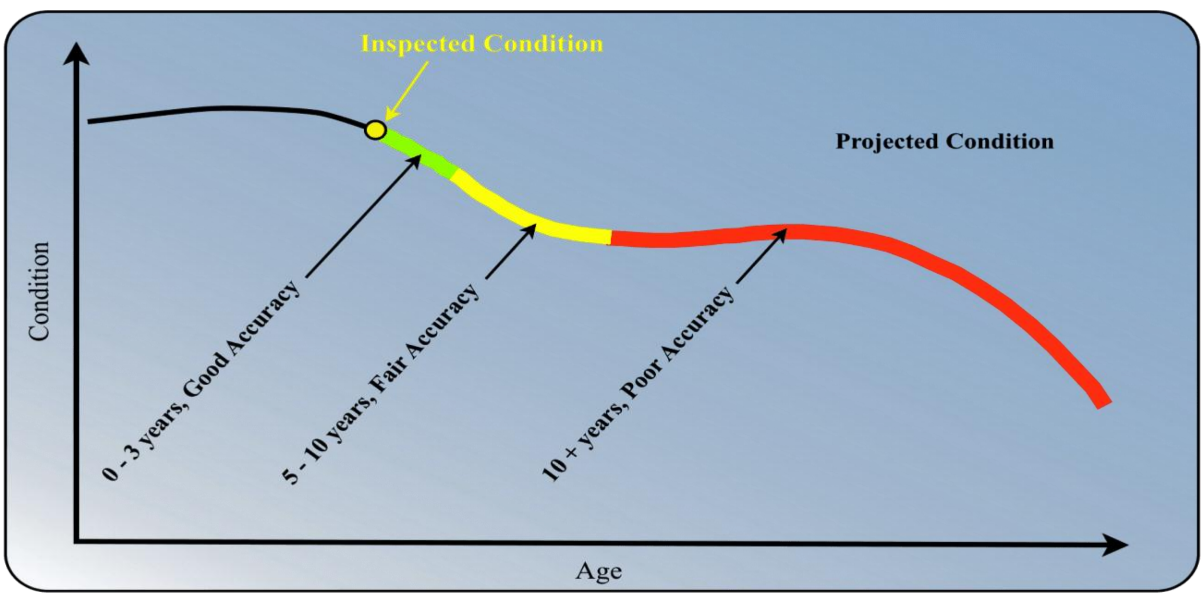
Some types of pavement distress have a greater impact on pavement deterioration than others. Rutting and alligator (fatigue) cracking are major structural failures and can lead to rapid pavement deterioration. Other distress types, like L&T cracking, develop slowly over time and typically do not cause a significant deviation from the baseline curve.

After current condition is accounted for with the curve rotation, pavement distress is addressed in the advanced analysis by compressing or expanding the baseline curve to account for the expected rate of pavement deterioration.



Projected PCI (near term vs. longer term)

Projecting pavement condition with advanced analysis is a combination of rotating, expanding, and contracting the baseline curves. This projection method provides good short-term results for all pavement sections and fair long-term projections on pavement sections with conditions near the baseline model. The long-term accuracy of outlier data is discussed on the following page.

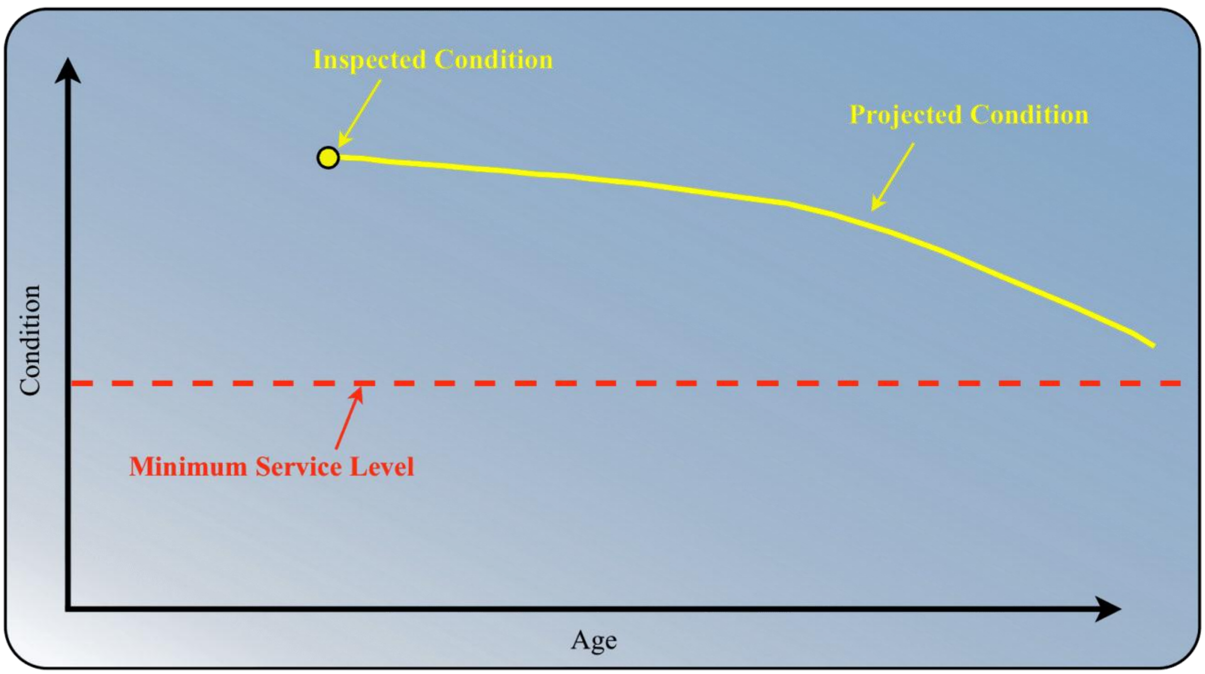


Projected PCI (why some features have unexpected projections)

Long-term PCI projections can be very useful for planning purposes. However, projections in excess of 10 years are well beyond the intended scope of the PCI procedure. FAA Advisory Circular 150/5380-6B establishes a maximum 3-year interval between detailed PCI surveys.

Curve rotation, expansion, and contraction are performed to produce the best possible accuracy of future pavement condition over the next 3 to 5 years. This methodology can overemphasize certain performance trends in the long term. This is especially true for outlier data, such as pavement features that are performing much better or worse than is typical.

The curve below shows an example of a performance trend being overemphasized in the long-term projection. Because the pavement feature is performing much better than the baseline curve, the long-term projection shows the pavement lasting an additional 30+ years before reaching the MSL. Rotation of the curve to provide the most accurate projection over 3 to 5 years has resulted in a long-term projection that is likely unrealistic.



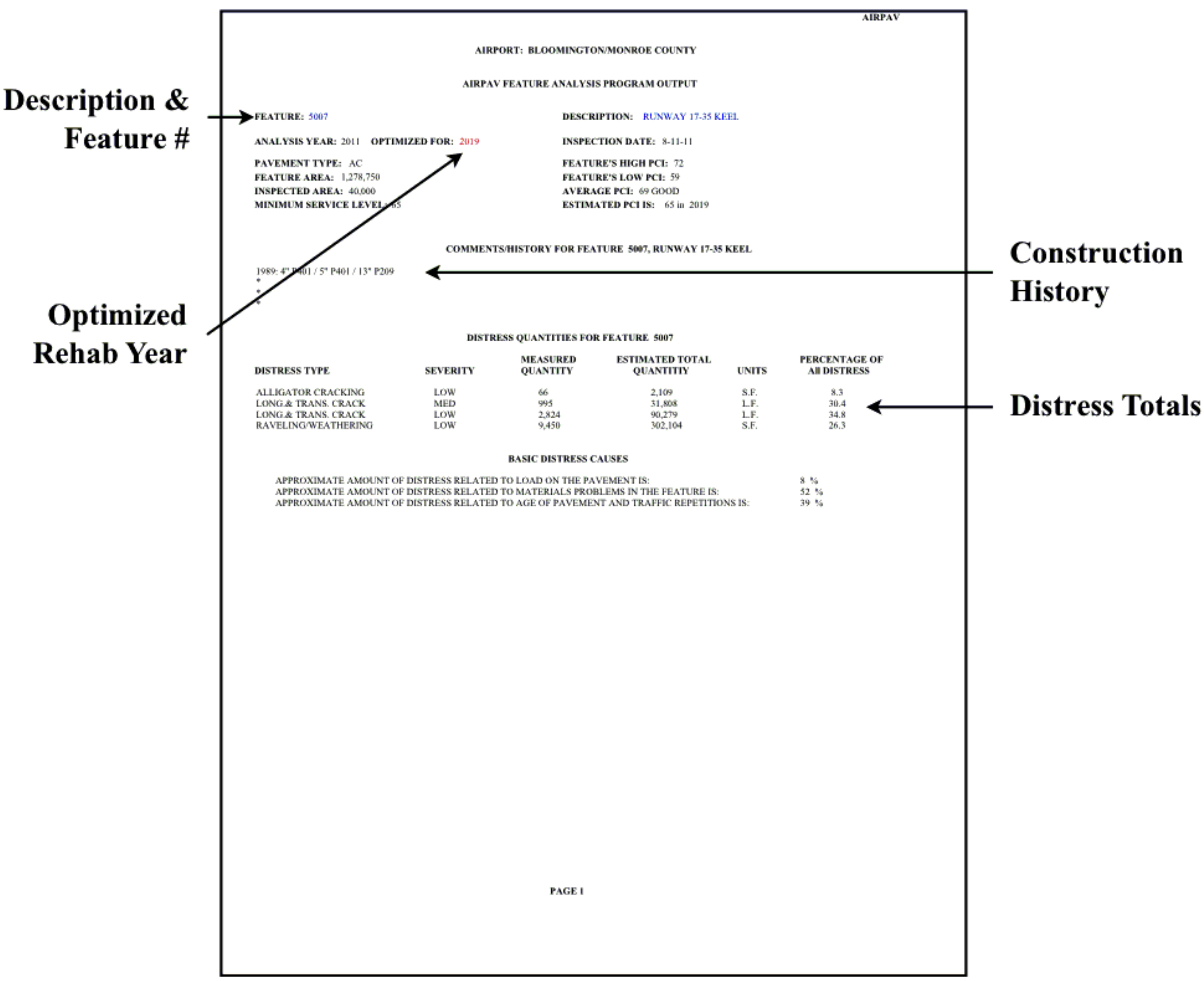
When long-term projections such as this are encountered, airport managers should not rely on projections in excess of 10 years. Managers can be confident that the pavement is performing much better than average and will not require rehabilitation within the current 5-year CIP planning window. As new distress develops over time, future PCI surveys will determine the ideal timing for rehabilitation.

Feature Analysis

As part of the PCI evaluation, a detailed analysis is presented for each airside pavement feature using the two-page format depicted below.

Page 1

The first page of the analysis is a feature summary. Located near the top left-hand corner is the feature number and pavement description. Construction history and inspector comments are listed below, along with a photo of the pavement section if available. Distress totals recorded during the PCI survey are listed next, and an approximation of the cause of the pavement deterioration is shown at the bottom. If the pavement is projected to fall below the desired MSL during the next 12 years, the analysis year will be shown along with the optimum year for pavement rehabilitation.



AIRPAV

AIRPORT: BLOOMINGTON/MONROE COUNTY

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 5007 DESCRIPTION: RUNWAY 17-35 KEEL

ANALYSIS YEAR: 2011 OPTIMIZED FOR: 2019 INSPECTION DATE: 8-11-11

PAVEMENT TYPE: AC FEATURE'S HIGH PCI: 72
FEATURE AREA: 1,278,750 FEATURE'S LOW PCI: 59
INSPECTED AREA: 40,000 AVERAGE PCI: 69 GOOD
MINIMUM SERVICE LEVEL: 65 ESTIMATED PCI IS: 65 in 2019

COMMENTS/HISTORY FOR FEATURE 5007, RUNWAY 17-35 KEEL

1989: 4" P401 / 5" P401 / 13" P209
*
*
*

DISTRESS QUANTITIES FOR FEATURE 5007

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
ALLIGATOR CRACKING	LOW	66	2,109	S.F.	8.3
LONG.& TRANS. CRACK	MED	995	31,808	L.F.	30.4
LONG.& TRANS. CRACK	LOW	2,824	90,279	L.F.	34.8
RAVELING/WEATHERING	LOW	9,450	302,104	S.F.	26.3

BASIC DISTRESS CAUSES

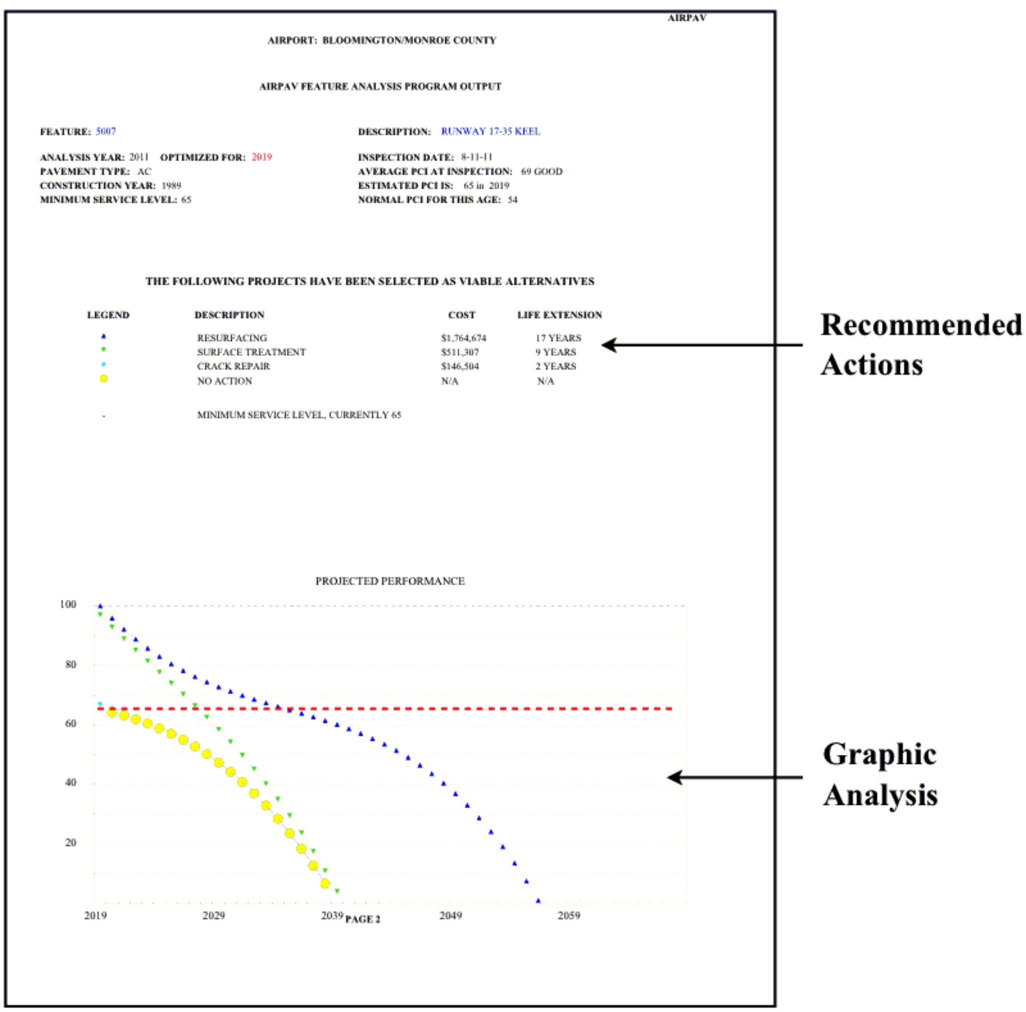
APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS: 8 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS: 52 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS: 39 %

PAGE 1

Page 2

The second page is a graphic analysis of pavement deterioration. Pavement deterioration is forecast based on historic deterioration of similar Indiana pavement types. Remaining life is projected by stretching and rotating the baseline curves to fit the current condition determined from the PCI survey.

When pavement condition drops below the desired MSL, the software selects rehabilitation actions that address the cause of the pavement failure while restoring the pavement to a condition above the MSL. A NO ACTION recommendation indicates that the feature is expected to remain serviceable during the 12-year forecasting period without major repairs. NO ACTION recommendations do not diminish the need for regular maintenance.



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 115

DESCRIPTION: TAXIWAY CONNECTOR

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2018

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC OVERLAY
FEATURE AREA: 3,450
INSPECTED AREA: 3,450
MINIMUM SERVICE LEVEL: 55

FEATURE'S HIGH PCI: 78
FEATURE'S LOW PCI: 78
AVERAGE PCI: 78 SATISFACTORY
ESTIMATED PCI IS: 47 in 2018

COMMENTS/HISTORY FOR FEATURE 115, TAXIWAY CONNECTOR

2013 AC Overlay
1995 AC UNKNOWN SECTION
*
*

DISTRESS QUANTITIES FOR FEATURE 115

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
LONG.& TRANS. CRACK	MED	29	29	L.F.	37
LONG.& TRANS. CRACK	LOW	219	219	L.F.	62.9

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS:	0 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS:	67 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS:	33 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 115

DESCRIPTION: TAXIWAY CONNECTOR

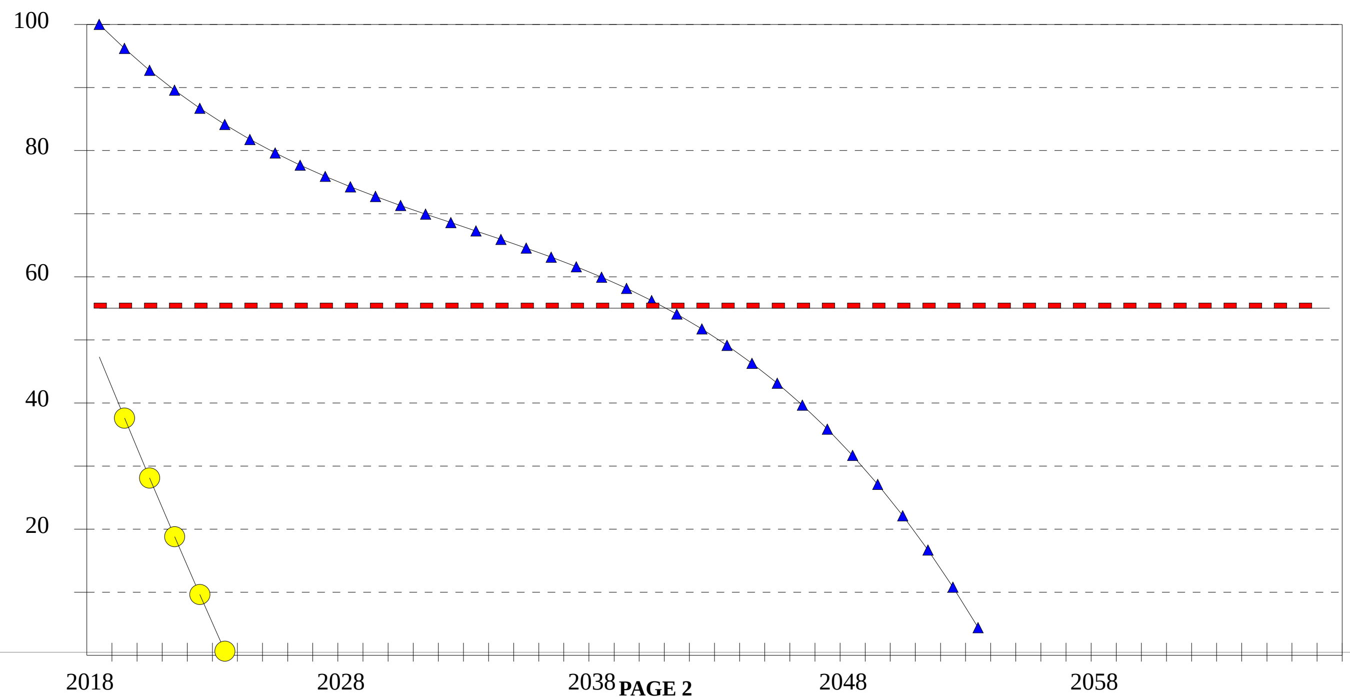
ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2018
PAVEMENT TYPE: AC OVERLAY
CONSTRUCTION YEAR: 2013
MINIMUM SERVICE LEVEL: 55

INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 78 SATISFACTORY
ESTIMATED PCI IS: 47 in 2018
NORMAL PCI FOR THIS AGE: 84

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$4,968	23 YEARS
○	NO ACTION	N/A	N/A
-	MINIMUM SERVICE LEVEL, CURRENTLY 55		

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 125

DESCRIPTION: TAXIWAY B

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2024

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC
FEATURE AREA: 56,120
INSPECTED AREA: 21,000
MINIMUM SERVICE LEVEL: 55

FEATURE'S HIGH PCI: 75
FEATURE'S LOW PCI: 60
AVERAGE PCI: 69 FAIR
ESTIMATED PCI IS: 54 in 2024

COMMENTS/HISTORY FOR FEATURE 125, TAXIWAY B

1998 AC UNKNOWN SECTION
*
*
*

DISTRESS QUANTITIES FOR FEATURE 125

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
ALLIGATOR CRACKING	LOW	4	10	S.F.	3.3
LONG.& TRANS. CRACK	MED	294	785	L.F.	30.8
LONG.& TRANS. CRACK	LOW	1,861	4,973	L.F.	54.8
WEATHERING	MED	100	267	S.F.	.6
WEATHERING	LOW	10,750	28,728	S.F.	10.2

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS: 3 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS: 61 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS: 36 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 125

DESCRIPTION: TAXIWAY B

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2024
PAVEMENT TYPE: AC
CONSTRUCTION YEAR: 1998
MINIMUM SERVICE LEVEL: 55

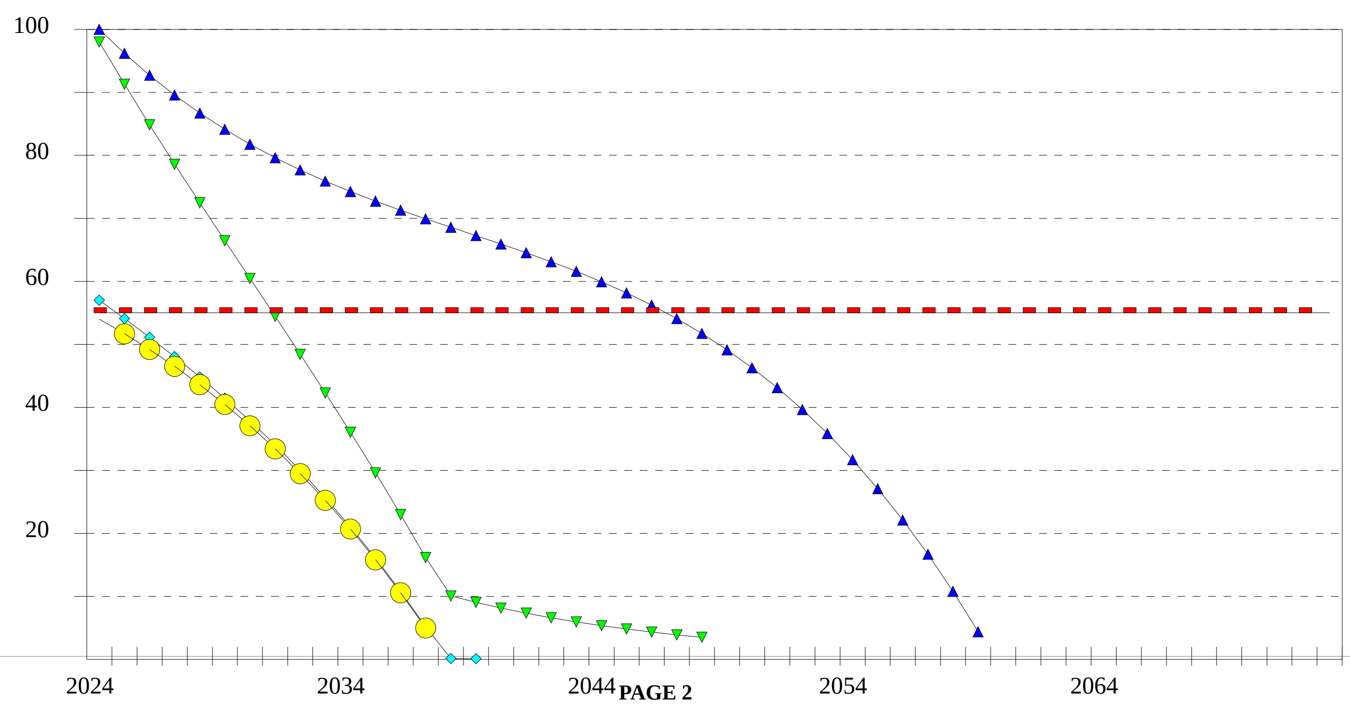
INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 69 FAIR
ESTIMATED PCI IS: 54 in 2024
NORMAL PCI FOR THIS AGE: 50

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$80,812	23 YEARS
▼	SURFACE TREATMENT	$22,860	7 YEARS
◆	CRACK REPAIR	$7,139	1 YEAR
●	NO ACTION	N/A	N/A

- MINIMUM SERVICE LEVEL, CURRENTLY 55

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 130

DESCRIPTION: TAXIWAY B

ANALYSIS YEAR: 2015

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC OVERLAY
FEATURE AREA: 5,825
INSPECTED AREA: 5,825
MINIMUM SERVICE LEVEL: 55

FEATURE'S HIGH PCI: 55
FEATURE'S LOW PCI: 46
AVERAGE PCI: 51 POOR
ESTIMATED PCI IS: 51 in 2015

COMMENTS/HISTORY FOR FEATURE 130, TAXIWAY B

1999 AC OVERLAY
EST 1998 AC UNKNOWN SECTION
*
*

DISTRESS QUANTITIES FOR FEATURE 130

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
ALLIGATOR CRACKING	LOW	6	6	S.F.	5.2
BLOCK CRACKING	LOW	560	560	S.F.	11.1
LONG.& TRANS. CRACK	MED	34	34	L.F.	10.8
LONG.& TRANS. CRACK	LOW	522	522	L.F.	27.7
RAVELING	HIGH	15	15	S.F.	9.7
WEATHERING	HIGH	410	410	S.F.	22.5
WEATHERING	MED	900	900	S.F.	10.5
WEATHERING	LOW	2,000	2,000	S.F.	2.2

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS:	5 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS:	41 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS:	54 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 130

DESCRIPTION: TAXIWAY B

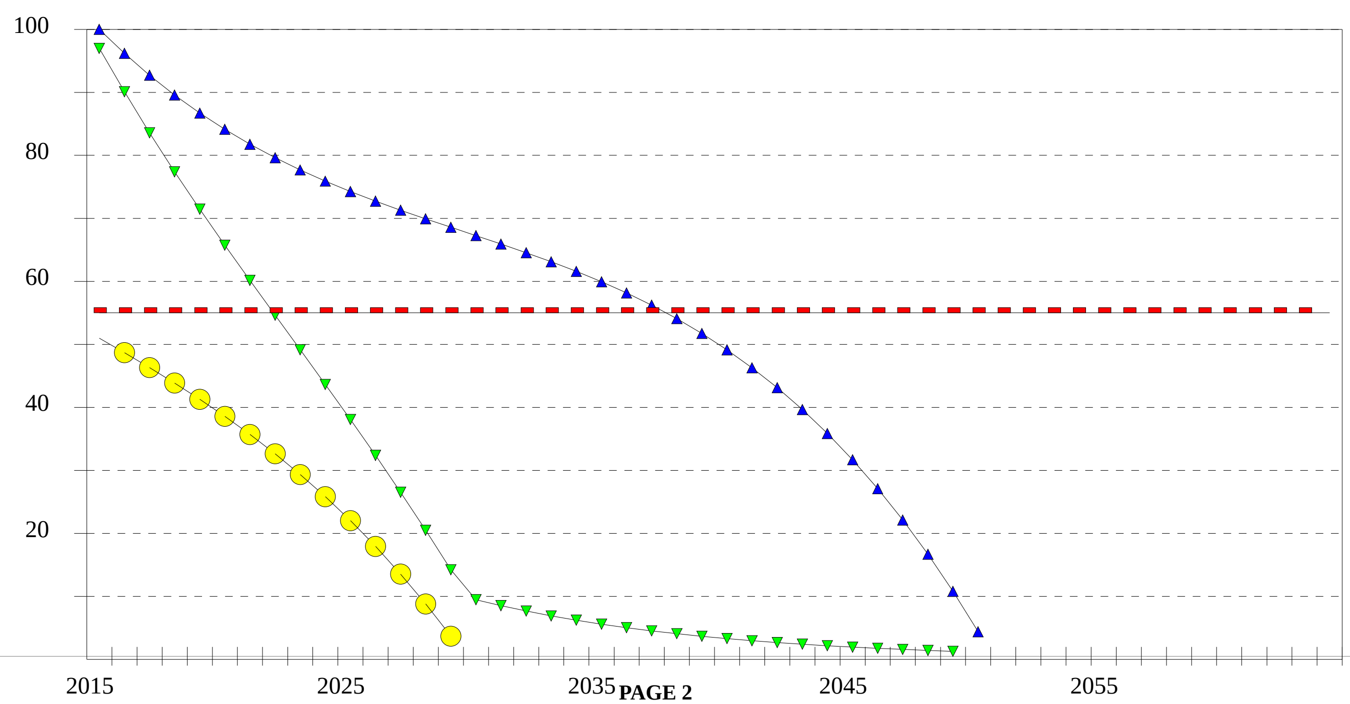
ANALYSIS YEAR: 2015
PAVEMENT TYPE: AC OVERLAY
CONSTRUCTION YEAR: 1999
MINIMUM SERVICE LEVEL: 55

INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 51 POOR
ESTIMATED PCI IS: 51 in 2015
NORMAL PCI FOR THIS AGE: 65

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$8,388	23 YEARS
▼	SURFACE TREATMENT	$2,313	7 YEARS
●	NO ACTION	N/A	N/A
-	MINIMUM SERVICE LEVEL, CURRENTLY 55		

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 135

DESCRIPTION: TAXIWAY B

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2023

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC OVERLAY
FEATURE AREA: 11,250
INSPECTED AREA: 11,250
MINIMUM SERVICE LEVEL: 55

FEATURE'S HIGH PCI: 68
FEATURE'S LOW PCI: 68
AVERAGE PCI: 68 FAIR
ESTIMATED PCI IS: 54 in 2023

COMMENTS/HISTORY FOR FEATURE 135, TAXIWAY B

1999 AC OVERLAY
EST 1988 4" P401
*
*

DISTRESS QUANTITIES FOR FEATURE 135

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
ALLIGATOR CRACKING	LOW	18	18	S.F.	22.8
LONG.& TRANS. CRACK	MED	78	78	L.F.	22.1
LONG.& TRANS. CRACK	LOW	805	805	L.F.	45.5
SWELL	LOW	24	24	S.F.	2.9
WEATHERING	LOW	3,000	3,000	S.F.	6.5

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS: 23 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS: 50 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS: 27 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 135 **DESCRIPTION:** TAXIWAY B

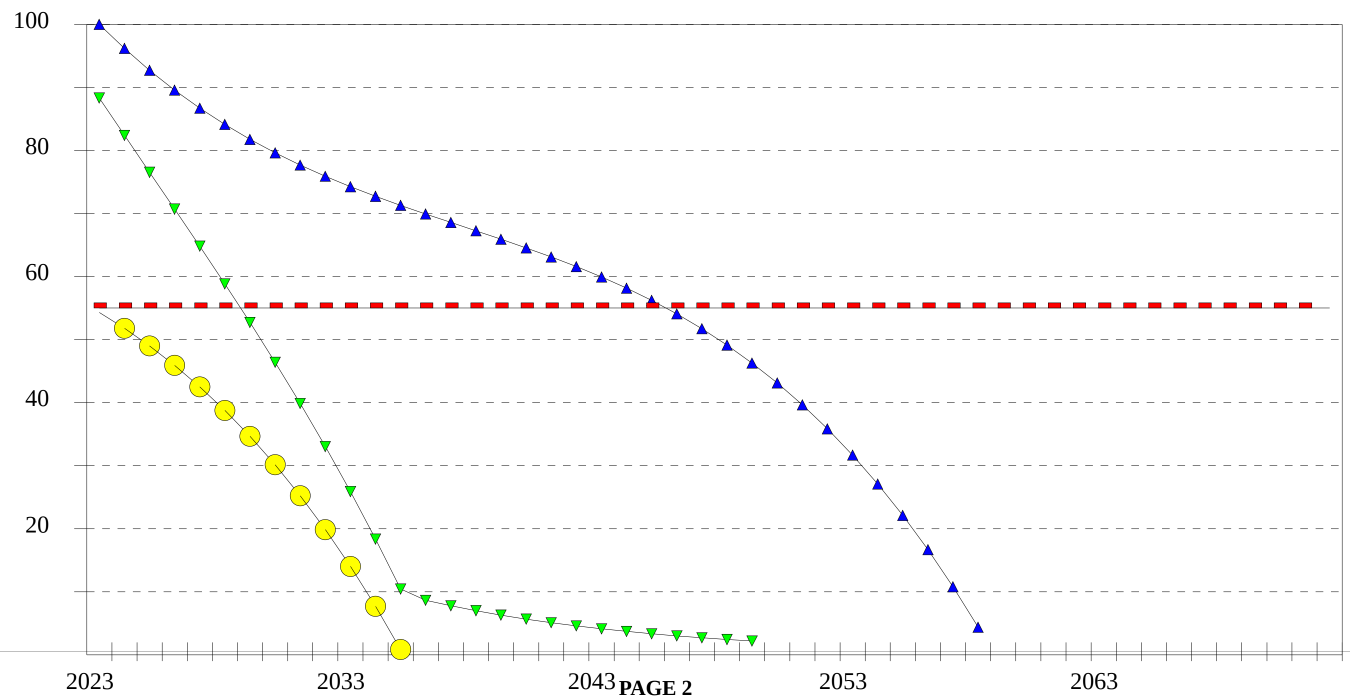
ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2023
PAVEMENT TYPE: AC OVERLAY
CONSTRUCTION YEAR: 1999
MINIMUM SERVICE LEVEL: 55

INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 68 FAIR
ESTIMATED PCI IS: 54 in 2023
NORMAL PCI FOR THIS AGE: 51

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$16,200	23 YEARS
▼	SURFACE TREATMENT	$4,484	6 YEARS
●	NO ACTION	N/A	N/A
-	MINIMUM SERVICE LEVEL, CURRENTLY 55		

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 145

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2016

PAVEMENT TYPE: AC
FEATURE AREA: 9,808
INSPECTED AREA: 7,000
MINIMUM SERVICE LEVEL: 55

DESCRIPTION: TAXIWAY A2

INSPECTION DATE: 9-17-15

FEATURE'S HIGH PCI: 58
FEATURE'S LOW PCI: 52
AVERAGE PCI: 55 POOR
ESTIMATED PCI IS: 51 in 2016

COMMENTS/HISTORY FOR FEATURE 145, TAXIWAY A2

2006 AC 2" P-401/6" P-401/12" P-209
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*

DISTRESS QUANTITIES FOR FEATURE 145

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
DEPRESSION	LOW	40	56	S.F.	5.4
LONG.& TRANS. CRACK	MED	140	196	L.F.	22.4
LONG.& TRANS. CRACK	LOW	643	900	L.F.	33.6
RUTTING	LOW	20	28	S.F.	10.8
SWELL	LOW	275	385	S.F.	14.4
WEATHERING	MED	500	700	S.F.	6.6
WEATHERING	LOW	4,000	5,604	S.F.	6.4

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS: 7 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS: 65 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS: 27 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 145

DESCRIPTION: TAXIWAY A2

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2016
PAVEMENT TYPE: AC
CONSTRUCTION YEAR: 2006
MINIMUM SERVICE LEVEL: 55

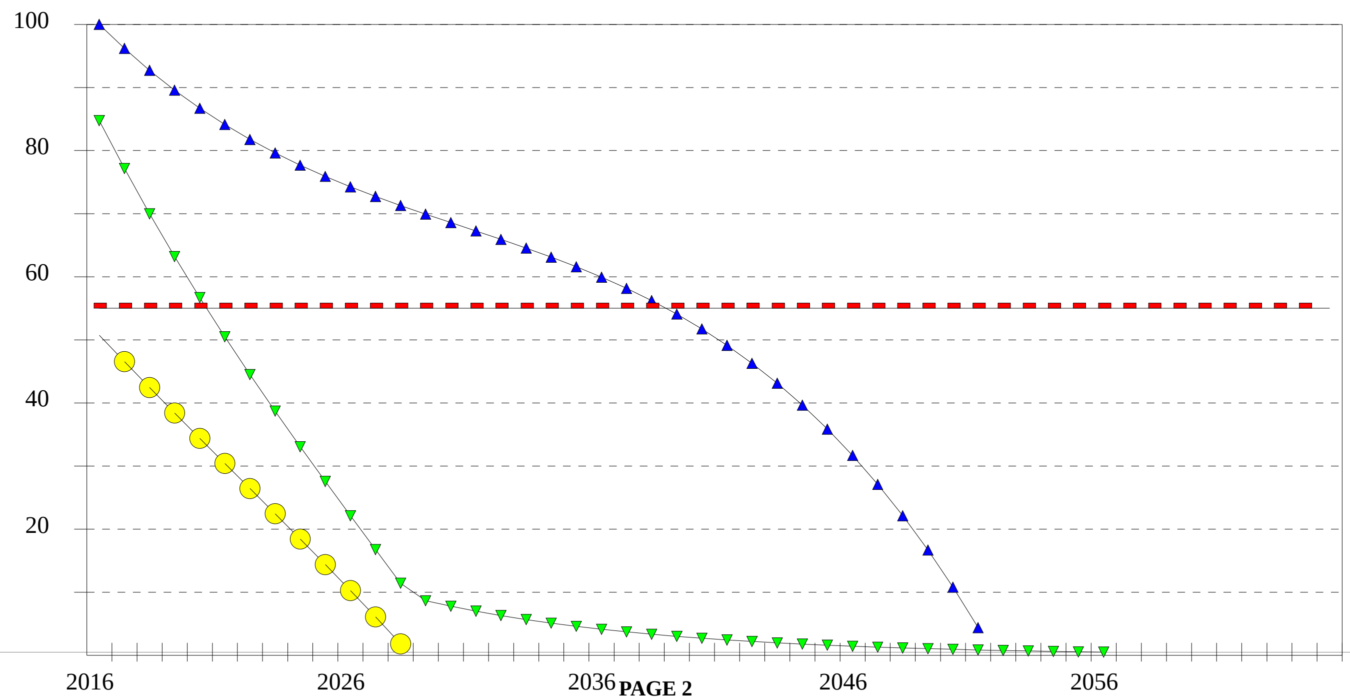
INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 55 POOR
ESTIMATED PCI IS: 51 in 2016
NORMAL PCI FOR THIS AGE: 76

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$14,123	23 YEARS
▼	SURFACE TREATMENT	$4,068	5 YEARS
●	NO ACTION	N/A	N/A

\- MINIMUM SERVICE LEVEL, CURRENTLY 55

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 205

DESCRIPTION: TAXIWAY B

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2019

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC
FEATURE AREA: 76,569
INSPECTED AREA: 28,000
MINIMUM SERVICE LEVEL: 55

FEATURE'S HIGH PCI: 73
FEATURE'S LOW PCI: 34
AVERAGE PCI: 62 FAIR
ESTIMATED PCI IS: 55 in 2019

COMMENTS/HISTORY FOR FEATURE 205, TAXIWAY B

1995 AC UNKNOWN SECTION
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*

DISTRESS QUANTITIES FOR FEATURE 205

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
ALLIGATOR CRACKING	LOW	32	95	S.F.	7.7
ALLIGATOR CRACKING	MED	186	277	S.F.	13.6
DEPRESSION	LOW	50	50	S.F.	.1
LONG.& TRANS. CRACK	LOW	1,674	4,695	L.F.	30.4
LONG.& TRANS. CRACK	MED	556	1,463	L.F.	25.5
RAVELING	LOW	450	1,044	S.F.	2.5
RUTTING	LOW	156	167	S.F.	2.9
SWELL	LOW	66	196	S.F.	1.5
WEATHERING	LOW	16,600	45,543	S.F.	7.8
WEATHERING	MED	1,525	3,556	S.F.	4.6

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS:	24 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS:	46 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS:	30 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 205

DESCRIPTION: TAXIWAY B

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2019

PAVEMENT TYPE: AC

CONSTRUCTION YEAR: 1995

MINIMUM SERVICE LEVEL: 55

INSPECTION DATE: 9-17-15

AVERAGE PCI AT INSPECTION: 62 FAIR

ESTIMATED PCI IS: 55 in 2019

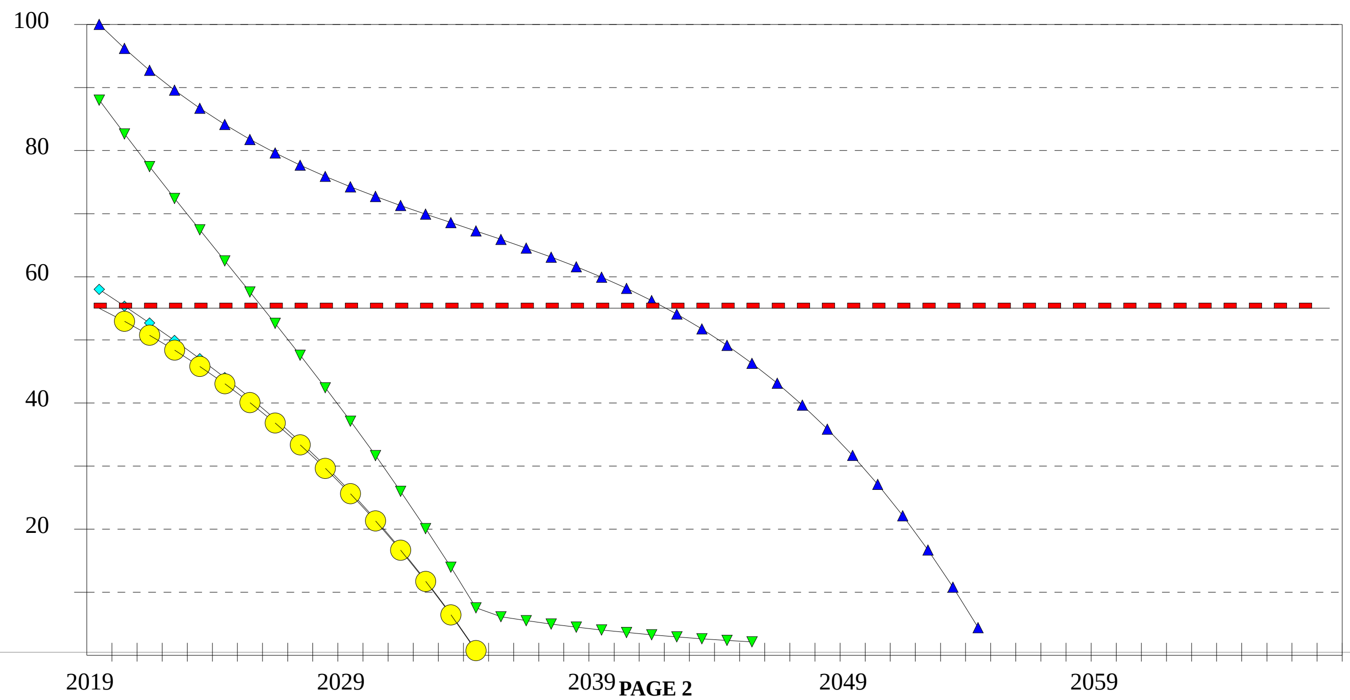
NORMAL PCI FOR THIS AGE: 54

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$110,259	23 YEARS
▼	SURFACE TREATMENT	$29,861	7 YEARS
◆	CRACK REPAIR	$7,635	2 YEARS
●	NO ACTION	N/A	N/A

-	MINIMUM SERVICE LEVEL, CURRENTLY 55

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 210

DESCRIPTION: TAXIWAY B

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2020

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC OVERLAY
FEATURE AREA: 4,918
INSPECTED AREA: 3,475
MINIMUM SERVICE LEVEL: 55

FEATURE'S HIGH PCI: 62
FEATURE'S LOW PCI: 62
AVERAGE PCI: 62 FAIR
ESTIMATED PCI IS: 53 in 2020

COMMENTS/HISTORY FOR FEATURE 210, TAXIWAY B

1999 AC OVERLAY
EST 1988 4" P401
*
*

DISTRESS QUANTITIES FOR FEATURE 210

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
LONG.& TRANS. CRACK	MED	71	100	L.F.	28.5
LONG.& TRANS. CRACK	LOW	89	125	L.F.	15.7
PATCH & UTILITY CUT	MED	10	14	S.F.	14.3
PATCH & UTILITY CUT	LOW	22	31	S.F.	5.9
RUTTING	LOW	8	11	S.F.	22.3
SWELL	LOW	45	63	S.F.	8.6
WEATHERING	MED	20	28	S.F.	1
WEATHERING	LOW	500	707	S.F.	3.4

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS:	28 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS:	54 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS:	18 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 210

DESCRIPTION: TAXIWAY B

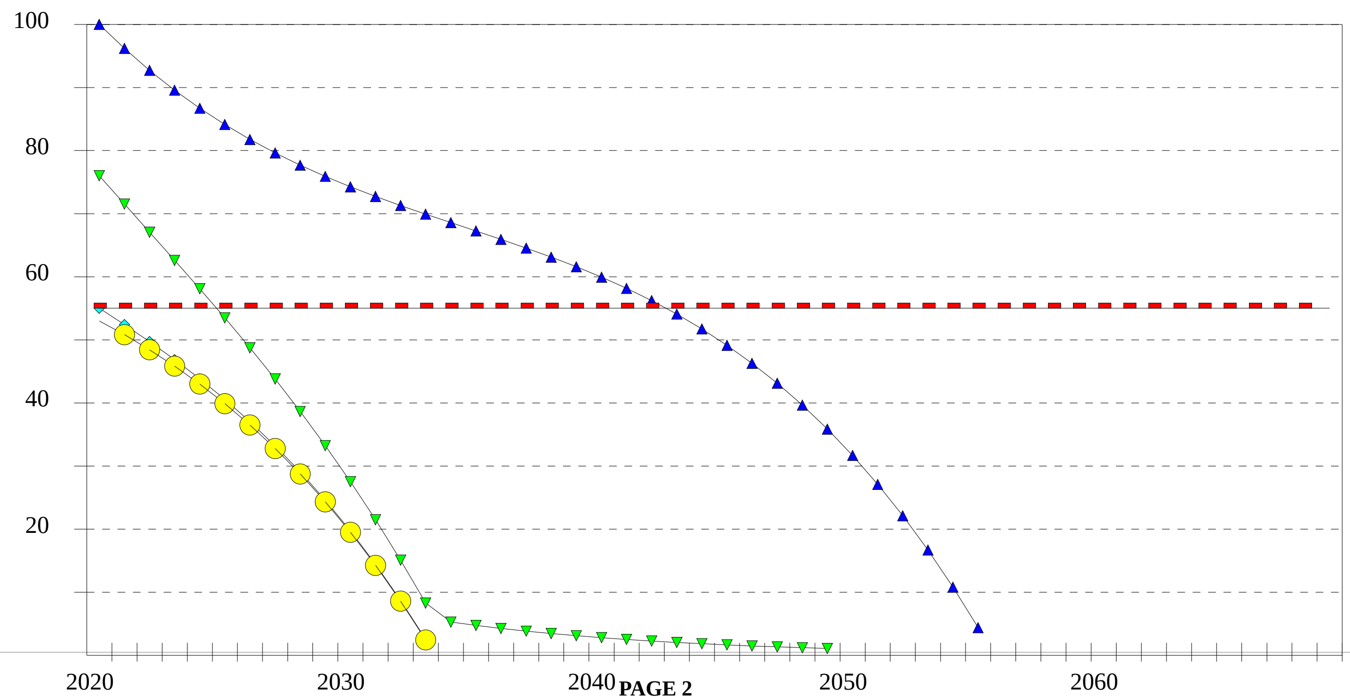
ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2020
PAVEMENT TYPE: AC OVERLAY
CONSTRUCTION YEAR: 1999
MINIMUM SERVICE LEVEL: 55

INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 62 FAIR
ESTIMATED PCI IS: 53 in 2020
NORMAL PCI FOR THIS AGE: 58

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	STRUCTURAL OVERLAY	$9,098	23 YEARS
▼	SURFACE TREATMENT	$2,042	5 YEARS
◆	CRACK REPAIR	$279	1 YEAR
●	NO ACTION	N/A	N/A
-	MINIMUM SERVICE LEVEL, CURRENTLY 55		

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 301

DESCRIPTION: TAXIWAY A1

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2018

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC OVERLAY
FEATURE AREA: 9,106
INSPECTED AREA: 7,000
MINIMUM SERVICE LEVEL: 55

FEATURE'S HIGH PCI: 80
FEATURE'S LOW PCI: 80
AVERAGE PCI: 80 SATISFACTORY
ESTIMATED PCI IS: 52 in 2018

COMMENTS/HISTORY FOR FEATURE 301, TAXIWAY A1

2013 AC Thin Overlay
1989 4" P401
6" P208
*

DISTRESS QUANTITIES FOR FEATURE 301

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
LONG.& TRANS. CRACK	MED	19	24	L.F.	26.8
LONG.& TRANS. CRACK	LOW	397	516	L.F.	73.1

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS:	0 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS:	67 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS:	33 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 301

DESCRIPTION: TAXIWAY A1

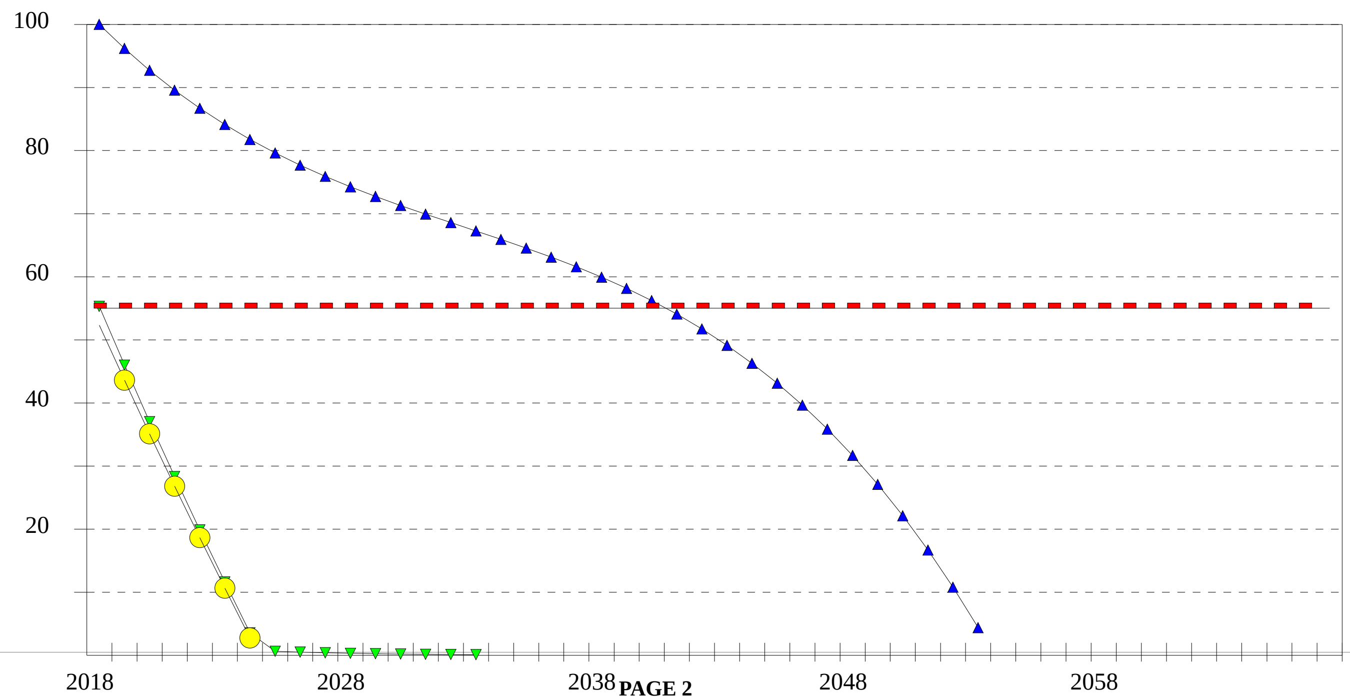
ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2018
PAVEMENT TYPE: AC OVERLAY
CONSTRUCTION YEAR: 2013
MINIMUM SERVICE LEVEL: 55

INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 80 SATISFACTORY
ESTIMATED PCI IS: 52 in 2018
NORMAL PCI FOR THIS AGE: 84

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$13,112	23 YEARS
▼	CRACK REPAIR	$669	1 YEAR
●	NO ACTION	N/A	N/A
-	MINIMUM SERVICE LEVEL, CURRENTLY 55		

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 305

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2019

PAVEMENT TYPE: AC
FEATURE AREA: 6,125
INSPECTED AREA: 6,125
MINIMUM SERVICE LEVEL: 55

DESCRIPTION: TAXIWAY A1

INSPECTION DATE: 9-17-15

FEATURE'S HIGH PCI: 86
FEATURE'S LOW PCI: 82
AVERAGE PCI: 84 SATISFACTORY
ESTIMATED PCI IS: 54 in 2019

COMMENTS/HISTORY FOR FEATURE 305, TAXIWAY A1

2013 AC Thin Overlay
1995 AC UNKNOWN SECTION
*
*

DISTRESS QUANTITIES FOR FEATURE 305

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
LONG.& TRANS. CRACK	MED	45	45	L.F.	51.5
LONG.& TRANS. CRACK	LOW	176	176	L.F.	48.4

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS:	0 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS:	67 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS:	33 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 305

DESCRIPTION: TAXIWAY A1

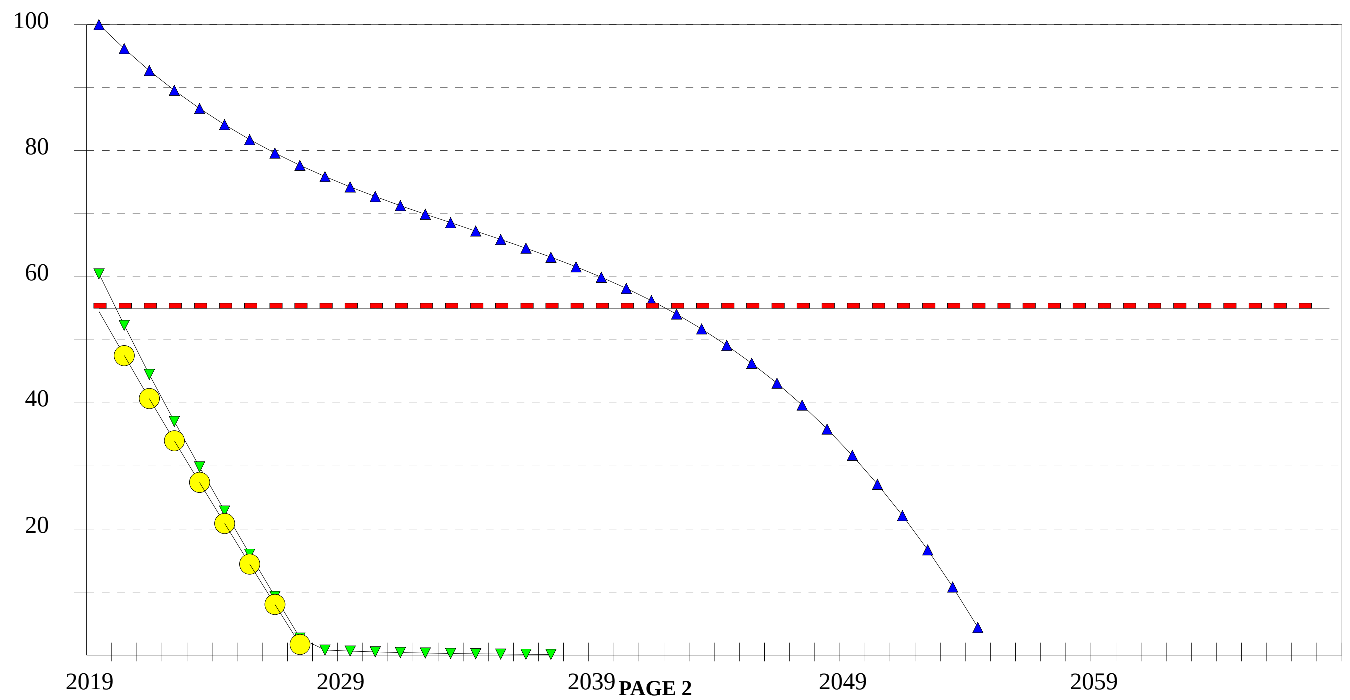
ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2019
PAVEMENT TYPE: AC
CONSTRUCTION YEAR: 2013
MINIMUM SERVICE LEVEL: 55

INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 84 SATISFACTORY
ESTIMATED PCI IS: 54 in 2019
NORMAL PCI FOR THIS AGE: 83

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$8,820	23 YEARS
▼	CRACK REPAIR	$274	1 YEAR
●	NO ACTION	N/A	N/A
-	MINIMUM SERVICE LEVEL, CURRENTLY 55		

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 310

DESCRIPTION: TAXIWAY A1

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2022

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC
FEATURE AREA: 5,670
INSPECTED AREA: 4,900
MINIMUM SERVICE LEVEL: 55

FEATURE'S HIGH PCI: 66
FEATURE'S LOW PCI: 66
AVERAGE PCI: 66 FAIR
ESTIMATED PCI IS: 54 in 2022

COMMENTS/HISTORY FOR FEATURE 310, TAXIWAY A1

1999 AC
*
*
*

DISTRESS QUANTITIES FOR FEATURE 310

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
LONG.& TRANS. CRACK	HIGH	36	41	L.F.	40.8
LONG.& TRANS. CRACK	MED	77	89	L.F.	29.2
LONG.& TRANS. CRACK	LOW	49	56	L.F.	11.9
PATCH & UTILITY CUT	LOW	80	92	S.F.	12.7
WEATHERING	LOW	1,000	1,157	S.F.	5.2

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS:	8 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS:	61 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS:	31 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 310

DESCRIPTION: TAXIWAY A1

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2022
PAVEMENT TYPE: AC
CONSTRUCTION YEAR: 1999
MINIMUM SERVICE LEVEL: 55

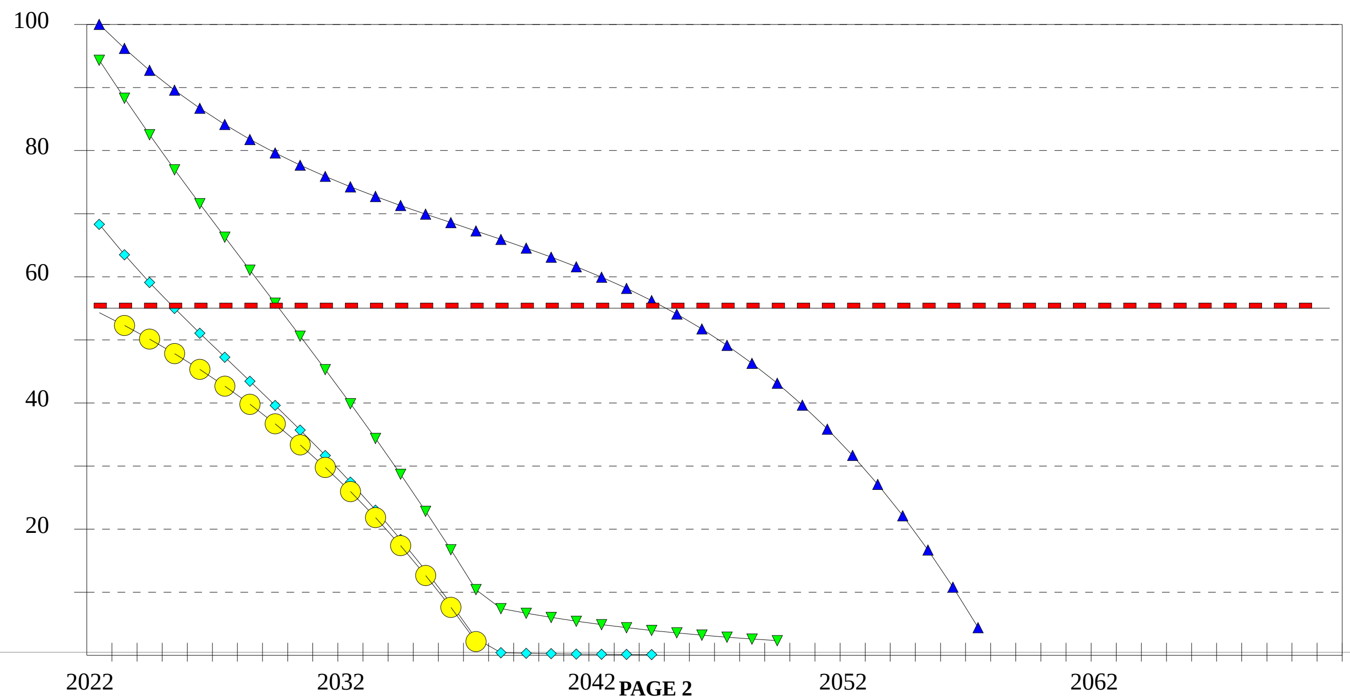
INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 66 FAIR
ESTIMATED PCI IS: 54 in 2022
NORMAL PCI FOR THIS AGE: 56

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$8,164	23 YEARS
▼	SURFACE TREATMENT	$2,372	8 YEARS
◆	CRACK REPAIR	$230	3 YEARS
●	NO ACTION	N/A	N/A

\- MINIMUM SERVICE LEVEL, CURRENTLY 55

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 315

DESCRIPTION: TAXIWAY B1

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2019

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC
FEATURE AREA: 4,150
INSPECTED AREA: 4,150
MINIMUM SERVICE LEVEL: 55

FEATURE'S HIGH PCI: 84
FEATURE'S LOW PCI: 84
AVERAGE PCI: 84 SATISFACTORY
ESTIMATED PCI IS: 54 in 2019

COMMENTS/HISTORY FOR FEATURE 315, TAXIWAY B1

2013 AC Thin Overlay
1989 4" P401
6" P208
*

DISTRESS QUANTITIES FOR FEATURE 315

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
LONG.& TRANS. CRACK	MED	55	55	L.F.	55.8
LONG.& TRANS. CRACK	LOW	126	126	L.F.	44.1

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS:	0 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS:	67 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS:	33 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 315 **DESCRIPTION:** TAXIWAY B1

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2019
PAVEMENT TYPE: AC
CONSTRUCTION YEAR: 2013
MINIMUM SERVICE LEVEL: 55

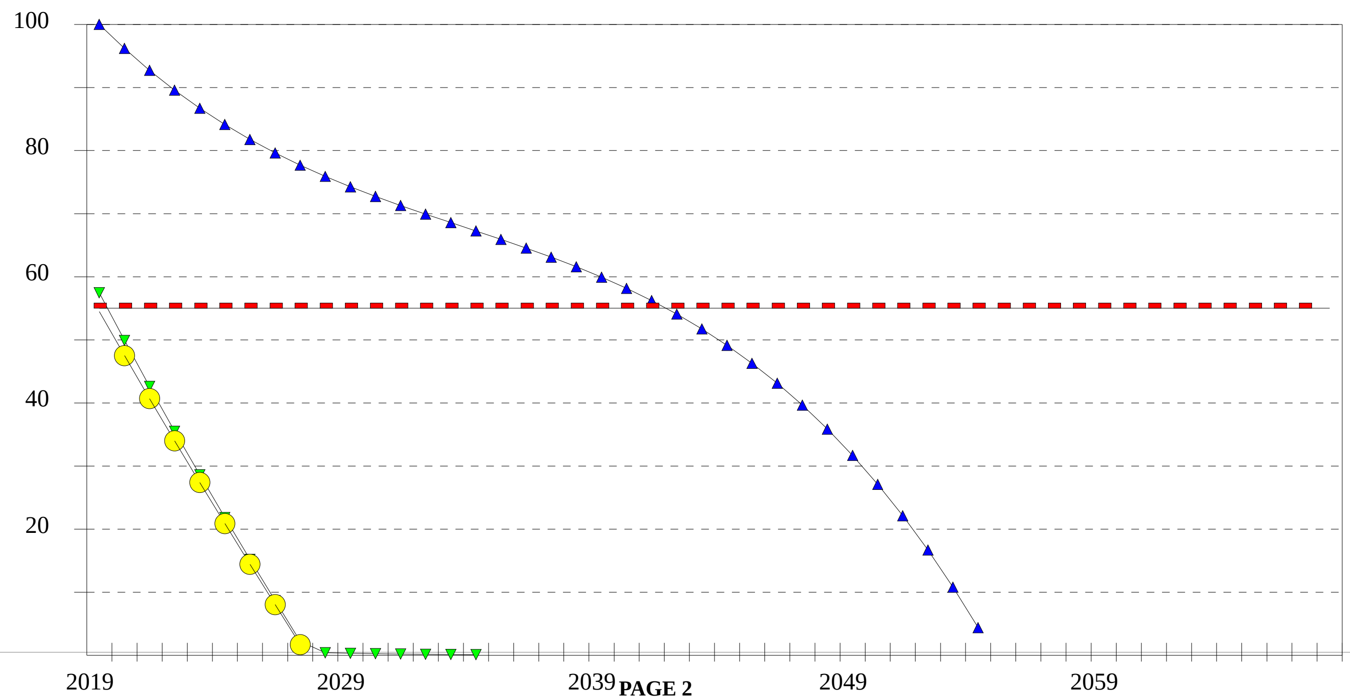
INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 84 SATISFACTORY
ESTIMATED PCI IS: 54 in 2019
NORMAL PCI FOR THIS AGE: 83

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$5,976	23 YEARS
▼	CRACK REPAIR	$224	1 YEAR
●	NO ACTION	N/A	N/A

\- MINIMUM SERVICE LEVEL, CURRENTLY 55

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 320

DESCRIPTION: TAXIWAY A2

ANALYSIS YEAR: 2015

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC OVERLAY
FEATURE AREA: 5,448
INSPECTED AREA: 4,900
MINIMUM SERVICE LEVEL: 55

FEATURE'S HIGH PCI: 79
FEATURE'S LOW PCI: 79
AVERAGE PCI: 79 SATISFACTORY
ESTIMATED PCI IS: 79 in 2015

COMMENTS/HISTORY FOR FEATURE 320, TAXIWAY A2

1999 AC OVERLAY
ESTIMATED 1989 AC UNKNOWN SECTION
*
*

DISTRESS QUANTITIES FOR FEATURE 320

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
LONG.& TRANS. CRACK	MED	18	20	L.F.	28.2
LONG.& TRANS. CRACK	LOW	214	237	L.F.	54.7
WEATHERING	LOW	2,500	2,779	S.F.	16.9

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS:	0 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS:	61 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS:	39 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 320

DESCRIPTION: TAXIWAY A2

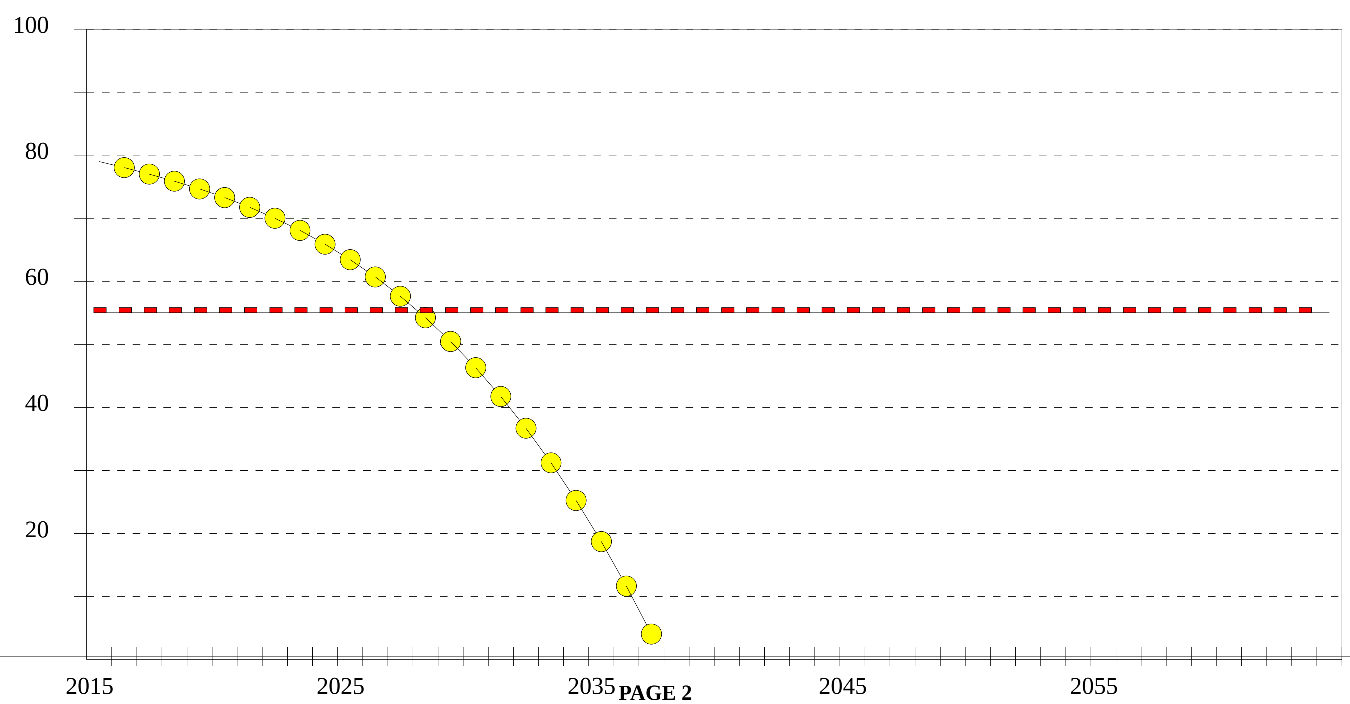
ANALYSIS YEAR: 2015
PAVEMENT TYPE: AC OVERLAY
CONSTRUCTION YEAR: 1999
MINIMUM SERVICE LEVEL: 55

INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 79 SATISFACTORY
ESTIMATED PCI IS: 79 in 2015
NORMAL PCI FOR THIS AGE: 65

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
● (yellow)	NO ACTION	N/A	N/A
-	MINIMUM SERVICE LEVEL, CURRENTLY 55		

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 325

DESCRIPTION: TAXIWAY A2

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2019

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC
FEATURE AREA: 5,425
INSPECTED AREA: 5,425
MINIMUM SERVICE LEVEL: 55

FEATURE'S HIGH PCI: 69
FEATURE'S LOW PCI: 54
AVERAGE PCI: 62 FAIR
ESTIMATED PCI IS: 55 in 2019

COMMENTS/HISTORY FOR FEATURE 325, TAXIWAY A2

1998 AC UNKNOWN SECTION
*
*
*

DISTRESS QUANTITIES FOR FEATURE 325

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
ALLIGATOR CRACKING	LOW	6	6	S.F.	17.4
DEPRESSION	LOW	15	15	S.F.	3.7
LONG.& TRANS. CRACK	MED	25	25	L.F.	16.8
LONG.& TRANS. CRACK	LOW	610	610	L.F.	56.5
WEATHERING	LOW	1,800	1,800	S.F.	5.3

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS: 17 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS: 55 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS: 28 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 325

DESCRIPTION: TAXIWAY A2

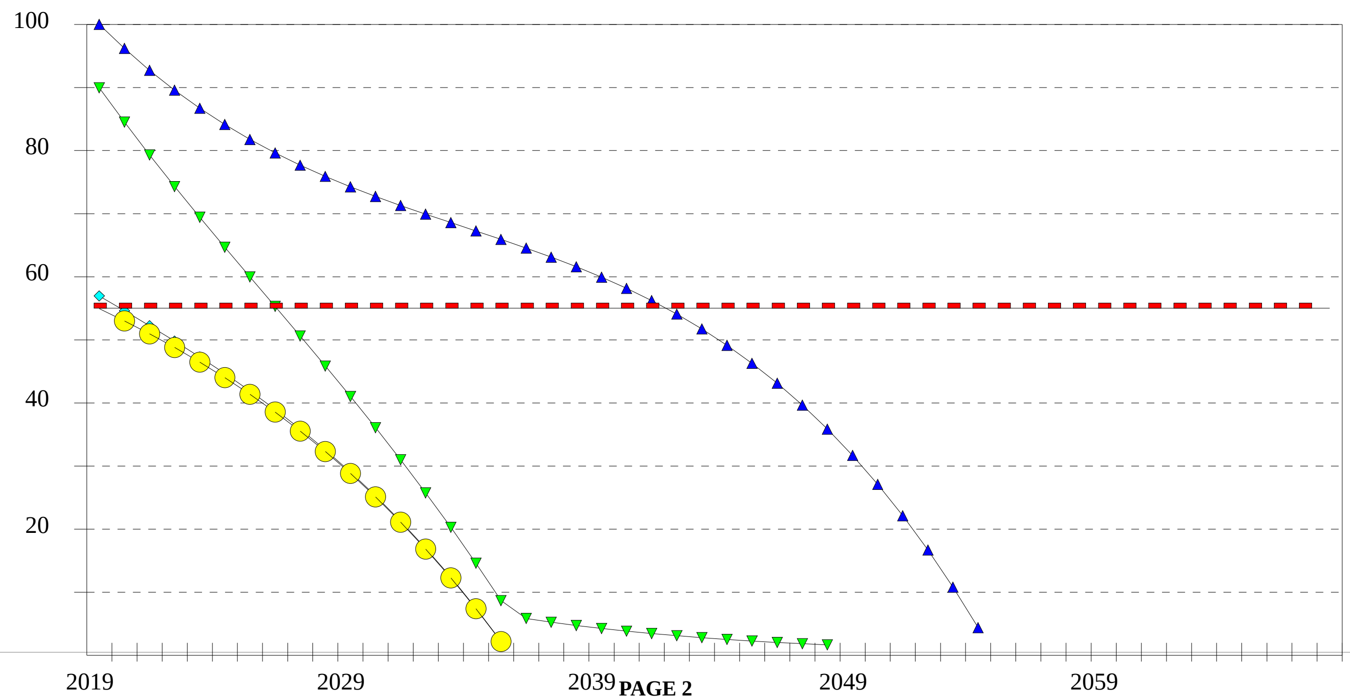
ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2019
PAVEMENT TYPE: AC
CONSTRUCTION YEAR: 1998
MINIMUM SERVICE LEVEL: 55

INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 62 FAIR
ESTIMATED PCI IS: 55 in 2019
NORMAL PCI FOR THIS AGE: 60

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$7,812	23 YEARS
▼	SURFACE TREATMENT	$2,146	8 YEARS
◆	CRACK REPAIR	$787	1 YEAR
●	NO ACTION	N/A	N/A
-	MINIMUM SERVICE LEVEL, CURRENTLY 55		

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 405

DESCRIPTION: TAXIWAY B2

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2019

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC
FEATURE AREA: 27,342
INSPECTED AREA: 14,000
MINIMUM SERVICE LEVEL: 55

FEATURE'S HIGH PCI: 84
FEATURE'S LOW PCI: 80
AVERAGE PCI: 82 SATISFACTORY
ESTIMATED PCI IS: 48 in 2019

COMMENTS/HISTORY FOR FEATURE 405, TAXIWAY B2

2013 AC Thin Overlay
1989 4" P401
8" P208
*

DISTRESS QUANTITIES FOR FEATURE 405

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
LONG.& TRANS. CRACK	MED	127	248	L.F.	39.6
LONG.& TRANS. CRACK	LOW	666	1,300	L.F.	60.3

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS:	0 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS:	67 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS:	33 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 405

DESCRIPTION: TAXIWAY B2

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2019
PAVEMENT TYPE: AC
CONSTRUCTION YEAR: 2013
MINIMUM SERVICE LEVEL: 55

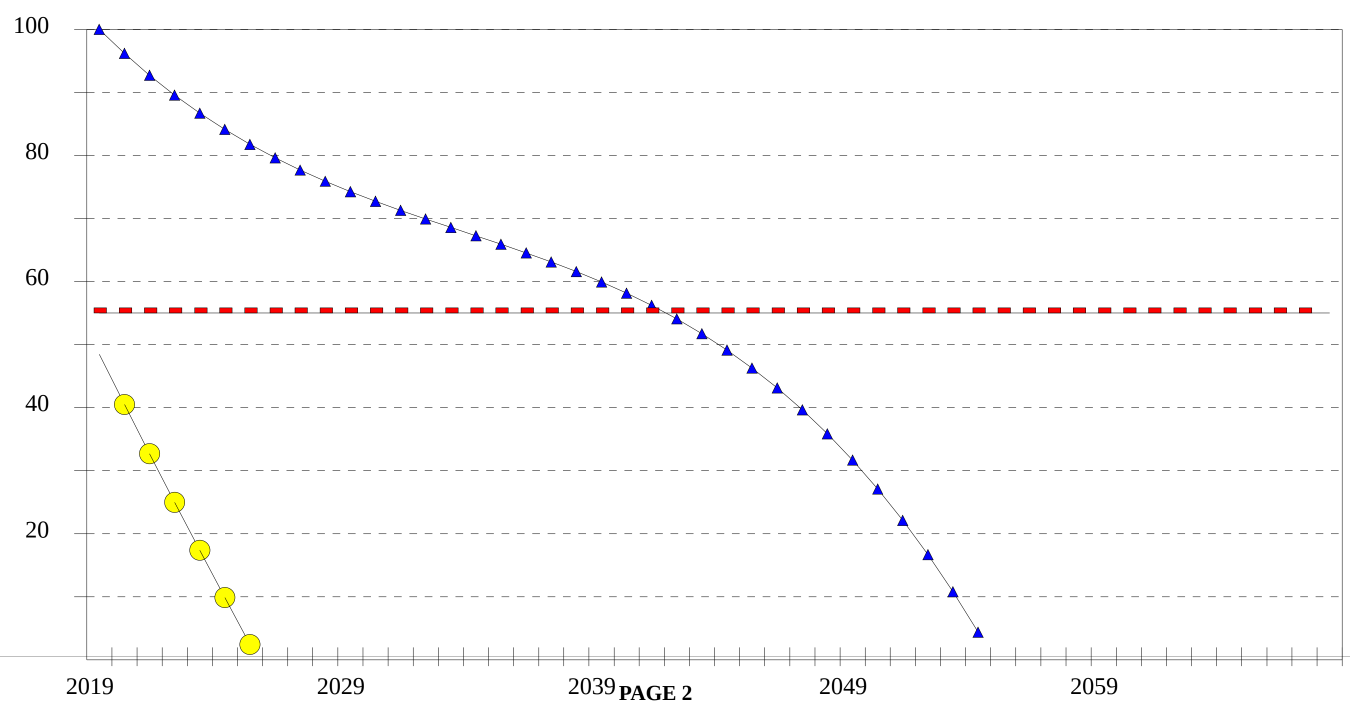
INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 82 SATISFACTORY
ESTIMATED PCI IS: 48 in 2019
NORMAL PCI FOR THIS AGE: 83

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$39,372	23 YEARS
●	NO ACTION	N/A	N/A

-	MINIMUM SERVICE LEVEL, CURRENTLY 55

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 3005

DESCRIPTION: RAMP

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2023

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: PCC
FEATURE AREA: 116,097
INSPECTED AREA: 34,675
MINIMUM SERVICE LEVEL: 55

FEATURE'S HIGH PCI: 84
FEATURE'S LOW PCI: 64
AVERAGE PCI: 74 SATISFACTORY
ESTIMATED PCI IS: 55 in 2023

COMMENTS/HISTORY FOR FEATURE 3005, RAMP

1989 PCC UNKNOWN SECTION
*
*
*

DISTRESS QUANTITIES FOR FEATURE 3005

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
CORNER BREAK	MED	1	3	SLABS	2.1
CORNER BREAK	LOW	8	26	SLABS	10.3
LONG/TRAN/DIAG CRK.	MED	2	6	SLABS	6.1
LONG/TRAN/DIAG CRK.	LOW	38	127	SLABS	39.4
PATCH<5 SF	LOW	11	36	SLABS	2.2
SETTLEMENT/FAULT	MED	5	16	SLABS	9.6
SETTLEMENT/FAULT	LOW	17	56	SLABS	20.2
DIVIDED SLAB	LOW	1	3	SLABS	2.6
SHRINKAGE CRACKS	N/A	7	23	SLABS	1.9
SPALLING-JOINTS	MED	2	6	SLABS	2.5
SPALLING-JOINTS	LOW	2	6	SLABS	1.1
ALKALI SILICA	LOW	1	3	SLABS	1.6

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS: 48 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS: 19 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS: 34 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 3005 **DESCRIPTION:** RAMP

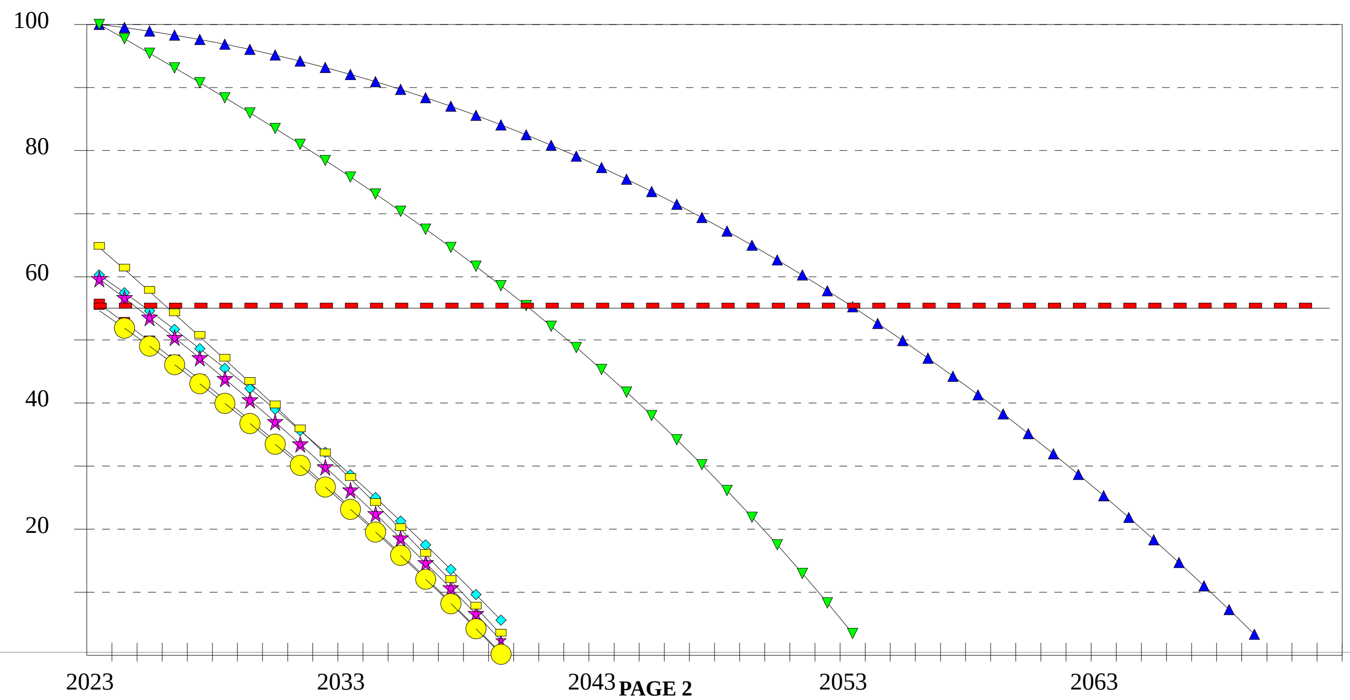
ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2023
PAVEMENT TYPE: PCC
CONSTRUCTION YEAR: 1989
MINIMUM SERVICE LEVEL: 55

INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 74 SATISFACTORY
ESTIMATED PCI IS: 55 in 2023
NORMAL PCI FOR THIS AGE: 44

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RECONSTRUCTION	$1,497,651	31 YEARS
▼	REPAIR AND/OR OVERLAY	$639,694	18 YEARS
◆	SLAB REPLACEMENT	$34,829	2 YEARS
■	JOINT/CRACK REPAIR	$387	1 YEAR
★	SLAB REPLACEMENT/JOINT SEAL	$35,216	2 YEARS
▬	SLAB REPLACEMENT/PATCHING/JOINT SEAL	$36,670	3 YEARS
●	NO ACTION	N/A	N/A
-	MINIMUM SERVICE LEVEL, CURRENTLY 55		

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 5005

DESCRIPTION: RUNWAY 2-20 KEEL

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2016

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC OVERLAY
FEATURE AREA: 130,772
INSPECTED AREA: 40,500
MINIMUM SERVICE LEVEL: 60

FEATURE'S HIGH PCI: 65
FEATURE'S LOW PCI: 50
AVERAGE PCI: 61 FAIR
ESTIMATED PCI IS: 59 in 2016

COMMENTS/HISTORY FOR FEATURE 5005, RUNWAY 2-20 KEEL

1999 AC OVERLAY
1988 3" P401
1958 8" AC ON 8" PUGMILL
*

DISTRESS QUANTITIES FOR FEATURE 5005

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
LONG.& TRANS. CRACK	LOW	2,959	9,335	L.F.	29.7
LONG.& TRANS. CRACK	MED	784	2,499	L.F.	22.2
LONG.& TRANS. CRACK	HIGH	163	526	L.F.	19.7
PATCH & UTILITY CUT	LOW	1,680	5,290	S.F.	14.5
SWELL	LOW	1,608	5,394	S.F.	6.4
SWELL	MED	25	25	S.F.	0
WEATHERING	LOW	12,000	38,329	S.F.	4.3

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS:	10 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS:	62 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS:	28 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 5005

DESCRIPTION: RUNWAY 2-20 KEEL

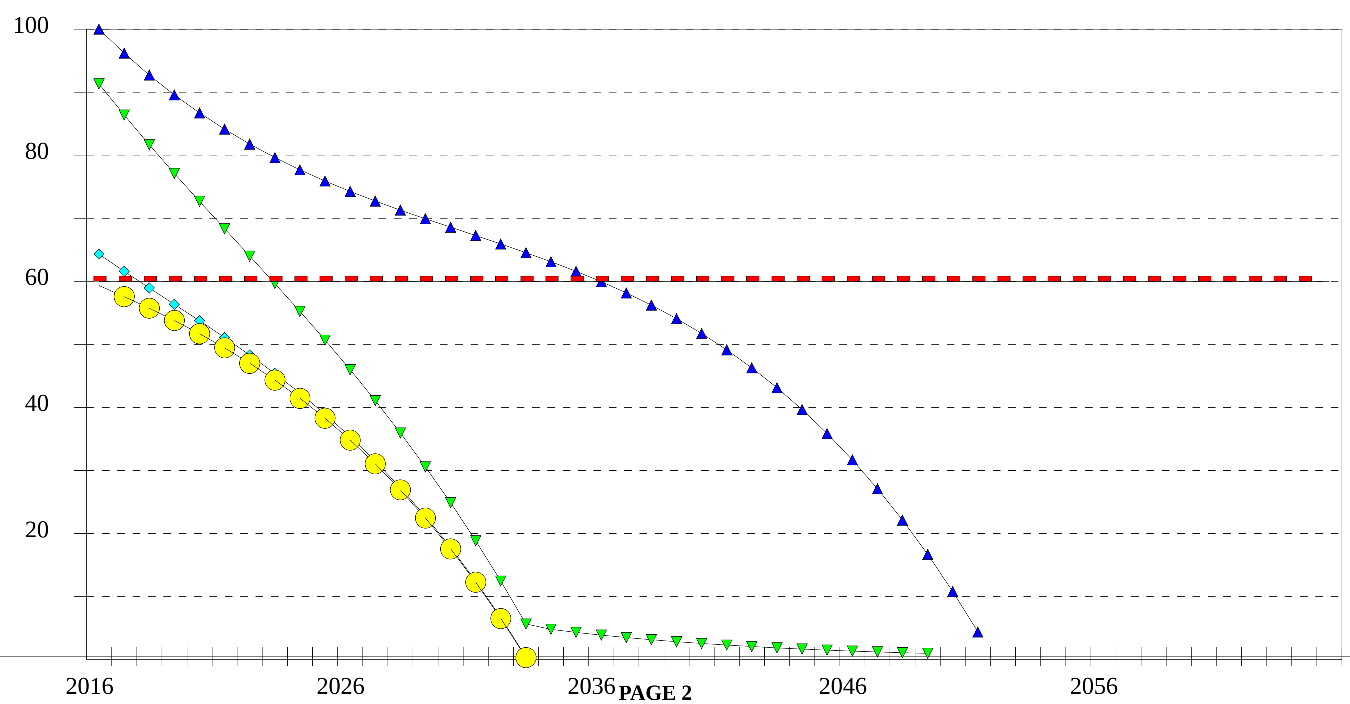
ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2016
PAVEMENT TYPE: AC OVERLAY
CONSTRUCTION YEAR: 1999
MINIMUM SERVICE LEVEL: 60

INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 61 FAIR
ESTIMATED PCI IS: 59 in 2016
NORMAL PCI FOR THIS AGE: 64

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$188,311	20 YEARS
▼	SURFACE TREATMENT	$51,001	7 YEARS
◆	CRACK REPAIR	$14,674	2 YEARS
●	NO ACTION	N/A	N/A
-	MINIMUM SERVICE LEVEL, CURRENTLY 60		

PROJECTED PERFORMANCE



AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 5010

DESCRIPTION: RUNWAY 2-20 WING

ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2019

INSPECTION DATE: 9-17-15

PAVEMENT TYPE: AC OVERLAY
FEATURE AREA: 175,618
INSPECTED AREA: 54,000
MINIMUM SERVICE LEVEL: 60

FEATURE'S HIGH PCI: 67
FEATURE'S LOW PCI: 62
AVERAGE PCI: 65 FAIR
ESTIMATED PCI IS: 59 in 2019

COMMENTS/HISTORY FOR FEATURE 5010, RUNWAY 2-20 WING

1999 AC OVERLAY
1988 4" P401
1970 2.5" AC- inside 10" either side
1958 8" AC ON 8" PUGMILL- inside 10" either side

DISTRESS QUANTITIES FOR FEATURE 5010

DISTRESS TYPE	SEVERITY	MEASURED QUANTITY	ESTIMATED TOTAL QUANTITIY	UNITS	PERCENTAGE OF All DISTRESS
LONG.& TRANS. CRACK	HIGH	254	826	L.F.	27
LONG.& TRANS. CRACK	MED	1,146	3,727	L.F.	29.4
LONG.& TRANS. CRACK	LOW	1,665	5,414	L.F.	18.7
PATCH & UTILITY CUT	LOW	1,800	5,853	S.F.	16.4
SWELL	LOW	22	71	S.F.	.6
WEATHERING	MED	200	650	S.F.	.4
WEATHERING	LOW	23,800	77,402	S.F.	7.2

BASIC DISTRESS CAUSES

APPROXIMATE AMOUNT OF DISTRESS RELATED TO LOAD ON THE PAVEMENT IS:	11 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO MATERIALS PROBLEMS IN THE FEATURE IS:	59 %
APPROXIMATE AMOUNT OF DISTRESS RELATED TO AGE OF PAVEMENT AND TRAFFIC REPETITIONS IS:	30 %

AIRPORT: MICHIGAN CITY MUNICIPAL

AIRPAV FEATURE ANALYSIS PROGRAM OUTPUT

FEATURE: 5010

DESCRIPTION: RUNWAY 2-20 WING

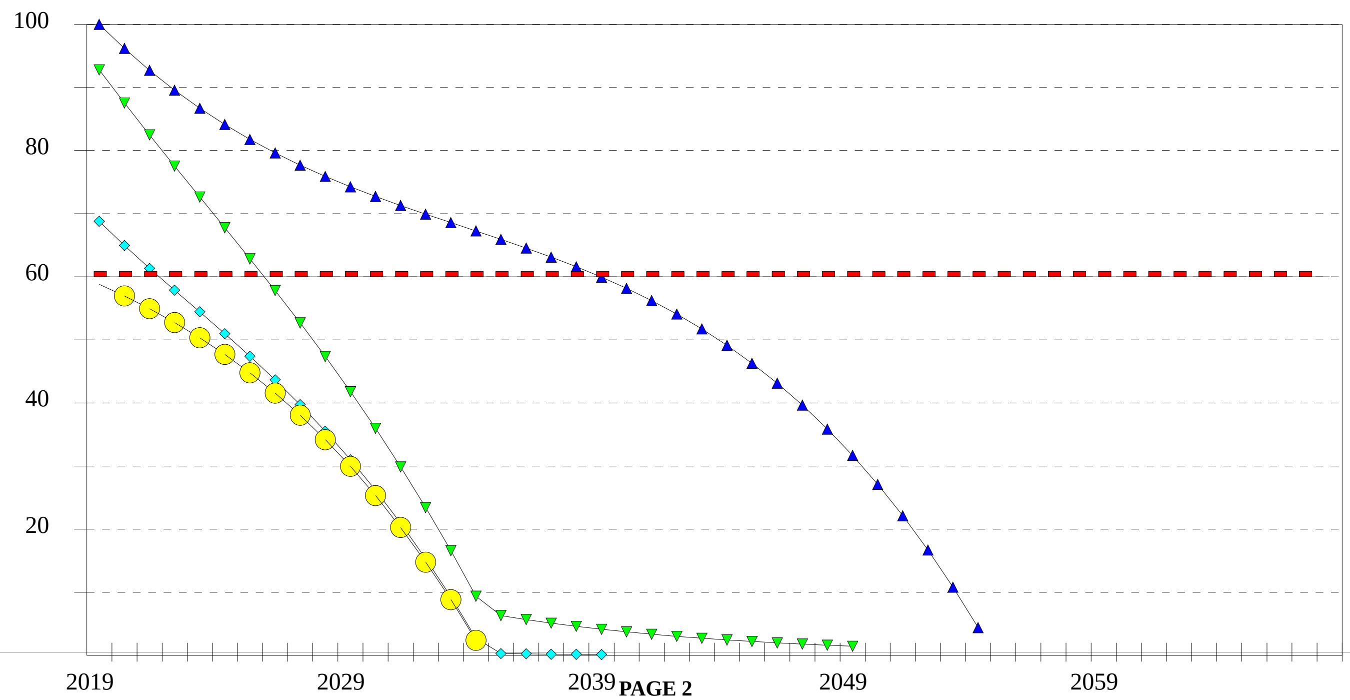
ANALYSIS YEAR: 2015 **OPTIMIZED FOR:** 2019
PAVEMENT TYPE: AC OVERLAY
CONSTRUCTION YEAR: 1999
MINIMUM SERVICE LEVEL: 60

INSPECTION DATE: 9-17-15
AVERAGE PCI AT INSPECTION: 65 FAIR
ESTIMATED PCI IS: 59 in 2019
NORMAL PCI FOR THIS AGE: 59

THE FOLLOWING PROJECTS HAVE BEEN SELECTED AS VIABLE ALTERNATIVES

LEGEND	DESCRIPTION	COST	LIFE EXTENSION
▲	RESURFACING	$252,889	20 YEARS
▼	SURFACE TREATMENT	$74,136	7 YEARS
◆	CRACK REPAIR	$12,359	3 YEARS
●	NO ACTION	N/A	N/A
-	MINIMUM SERVICE LEVEL, CURRENTLY 60		

PROJECTED PERFORMANCE



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Appendix F. Airport Responsibilities

Grant Assurances

In 1995, Congress mandated that the FAA require, as a condition of grant funding, that airport sponsors prepare documentation of a maintenance management program on pavement that has been constructed, reconstructed, or repaired with Federal assistance.

This report fulfills many of the grant assurance requirements, including documenting:

- Locating all runways, taxiways, and aprons.
- Documenting pavement dimensions.
- Documenting types of pavement.
- Documenting year of construction or most recent major rehabilitation.

ASSURANCES
Airport Sponsors

A. General.

1. These assurances shall be complied with in the performance of grant agreements for airport development, airport planning, and noise compatibility program grants for airport sponsors.
2. These assurances are required to be submitted as part of the project application by sponsors requesting funds under the provisions of Title 49, U.S.C., subtitle VII, as amended. As used herein, the term "public agency sponsor" means a public agency with control of a public-use airport; the term "private sponsor" means a private owner of a public-use airport; and the term "sponsor" includes both public agency sponsors and private sponsors.
3. Upon acceptance of the grant offer by the sponsor, these assurances are incorporated in and become part of the grant agreement.

B. Duration and Applicability.

1. **Airport development or Noise Compatibility Program Projects Undertaken by a Public Agency Sponsor.** The terms, conditions and assurances of the grant agreement shall remain in full force and effect throughout the useful life of the facilities developed or equipment acquired for an airport development or noise compatibility program project, or throughout the useful life of the project items installed within a facility under a noise compatibility program project, but in any event not to exceed twenty (20) years from the date of acceptance of a grant offer of Federal funds for the project. However, there shall be no limit on the duration of the assurances regarding Exclusive Rights and Airport Revenue so long as the airport is used as an airport. There shall be no limit on the duration of the terms, conditions, and assurances with respect to real property acquired with federal funds. Furthermore, the duration of the Civil Rights assurance shall be specified in the assurances.

2. **Airport Development or Noise Compatibility Projects Undertaken by a Private Sponsor.** The preceding paragraph 1 also applies to a private sponsor except that the useful life of project items installed within a facility or the useful life of the facilities developed or equipment acquired under an airport development or noise compatibility program project shall be no less than ten (10) years from the date of acceptance of Federal aid for the project.

3. **Airport Planning Undertaken by a Sponsor.** Unless otherwise specified in the grant agreement, only Assurances 1, 2, 3, 5, 6, 13, 18, 30, 32, 33, and 34 in section C apply to planning projects. The terms, conditions, and assurances of the grant agreement shall remain in full force and effect during the life of the project.

C. Sponsor Certification. The sponsor hereby assures and certifies, with respect to this grant that:

1. **General Federal Requirements.** It will comply with all applicable Federal laws, regulations, executive orders, policies, guidelines, and requirements as they relate to the application, acceptance and use of Federal funds for this project including but not limited to the following:

   Federal Legislation

   a. Title 49, U.S.C., subtitle VII, as amended.
   b. Davis-Bacon Act - 40 U.S.C. 276(a), et seq.[1]
   c. Federal Fair Labor Standards Act - 29 U.S.C. 201, et seq.
   d. Hatch Act - 5 U.S.C. 1501, et seq.[2]

Airport Assurances (3/2005)

The airport owners must be an active participant in maintaining compliance. Actions taken to ensure compliance include:

- Annotating areas constructed or repaired with Federal aid.
- Conducting monthly drive-by inspections to detect changes in pavement condition.
- Recording each drive-by inspection and any maintenance performed as a result.
- Keeping complete records of all maintenance activities.
- Keeping records for 5 years.
- Documenting detailed inspection information with a history of recorded pavement deterioration by PCI survey (e.g., this report).

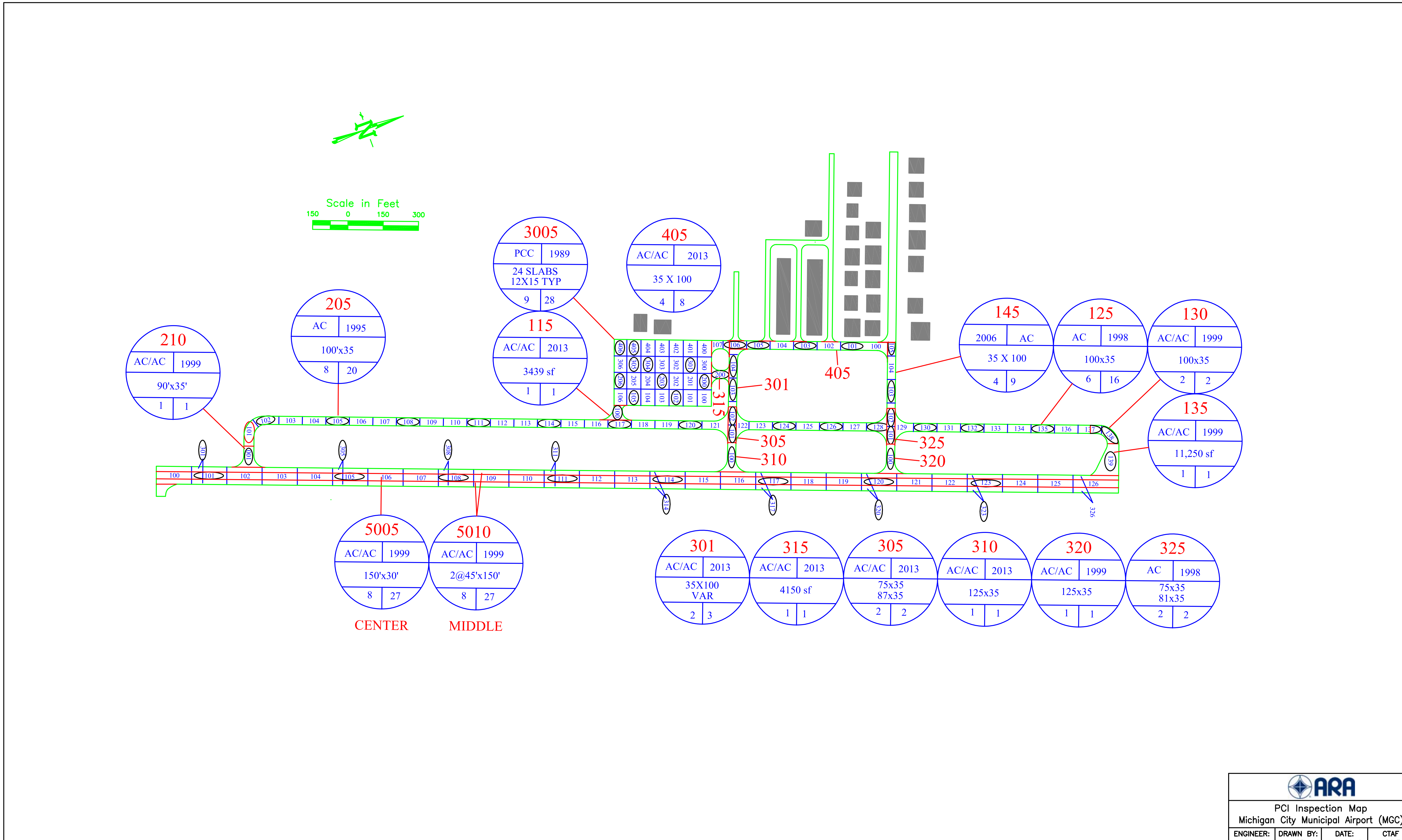
The table on the following pages is available for maintaining a record of drive-by inspections and maintenance repairs.

Table F-1. Monthly Pavement Inspection Log

Date	Inspector	Conditions/Changes	Repairs/Work Order

Date	Inspector	Conditions/Changes	Repairs/Work Order

Date	Inspector	Conditions/Changes	Repairs/Work Order


Scale in Feet
150 0 150 300
3005
PCC 1989
24 SLABS 12X15 TYP
9 28
405
AC/AC 2013
35 X 100
4 8
205
AC 1995
100'x35
8 20
210
AC/AC 1999
90'x35'
1 1
115
AC/AC 2013
3439 sf
1 1
145
2006 AC
35 X 100
4 9
125
AC 1998
100x35
6 16
130
AC/AC 1999
100x35
2 2
135
AC/AC 1999
11,250 sf
1 1
5005
AC/AC 1999
150'x30'
8 27
CENTER
5010
AC/AC 1999
2@45'x150'
8 27
MIDDLE
301
AC/AC 2013
35X100 VAR
2 3
315
AC/AC 2013
4150 sf
1 1
305
AC/AC 2013
75x35 87x35
2 2
310
AC/AC 2013
125x35
1 1
320
AC/AC 1999
125x35
1 1
325
AC 1998
75x35 81x35
2 2
ARA
PCI Inspection Map
Michigan City Municipal Airport (MGC)
ENGINEER: BDA
DRAWN BY: JCB
DATE: Jan 2016
CTAF 122.7